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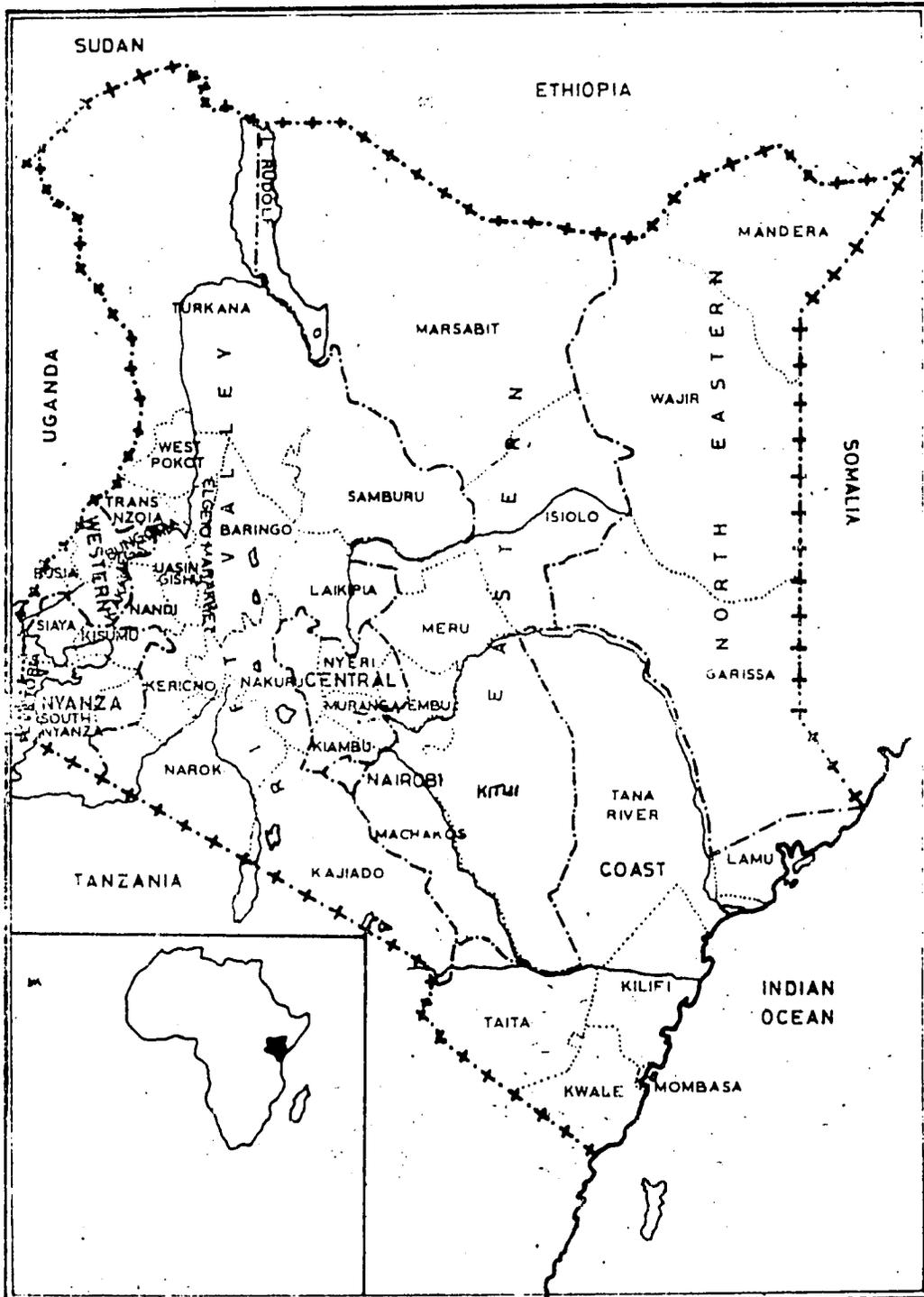
MINISTRY OF WORKS
ROADS DEPARTMENT

**RURAL ACCESS ROADS PROGRAMME
EVALUATION OF ROADS IN KAKAMEGA
REVISED**

DECEMBER 1978

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RURAL ACCESS ROADS PROGRAMME
EVALUATION OF RURAL ACCESS ROADS IN KAKAMEGA DISTRICT
FIRST-PHASE REVISED REPORT
MINISTRY OF WORKS ROADS DEPARTMENT
DECEMBER, 1978

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EVALUATION OF RURAL ACCESS ROADS IN KAKAMEGA DISTRICT

This report pertains to the evaluation of the group of 56 km of rural access road in Kakamega District. The roads evaluated in this report were selected by the District Development Committee (DDC) as being priority routes in terms of much needed access into economically potential areas. In selecting the roads the DDC used guidelines laid down for this purpose.

The proposed alignments have been reviewed by members from Planning Section, M.O.W. Headquarters and have all been found feasible. The roads selected for inclusion in the Rural Access Roads Programme during 1979 including other relevant detail such as approximate lengths and location are shown below.

ROAD NO	DESCRIPTION OF THE	APPROX. LENGTH	LOCATION	MAP NO.
1	Maturu-Lorale Market	6	North Kabras	
2	Matere-Chebaiywa	4	"	
3	Vihiga-Namirimba	6	"	
4	Namirimba-Sivilie Sch.	6	"	
5	Butali Market-Shirugu	5	"	
6	Samisi-Mutsuma-Bukhakunga	6	South Kabras	
7	Shirugu-Lukume	5	"	
8	Shikunga-Cheboso-Lubao	6	"	
9	Ngavira - Duka Moja School	8	"	
10	Kakoyi-Chemangeli	6	"	

The whole of Kabras Division will not be covered by the integrated Agricultural Development Plan (IADP), Map I depicts the roads within Kakamega District. A description of the roads listed above and the roads into which the rural access roads connect is given in appendix I.

Vicinity maps 3 to 8 depict the location of the proposed roads with the zones of influence. Map 2 depicts the classified road network in Kakamega District.

II.

A QUICK IMPRESSION

In order to get a quick impression of the 10 roads some indicators which are useful for comparison are given in Table I.

TABLE I

ROAD NO.	LENGTH (Km)	ZONE OF INFLUENCE (ha)	POPULATION DENSITY P/Km ² 1978	POPULATION IN ZONE OF INFLUENCE	ZONE OF INFLUENCE Ha/Km ROAD	POPULATION PER KM. ROAD
1	6	950	177	1681	158	280
2	4	850	208	1768	213	442
3	6	1550	251	3891	258	648
4	6	1950	251	4895	325	816
5	5	850	175	1488	170	298
6	6	1350	378	5103	225	850
7	5	1450	378	5481	190	1096
8	6	770	242	1863	128	310
9	8	910	207	1883	114	235
10	6	1190	169	1999	198	333

III. ACCESS - INDICATOR

The Access indicator is a criterion by which the adequacy of the access system to the local residents and Government administrative officers is measured.

Only those social service facilities for which a road is relevant are taken into account. The social services which will be supplied as part of another service (e.g. telephone services which is part of Post Office) have not been taken into account.

Four social service facilities have been selected. These include:

- Hospital (H.)
- Post Office (P.O.)
- Divisional Headquarters (Div. Hq.)
- Health Centre (H.C.)

The relative importance of the above stipulated services are determined by the frequency with which they are utilised. The following subjective weights are attached to each facility of service. The scale is chosen between 1 to 10 indicating higher rating for increasing frequency.

(a) Hospital (low frequency)	2
(b) Post Office (medium frequency)	5
(c) Div. Headquarters (high frequency)	10
(d) Health Centre (medium frequency)	5

The actual distance from a zone of influence to a social service facility will be multiplied by the weight attached to that facility. The sum of the weighted distances gives the total weighted distance for the zone of influence and this total weighted distance gives the access-indicator for the zone.

Table 2 below shows the calculated Access Indicators for each selected road and within each zone of influence.

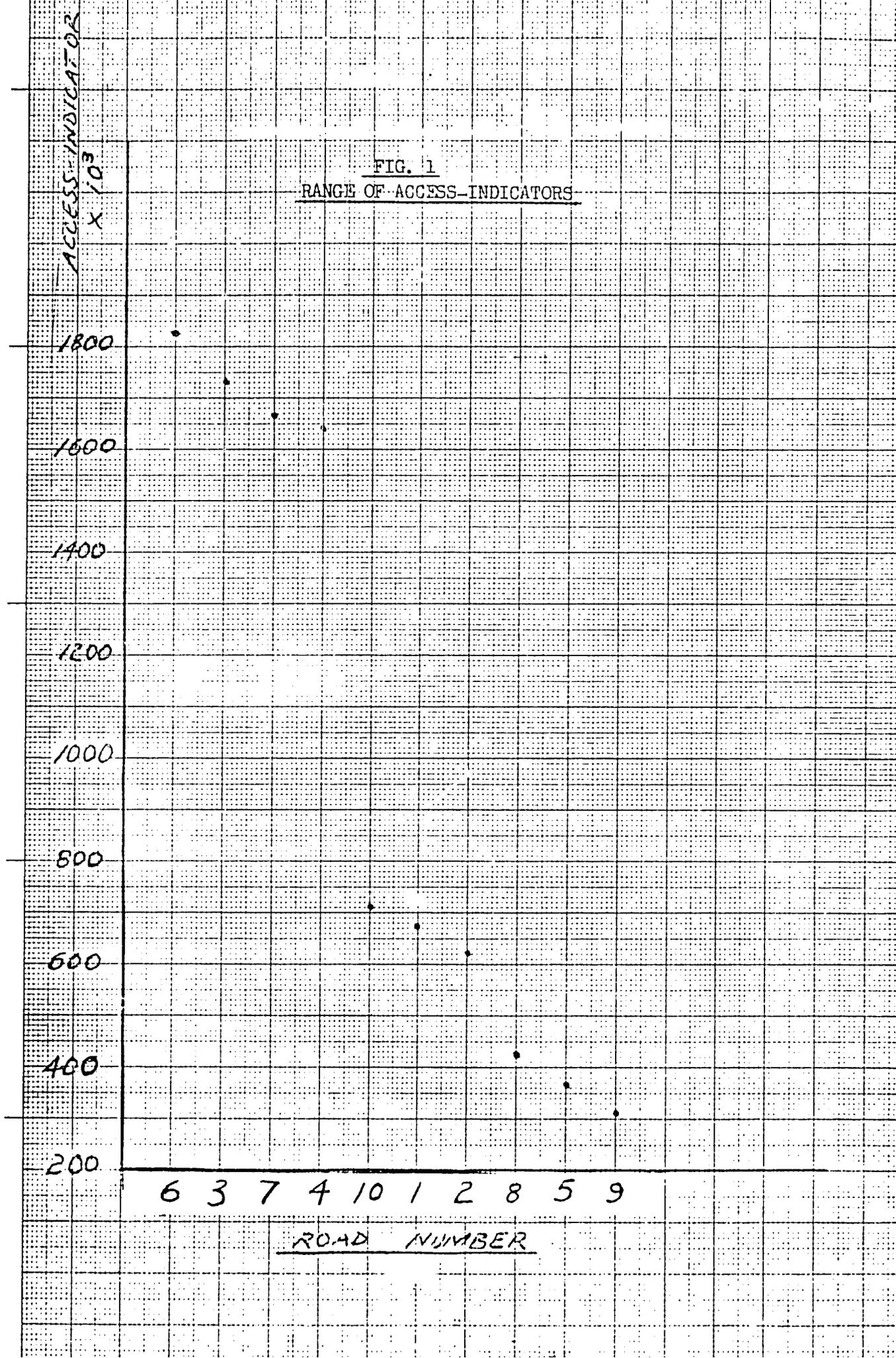
The location of the various social service facilities is also depicted on Map 9. Figure 1 shows the range of access-indicators for the proposed roads.

TABLE 2

ROAD	POPULATION IN ZONE OF INFLUENCE I	AVERAGE DISTANCE TO				WEIGHTED DISTANCE TO				TOTAL WEIGHTED DISTANCE II	ACCESS INDICATOR (I x II)	PRIORITY RATING BASED ON ACCESS INDICATOR
		H.	P.O.	D.HQ.	H.C.	H.	P.O.	D.HQ.	HC.			
1	1681	48	10	23	5	96	50	230	25	401	674,081	6
2	1768	40	15	15	10	80	75	150	50	355	627,640	7
3	3891	43	18	18	18	86	90	180	90	446	1,735,385	2
4	4895	38	13	13	13	76	65	130	65	336	1,644,720	4
5	1488	34	9	9	9	68	45	90	45	248	369,024	9
<u>6</u>	5103	34	14	15	14	68	70	150	70	358	1,826,874	1
7	5481	32	12	12	12	64	60	120	60	304	1,666,224	3
8	1863	13	6	14	6	26	30	140	30	226	421,038	8
9	1883	22	6	6	6	44	30	60	30	164	308,812	10
10	1999	39	14	14	14	78	70	140	70	358	715,642	5

H = Hospital
P.O. = Post Office

D.HQ. = Divisional Headquarter
HC = Health Centre



IV. POTENTIAL FOR DEVELOPMENT

The potential for development is directly related to the farming development prospects within each zone of influence. The present and future land utilization are shown in the tables below:-

MZ = Maize

SU = Sugar Cane

BE = Beans

DC = Dairy Cattle

O = Other crops (mostly subsistence)

P = Future without programme (present)

F = Future with programme.

PRESENT AND FUTURE LAND UTILIZATIONTABLE 3

	ROAD NO 1				ROAD NO 2				ROAD NO 3			
	P ha	F ha	P %	F %	P ha	F ha	P %	F %	P ha	F ha	P %	F %
MZ	189	237	20	25	170	170	20	20	310	310	20	20
SU	143	190	15	20	127	170	15	20	155	233	10	15
BE	95	143	10	15	127	127	15	15	233	233	15	15
DC	142	143	15	15	85	127	10	15	233	233	15	15
O	380	237	40	25	341	256	40	30	619	541	40	35
TOTAL	950	950	100	100	850	850	100	100	1550	1550	100	100

TABLE 4

	ROAD NO. 4				ROAD NO. 5				ROAD NO. 6			
	P ha	F ha	P %	F %	P ha	F ha	P %	F %	P ha	F ha	P %	F %
MZ	292	390	15	20	170	212	20	25	202	202	15	15
SU	292	390	15	20	127	170	15	20	202	270	15	20
BE	195	195	10	10	85	127	10	15	135	135	10	10
DC	292	292	15	15	127	127	15	15	135	135	10	10
O	879	683	45	35	341	214	40	25	676	608	50	45
TOTAL	1950	1950	100	100	850	850	100	100	1350	1350	100	100

TABLE 5

	ROAD NO 7				ROAD NO. 8				ROAD NO 9			
	P ha	F ha	P %	F %	P ha	F ha	P %	F %	P ha	F ha	P %	F %
MZ	217	217	15	15	154	154	20	20	137	182	15	20
SU	217	290	15	20	115	192	15	25	182	228	20	25
BE	145	145	10	10	77	77	10	10	91	91	10	10
DC	145	145	10	10	115	115	15	15	136	136	15	15
O	726	653	50	45	309	232	40	30	364	273	40	30
TOTAL	1450	1450	100	100	770	770	100	100	910	910	100	100

TABLE 6

	ROAD NO. 10			
	P ha	F ha	P %	F %
MZ	238	298	20	25
SU	119	238	10	20
BE	119	119	10	10
DC	238	238	20	20
O	476	297	40	25
TOTAL	1190	1190	100	100

V. CONSTRAINTS ON DEVELOPMENT

1. TYPES OF CONSTRAINTS

The constraints on (agricultural) development fall into two categories:-

(a) Natural Constraints:

- the constraints which cannot be removed by man (such as soil, rainfall and topography characteristics).

(b) Resource Constraints:

- The constraints which can be removed when enough capital is available (such as land registration, agricultural credit, agricultural inputs, marketing of produce, agro-industry, road infrastructure, attitude of the people towards modernisation and agriculture).

2. CONSTRAINTS AS THEY EXIST NOW

(a) Soil:

The soil pattern is largely an association of dark brown sandy loams with yellow-red loamy sands as well as dark red friable clays. Forest reserves are considerable in the district. 100% of the agricultural land is classified on a rainfall basis as high potential.

(b) Rainfall:

Rainfall increases with altitude and situation, varying between 2,000 mm and 1,250 mm. The main rainy months are April, May, August and - to a lesser degree - December. Map 9 depicts the mean annual rainfall.

(c) Topography:

The altitude varies from 1,850 m in the North-Eastern part of the district to 1,200 m in the Western part along the Nzoia River. The main rivers in the district are the Yala River and the Nzoia River, which has the Kipkarren River as a main tributary.

(d) Land Registration:

Most of the land is adjudicated, although still some sections have to be finalized. Arising from the forcsaid, not every one has a title deed. Those with title deed find it easier to secure loans for improving their land.

(e) Agricultural extension services:

The development of farming over the years has been hampered due to lack of or malfunctioning of extension services. The bad condition of vehicles and meagre transport funds rendered officers immobile from time to time.

(f) Mechanization on the farms:

Land is generally furrowed by the aid of oxen. Excluding those at Mumias Sugar Company and settlement schemes, some 120 functioning tractors are available in the district, against approximately 2,750 ox-ploughs.

(g) Marketing of produce:

Roughly half of the district area is under cultivation, of which approximately 40% is under cash crop. The unclassified feeder roads - which are especially for transportation of agricultural produce from farms to market centres - are in a poor state.

(h) Road infrastructure:

The trunk roads in the district are satisfactory. From the primary, secondary and minor roads a high percentage, especially minor roads, although passable throughout most of the year, pose a major problem after heavy rains.

(i) Attitude of the people:

There appears to be a positive attitude on the part of the local population towards modernizing their agricultural production and they seem to realize the great advantages of cash cropping as new way of life.

VI. IMPACT OF THE ROAD ON RURAL DEVELOPMENT

1. THE RURAL ACCESS ROAD CONSTRUCTION COST COMPONENTS

Cost estimates of the selected roads have not yet been prepared by the Rural Access Roads engineer in Kitale. Based on past experience for similar roads the following assumptions have been made:

Cost per kilometre is approximately £2,000. A breakdown of this total cost into the different components will roughly comprise of the following items:

<u>COST COMPONENT</u>	<u>%</u>	<u>COST £/KM ROAD</u>
Wages Permanent Staff	8	160
Wages casual labour force	40	800
Tools and equipment	27	540
Sand, Ballast and Cement	6	120
Construction Materials	7	140
Transport	10	200
Others	2	40
	<u>100%</u>	<u>£2000</u>

- Wages of the casual labour force will all be spent in the rural area adjacent to the selected access roads;
- Wages of the permanent staff will be spent within the district at large;
- Sand, ballast are available within the district;
- Tools, equipment, vehicles for transportation will all be imported and as such have little bearing on the rural and district economy;
- The maintenance expenditures are estimated at £120/km road. Out of this amount about 75% is paid to the casual labour force each year. Table 8 shows a breakdown of the relevant cash component for the selected access roads.

TABLE 7

ROAD NO.	CONSTRUCTION COSTS K£.	MAINTENANCE K£/YEAR	CONSTRUCTION WAGES K£	CASUAL LABOUR MANDAYS	MAINTENANCE WAGES K£/YEAR	MAINTENANCE MANDAYS PER YEAR	PERMANNENT STAFF WAGES K£ CONSTRUCTION
1	12,000	480	4800	14160	360	1560	960
2	8,000	320	3200	9440	240	1040	640
3	12,000	480	4800	14160	360	1560	960
4	12,000	480	4800	14160	360	1560	960
5	10,000	400	4000	11800	300	1300	800
6	12,000	480	4800	14160	360	1560	960
7	10,000	400	4000	11800	300	1300	800
8	12,000	480	4800	14160	360	1560	960
9	16,000	640	6400	18880	480	2080	1280
10	12,000	480	4800	14160	360	1560	960

2. SHORT TERM EFFECTS OF THE RURAL ACCESS ROAD

The short term effects of opening of rural access roads will be substantial for the mobility of the divisional officers. The roads will provide the agricultural, educational, and health officers etc. an all weather mobility to the areas, which will enable them to carry out their duties more effectively.

3. LONG TERM EFFECTS OF THE RURAL ROAD

The long term effects stem from the development of the agricultural potential within the zones of influence.

The potential for the expansion of cash crops within the zones of influence is shown in the table below:

TABLE 8

POTENTIAL FOR CASH CROP AND LIVESTOCK EXPANSION

ROAD NO	MAIZE	SUGAR CANE	BEANS	DAIRY CATTLE	TOTAL
1	48	47	48	-	143
2	12	43	12	42	85
3	-	78	-	-	78
4	98	98	-	-	196
5	42	43	42	-	127
6	-	68	-	-	68
7	-	73	-	-	73
8	-	77	-	-	77
9	45	43	-	-	88
10	60	119	-	-	179

The gross margins for maize, beans, sugar-cane and dairy shown in appendix II. The present value of the agricultural production is calculated over 20 years period between 1979 and 1998. It is assumed that the prices over this period will remain reasonably constant. The development of agricultural potential will take 10 years. It is assumed that potential will develop equally during the 10 years starting in 1980. Moreover the value of subsistence crops has not been taken into account in the economic analysis.

The total increment in agricultural production will be K£ 125560. It is assumed that during the first 10 years, the increment in agricultural production will be K£ 12556 annually.

TABLE 9
EXISTING AND FUTURE CASH CROP AND
LIVESTOCK AREAS (ha)

ROAD NO	EXISTING CASH AREA WITH				FUTURE CASH AREA WITH			
	MAIZE	SUGAR CANE	BEANS	DAIRY CATTLE	MAIZE	SUGAR CANE	BEANS	DAIRY CATTLE
1	189	143	95	143	237	190	143	143
2	170	127	127	85	170	170	127	127
3	310	155	233	233	310	233	233	233
4	292	292	195	292	390	390	195	292
5	170	127	85	127	212	170	127	127
6	202	202	135	135	202	270	135	135
7	217	217	145	145	212	290	145	145
8	154	115	77	115	154	192	77	115
9	137	182	91	136	182	228	91	136
10	238	119	119	238	298	238	119	238

TABLE 10

EXISTING AND FUTURE CROSS MARGINS

ROAD NO	EXISTING CROSS MARGINS					FUTURE CROSS MARGINS					TOTAL
	MAIZE	SUGAR CANE	BEANS	DAIRY CATTLE	TOTAL	MAIZE	SUGAR CANE	BENS	DAIRY CATTLE	TOTAL	
1	5727	14300	6821	3403	30251	12466	19000	14643	5792	51501	21650
2	5151	12700	9119	2023	28993	8942	17000	13005	5143	44090	15097
3	9393	15500	16729	5545	47167	16306	23300	23859	9437	72902	25735
4	8848	29200	14001	6950	58999	20514	39000	19966	11826	91308	32309
5	5151	12700	6103	3023	26977	11151	17000	13005	5144	46300	19323
6	6121	20200	9693	3213	39227	10625	27000	13824	5467	56916	17689
7	6575	21700	10411	3451	42137	11414	29000	14848	5873	61135	18998
8	4666	11500	5529	2737	24432	8100	19200	7885	4657	39842	15410
9	4151	18200	6534	3237	32122	9573	22800	9318	5508	44199	15077
10	7211	11900	8544	5664	33319	15675	23800	12186	9639	61300	27981
TOTAL	62994	167900	93484	39246	363624	124766	237100	142541	38486	572893	209269

VII. DISCOUNTED COSTS AND BENEFITS OF THE PROPOSED
INVESTMENT

The road construction has many impacts on rural economy. Many of these cannot (yet) be quantified in monetary terms. For this reason the present monetary evaluation criteria for rural access roads investment can be considered as an art rather than a scientific approach.

Since it is rather unrealistic to calculate the internal rate of return of each road in view of the very short lengths involved the internal rate of return of the whole package has been calculated. The cost of road construction and maintenance and the benefits of agricultural development are discounted to the base year 1979.

The project gestation period has been assumed as 20 years (up to and including 1978). Total costs shadow prices for the construction of the roads are:

$$58 \times 2000 \times 0.83 = \text{K}\text{£} 96280 \text{ to be spent wholly in 1979.}$$

The yearly maintenance costs are in shadow prices.

$$58 \times 80 \times 0.61 = \text{K}\text{£} 2804$$

The total increment in agricultural production to be discounted in

$$\text{K}\text{£} 209269 \times \frac{60}{100} = \text{K}\text{£} 125,560$$

Therefore the yearly increment to be discounted in the first 10 years is K£ 12,556 starting in 1980 from 1990 onwards the full benefit of K£ 125,560 will be gained annually. In the table 11 below are indicated the discounted costs and benefits for discounting rates. The benefit rates are given in the same table. The I.R.R. for the whole package is above 50% and therefore the investment is highly beneficial to undertake.

TABLE II

DISCOUNTING	14%	30%	40%	45%	50%
COSTS	114654	105565	103279	102505	101884
BENEFITS	533954	215911	148102	126976	111004
B/C RATIO	4.65	2.04	1.43	1.24	1.09

VIII. DEVELOPMENT OF RURAL INCOME

Given the development of the agricultural potential and the growth of the population within the Zones of influence of the roads the rural cash income per capita can be calculated.

The income per capita has been calculated for the year 1989 when the agricultural potential is fully developed. For the purpose of this submission it is assumed that the gross margins of the agricultural output is equal to the income of the farmers. The population growth over the period 1979 - 89 is assumed to be 3%. The results are as shown in the table below.

TABLE 12

RURAL PER CAPITA INCOME 1989

ROAD	GROSS MARGIN CASH PRODUCTION IN 1989 K£.	POPULATION IN ZONE OF INFLUENCE		INCOME PER CAPITA 1989
		1978	1989	
1	51901	1681	2259	23.0
2	44090	1768	2376	18.6
3	72902	3891	5229	13.9
4	91308	4895	6578	13.9
5	46300	1488	1999	23.2
6	56916	5103	6858	8.3
7	61135	5481	7366	8.3
8	39842	1863	2504	15.9
9	44199	1883	2531	17.5
10	61300	1999	2686	22.8

Given the constant prices for agricultural products, the income per capita will diminish after the year 1989 at a rate equal to the population growth rate. In addition more land will be needed for the cultivation of subsistence crops at the expense of the area under cash crops.

DESCRIPTION OF THE PROPOSED ROADS

GENERAL

The whole area consist mainly of gentle hills with slopes not in excess of 10% except at river crossings. The soil consists mainly of a mixture of clay, sand, murram with organic components near rivers. In several places rock outcrops pose obstacles for construction. However, in more cases cut of about 0.5 m or an overfill will do.

MATURU - LORALE MARKET (2)

The alignmemnt follows an existing track which crosses a river with a rocky bed which could be transformed into a drift. Access to the road on the Maturu side is a good tarmacked road (A104). On the Lorele side is an unclassified earth road which is sufficiently motorable.

MATETE - CHEBAIYWA (3)

The road follows an existing motorable track free of river crossing and does not pose any construction problems. The connecting road in a high standard classified road (A1) which is tarmacked.

VIHIGA - NAMIRSIMBA (4)

This road has been graded up to Namirsimba and just lacks maintenance and proper drainage facilities. It has R.A.R. standard.

NAMIRSIMBA - SIVILIE SCHOOL (5)

The road crosses a river near Namirisamba by a concrete bridge and is

interrupted by a stream near Sivilie which could be crossed by a drift or a bridge of 5 - 6 m span.

5. BUTALI MARKET - SHIRUGU (6)
There is one stream about 3 km from Butali which can be crossed by bridge of 5 m span. The connecting roads on either side are in good condition.
 6. SAMISI - MUTSUMA - BUKHAKUNGU (8)
The road is technically feasible except for one stream which will need a bridge of about 8 m. The road could however, stop at the stream.
 7. SHIRUGU - LUKUME (9)
Same as for No. 6.
 8. SHIKUNGA - CHEBOSO-LUBAO (11)
The track is characterised by rock outcrops for half the distance, and crosses a small stream which will require a 4 m span bridge. At the stream is a 50 m wide swamp which according to the local chief could easily be improved by draining through Harambee effort.

The connecting classified Roads on either side are in very good condition.
 9. NGAVIRA - DUKA MOJA SCHOOL (12)
This road contains some very bad sections which are impassable during rainy weather. Two rivers can be crossed by means of culverting. The connecting roads are in good shape.
 10. KAKOYI - CHEMANGETI (15)
The track is motorable except in a few sections which have erosion gullies. There is one stream which can be crossed by means of culverting.

The access on the Kakoyi side is a very Good farmac road. On the Chemangeti side is a classified earth road which is difficult when wet.
- * The numbers in brackets indicate the priority given by the DDC. From the DDC list, the following roads were omitted from the first evaluation.

ROAD NO	DESCRIPTION	APPROX. LENGTH	LOCATION
1.	Maturu Sch. - Makhanga Mkt. Makanga Sch.	5	N/Kabras
7	Shingu Mabusi - Samisi - Sango	6	S/Kabras
10	Makkuyu Matika	3	"
13	Kakoyi - Manguhiro- Firabe-Ndalu	8	"
14	Kakoyi - Tumbeni - Chimoroni	10	"

These roads do not conform to the dictates of the engineering criteria. Road No. 1 would serve more as a short-cut, No. 7 is comprising of two short lengths connecting two close classified road running parallel. No. 10 is too short. Nos. 13 and 14 are too close to existing classified roads.

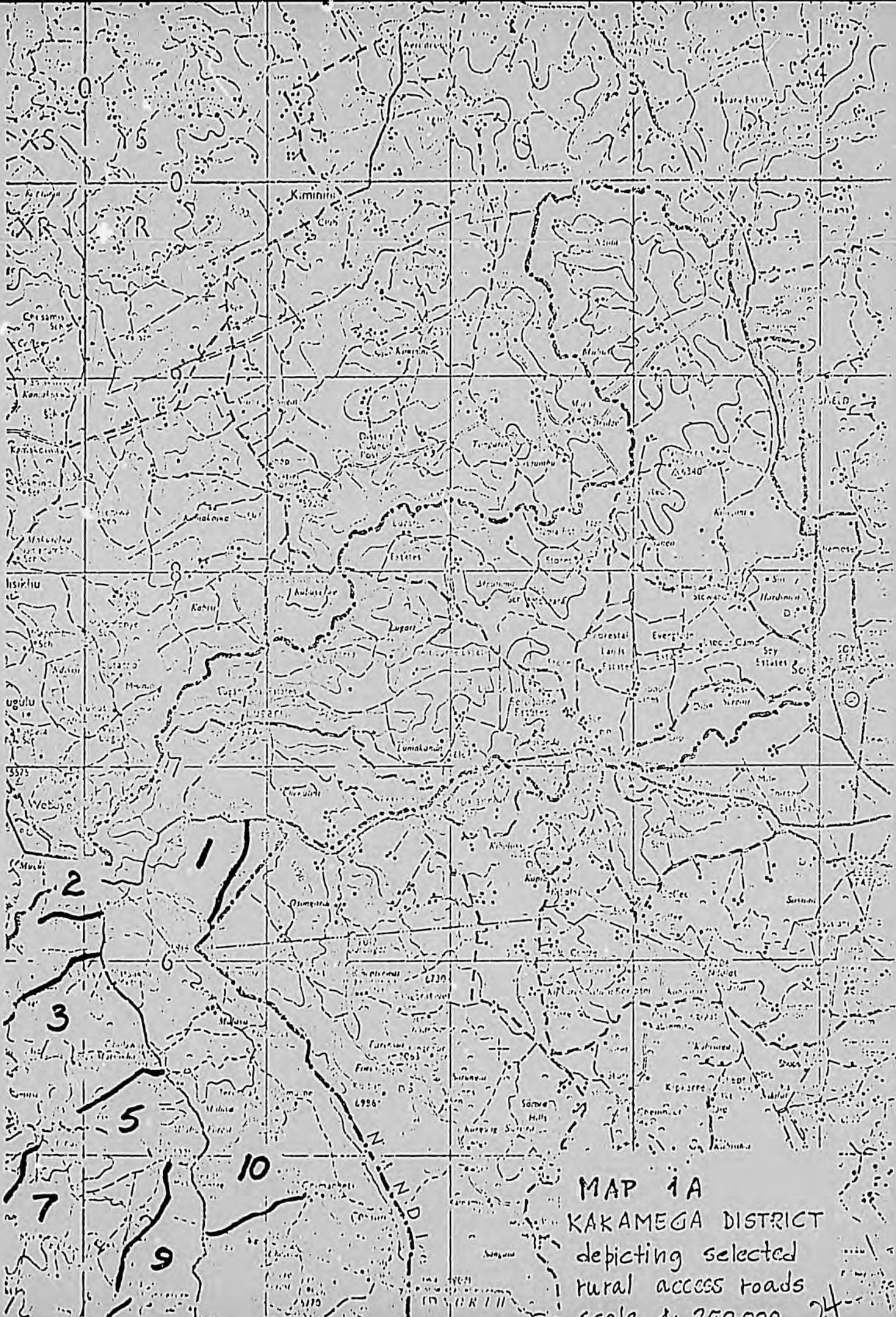
GROSS MARGINS FOR AGRICULTURAL PRODUCTION

	PRODUCT			SOURCE
		FUTURE WITHOUT RARP	FUTURE WITH RARP	
MZ	MAIZE	30.3	52.6	A
SU	SUGARCANE	100.0	100.0	X
BE	BEANS	71.8	102.4	A
DC	DAIRY-CATTLE	23.8	40.5	A

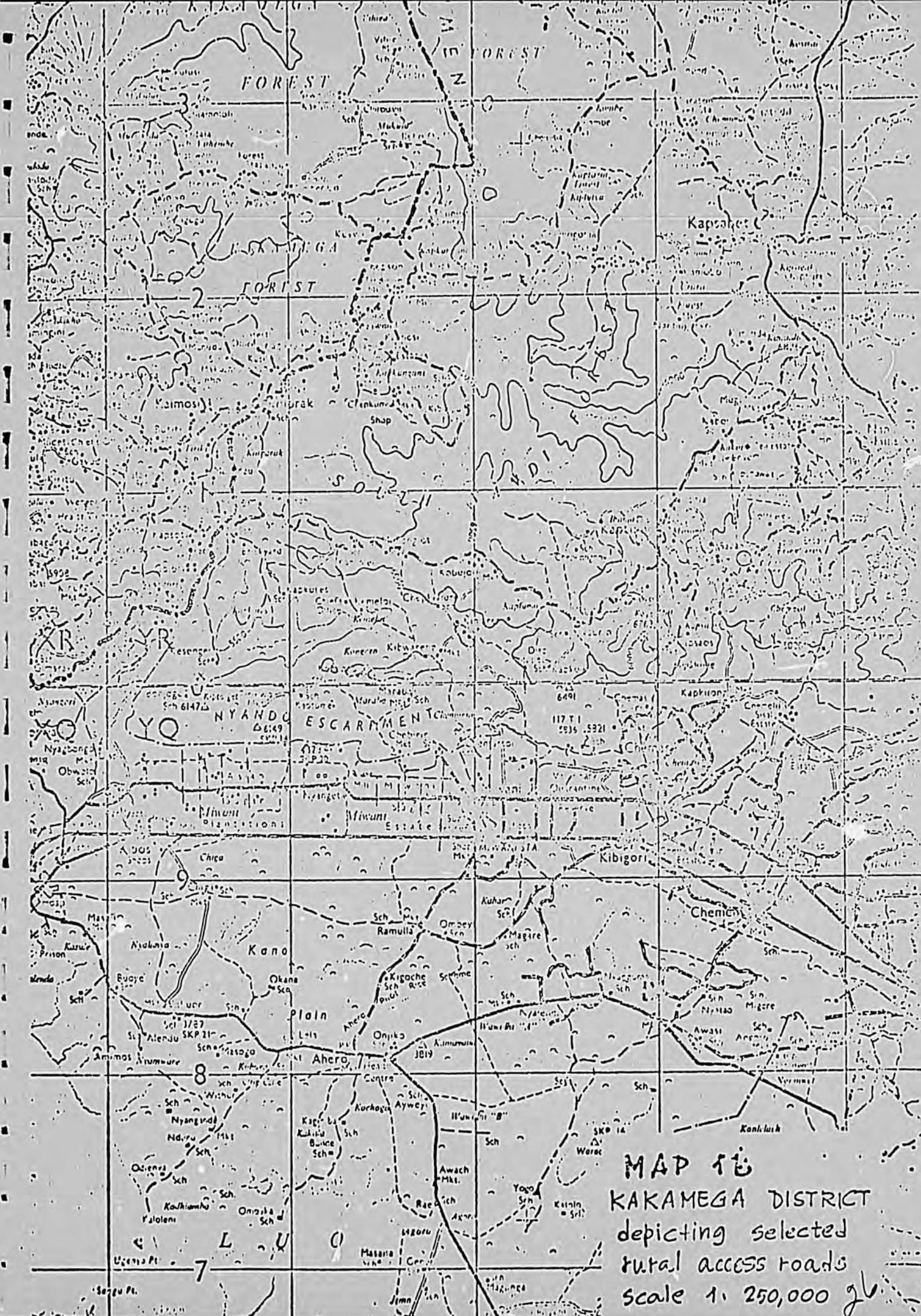
A = District farm management guidelines

M.O.A. 1977

X = Estimated

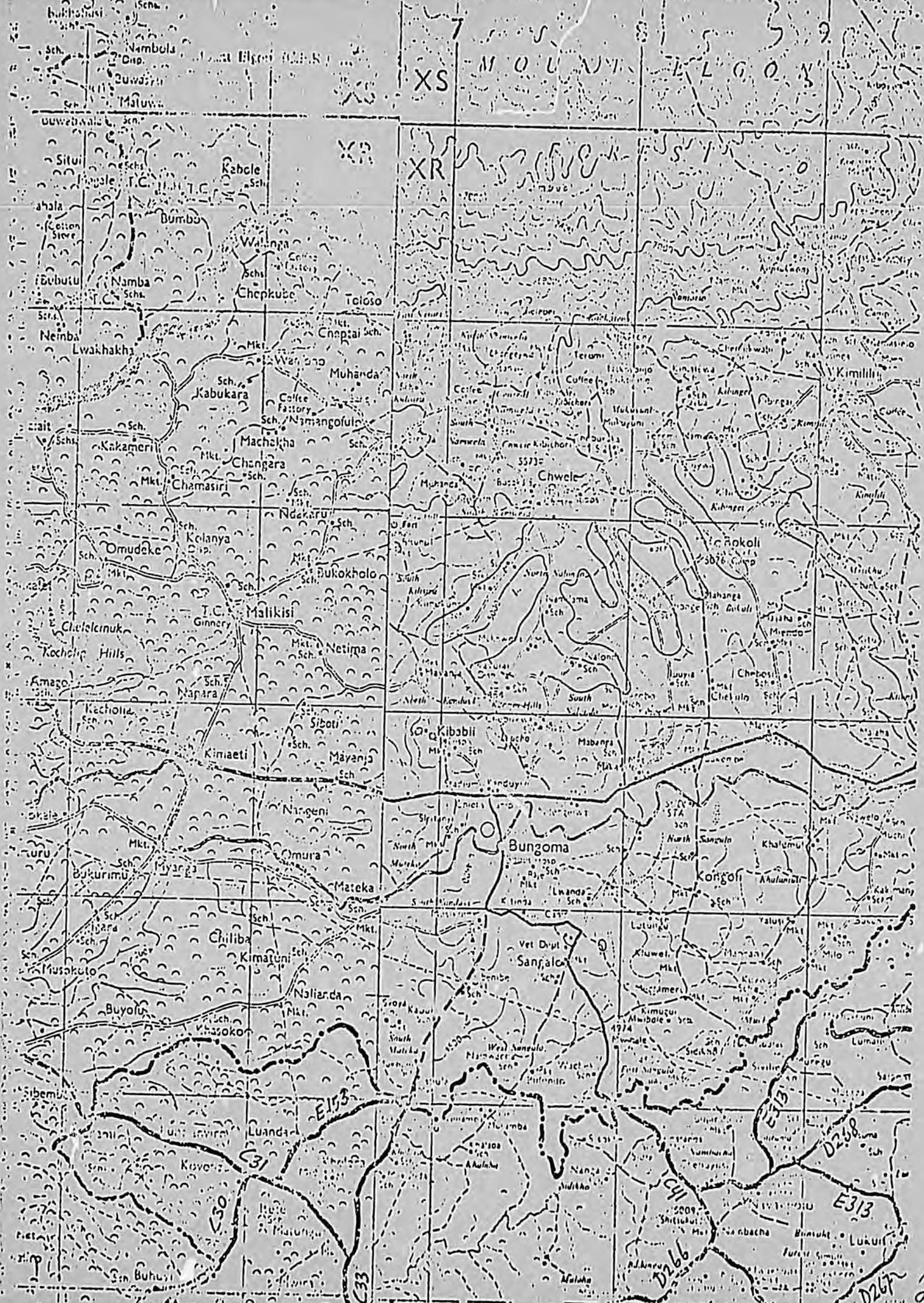


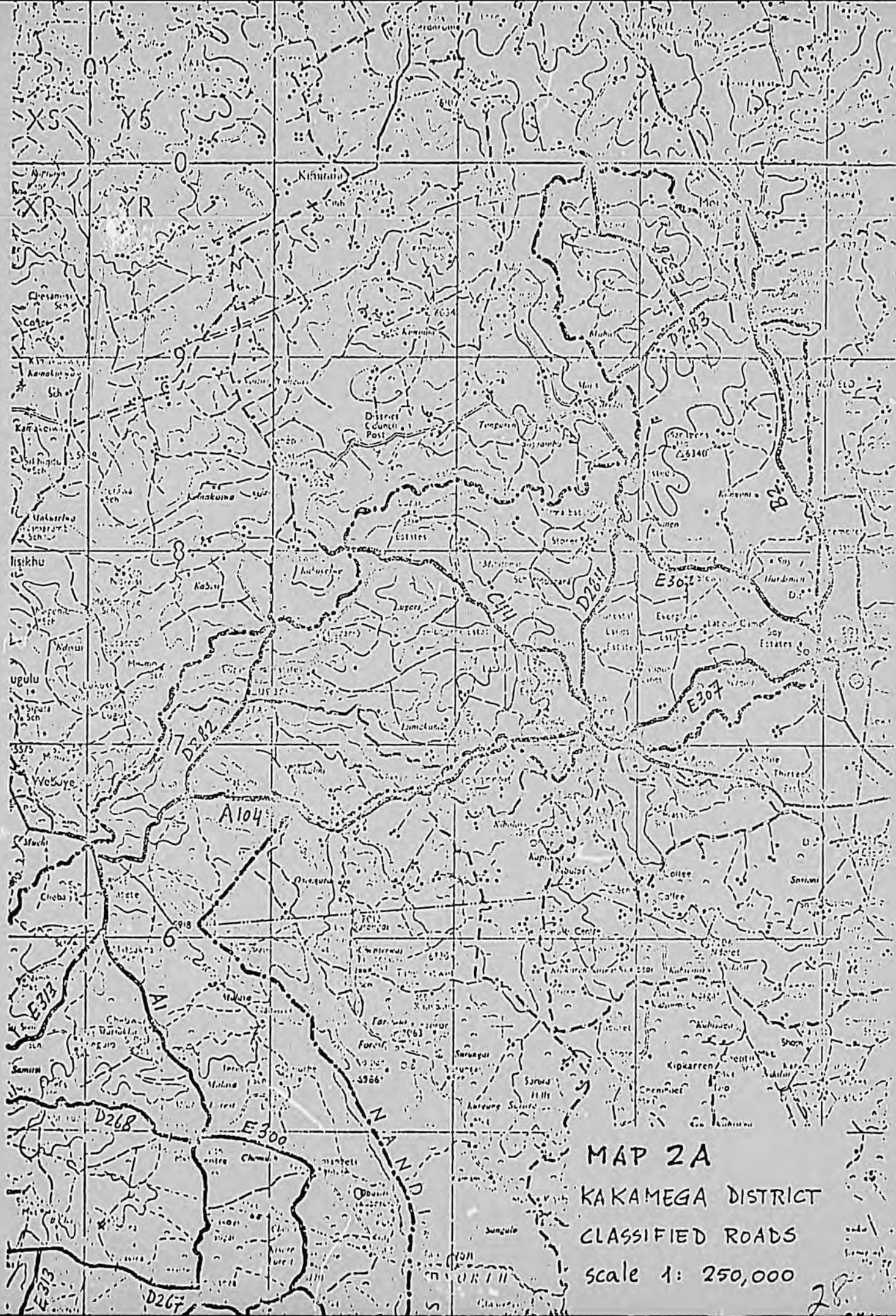
MAP 1A
 KAKAMEGA DISTRICT
 depicting selected
 rural access roads
 scale 1:250,000



MAP 16
 KAKAMEGA DISTRICT
 depicting selected
 rural access roads
 scale 1:250,000

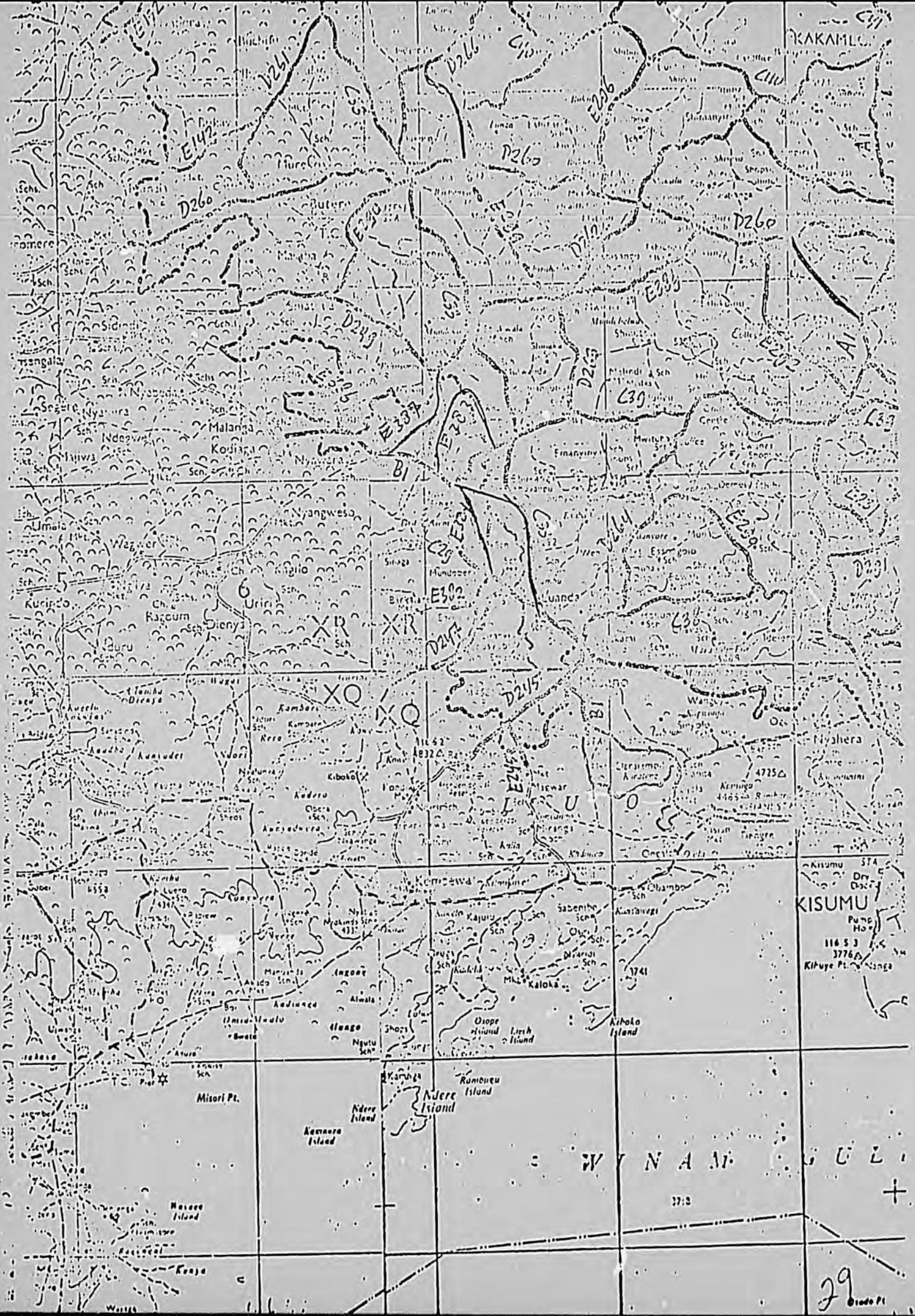
X S M O U N T A I N R A N G E





MAP 2A
 KAKAMEGA DISTRICT
 CLASSIFIED ROADS
 scale 1: 250,000

28



KAKAMBO

D260

D260

D260

D243

E337

L39

E203

L39

XR

XQ

D215

L36

D231

4735

KISUMU

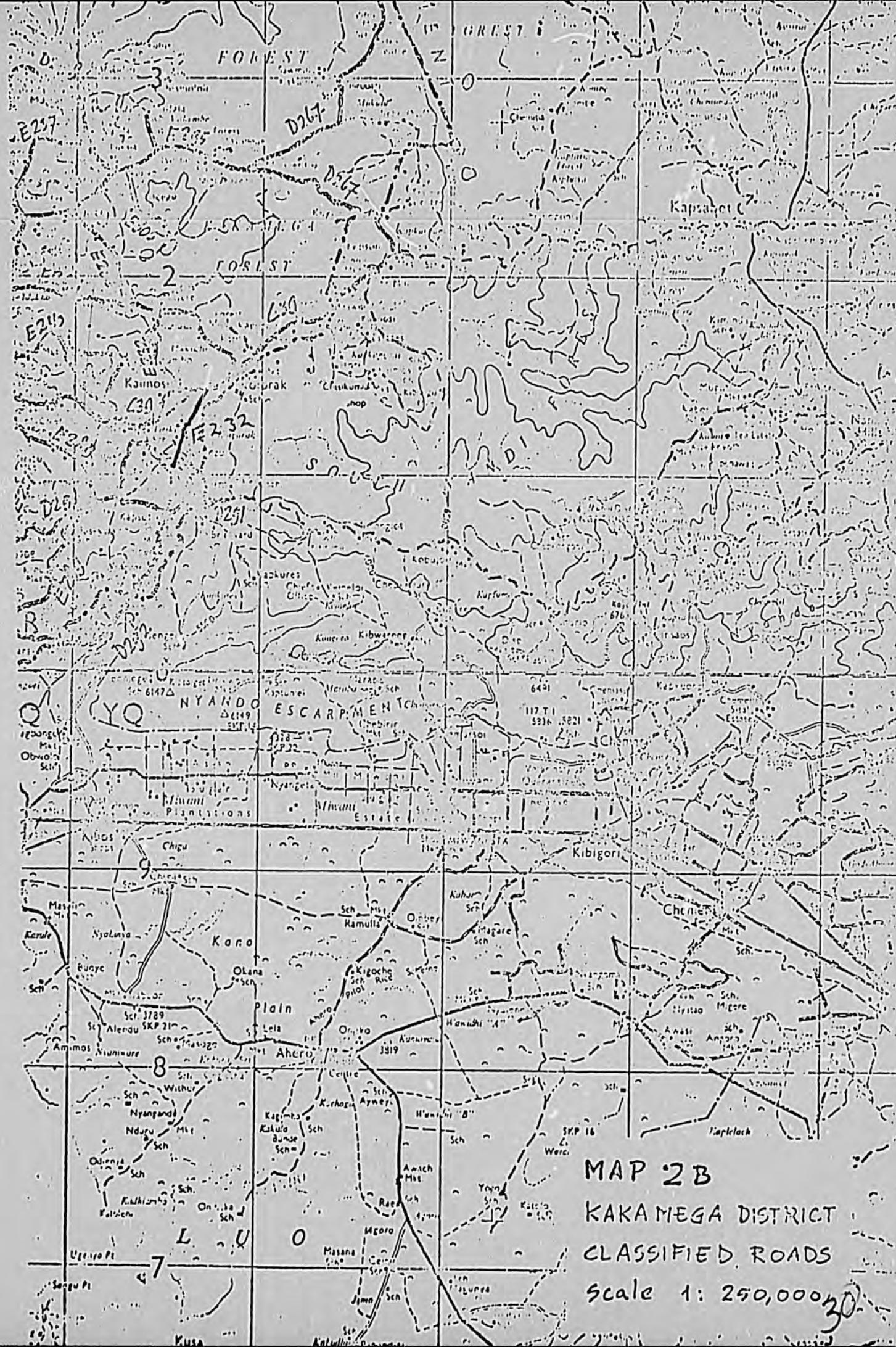
11653
3776

Kibuye Pt. Munga

WYNAMULI

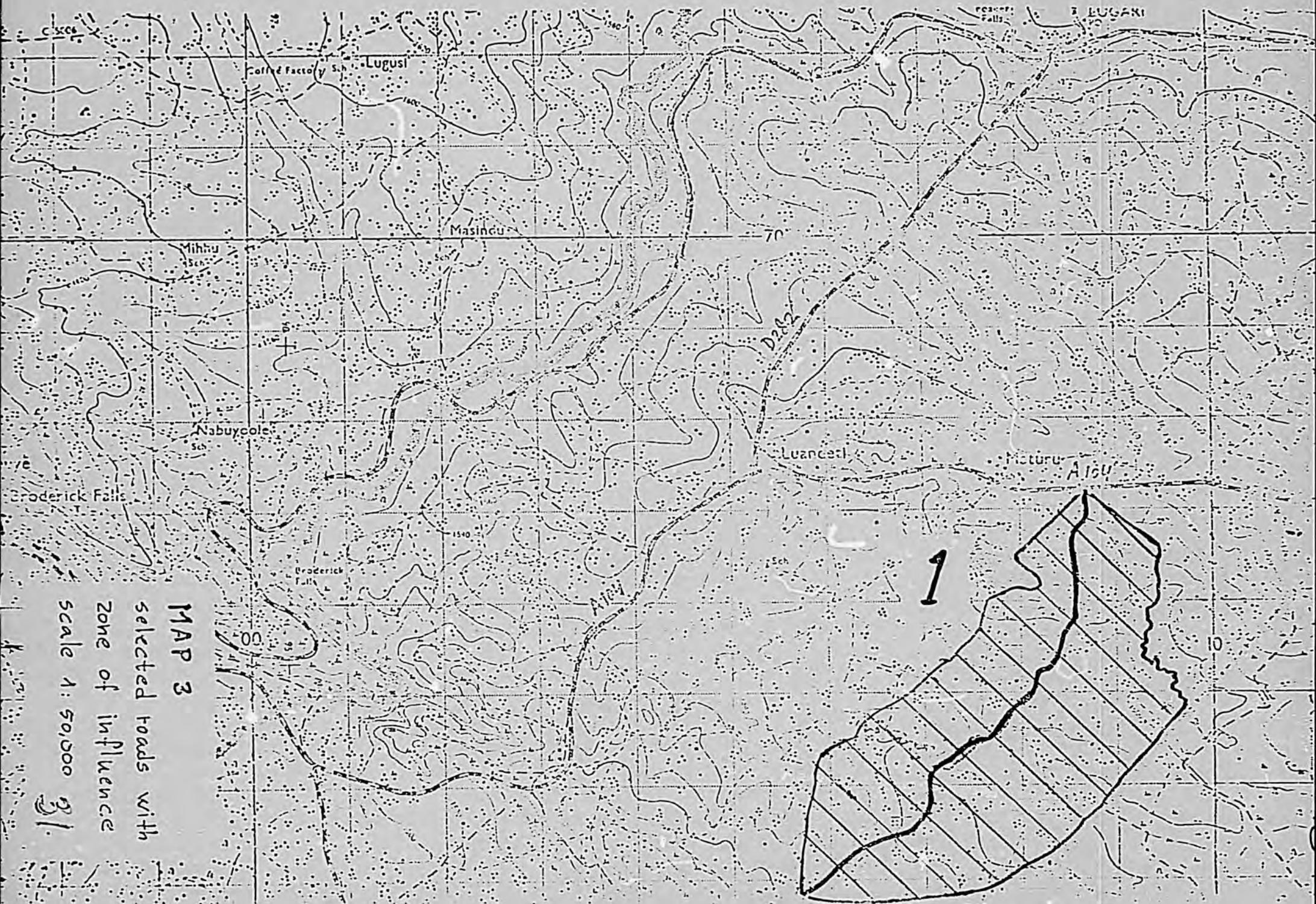
37:3

29
Grade Pt.

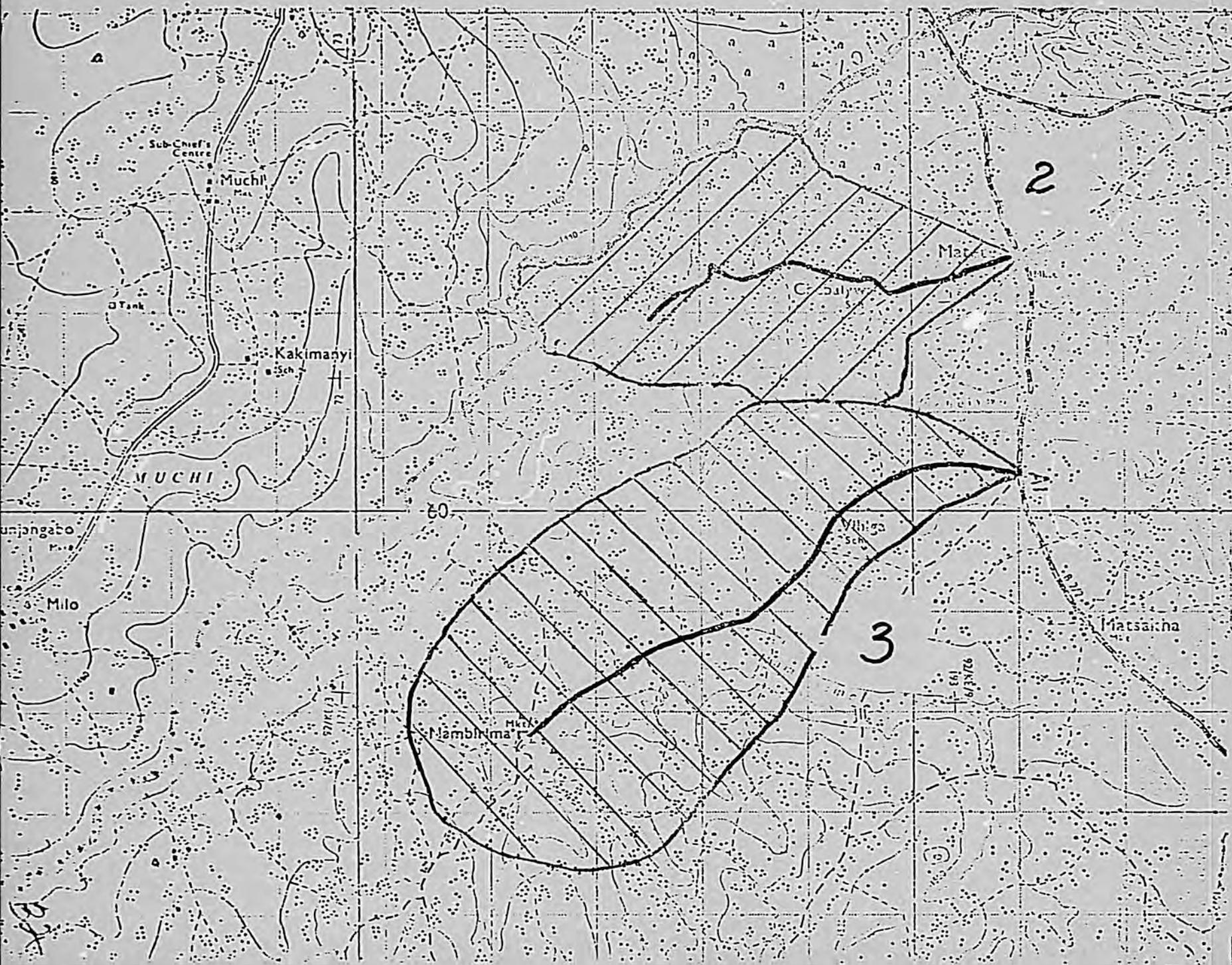


MAP 2B
 KAKAMEGA DISTRICT
 CLASSIFIED ROADS
 Scale 1: 250,000

30

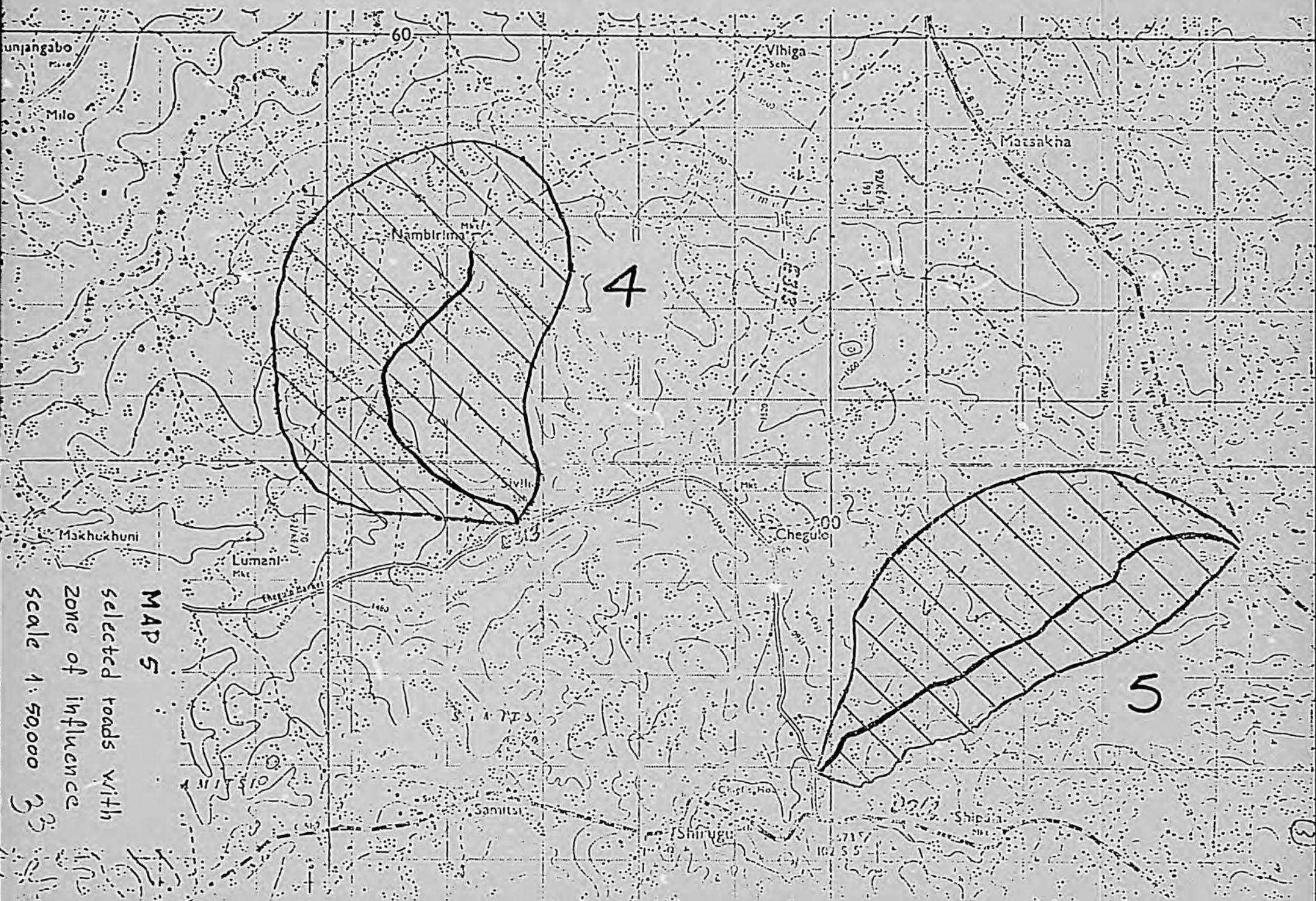


MAP 3
selected roads with
zone of influence
scale 1:50,000
31



MAP 4
selected roads with
zone of influence
scale 1:50,000

BA

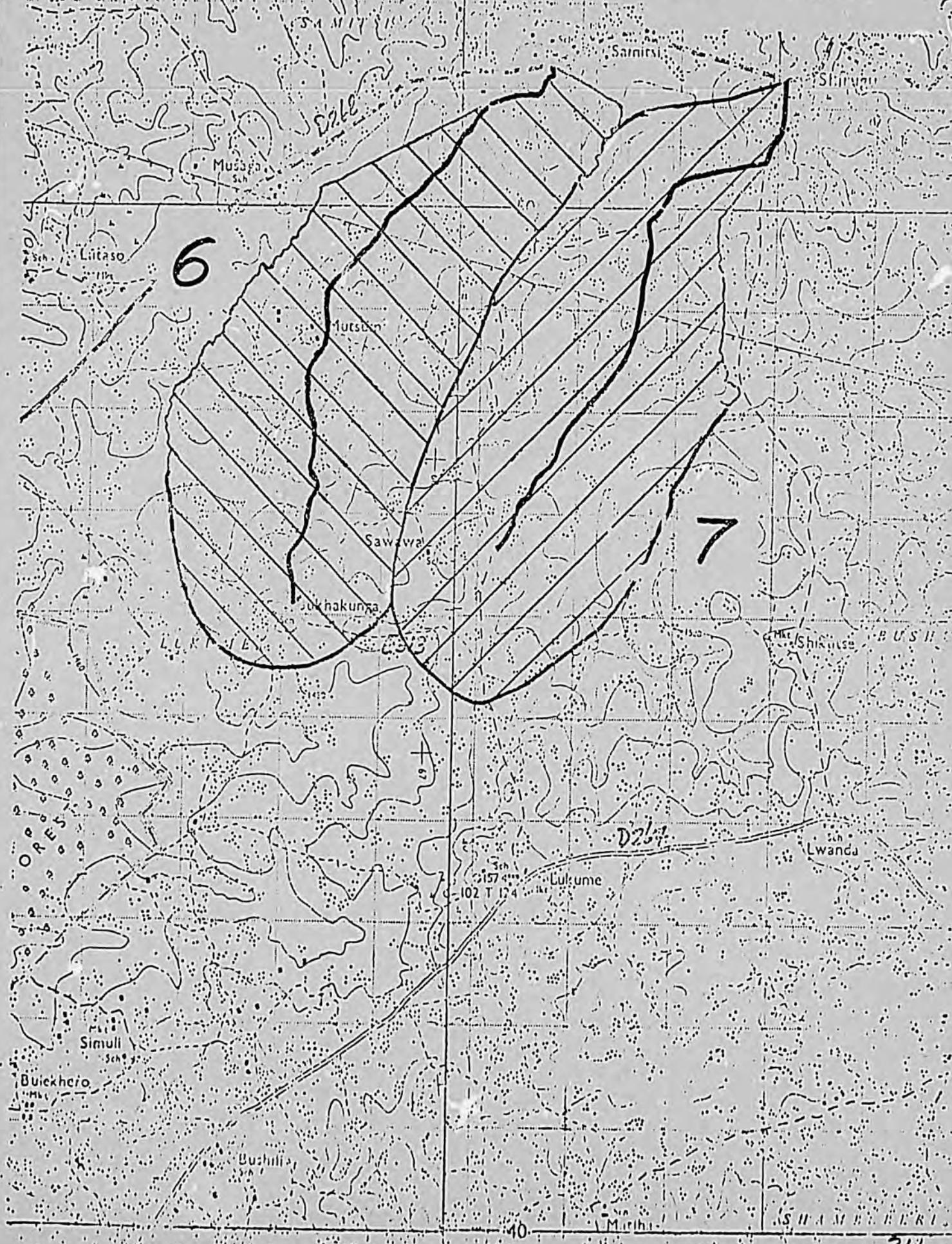


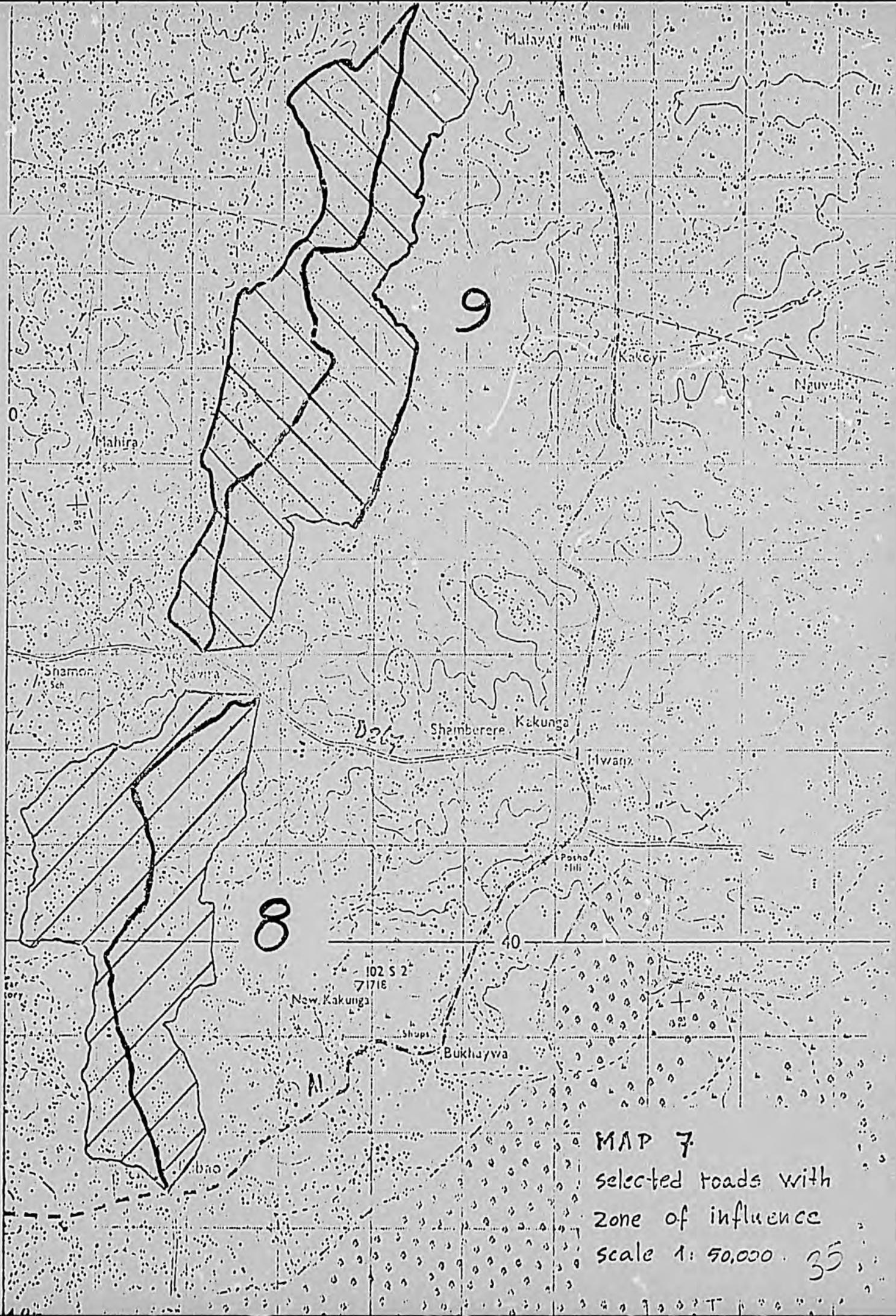
MAP 5
selected roads with
zone of influence
scale 1:50,000

4

5

selected roads with
zone of influence
Scale 1:50,000





9

8

MAP 7
selected roads with
zone of influence
scale 1:50,000 35

MAP 8
Selected roads with
Zone of influence
Scale 1:50,000
36

