EXPANDED TECHNICAL ASSISTANCE PROGRAM FAO No. 1269

THE RUFIJI BASIN
TANGANYIKA

FAO REPORT TO THE GOVERNMENT OF TANGANYIKA ON THE PRELIMINARY RECONNAISSANCE SURVEY OF THE RUFIJI BASIN

VOLUME II Hydrology and Water Resources
PART I Computation and Analyses

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS - ROME 1960

FAO Report No.

Expanded Technical Assistance Program.

THE
RUFIJI BASIN
TANGANYIKA

Section I
of
FAO Report to the Government of Tanganyika
on the preliminary reconnaissance
survey of the Rufiji Basin

Volume II, HYDROLOGY AND WATER RESOURCES

Part I, General Report on Hydrology, Computations and Analyses

by

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Food and Agriculture Organization of the United Nations
Rome 1960

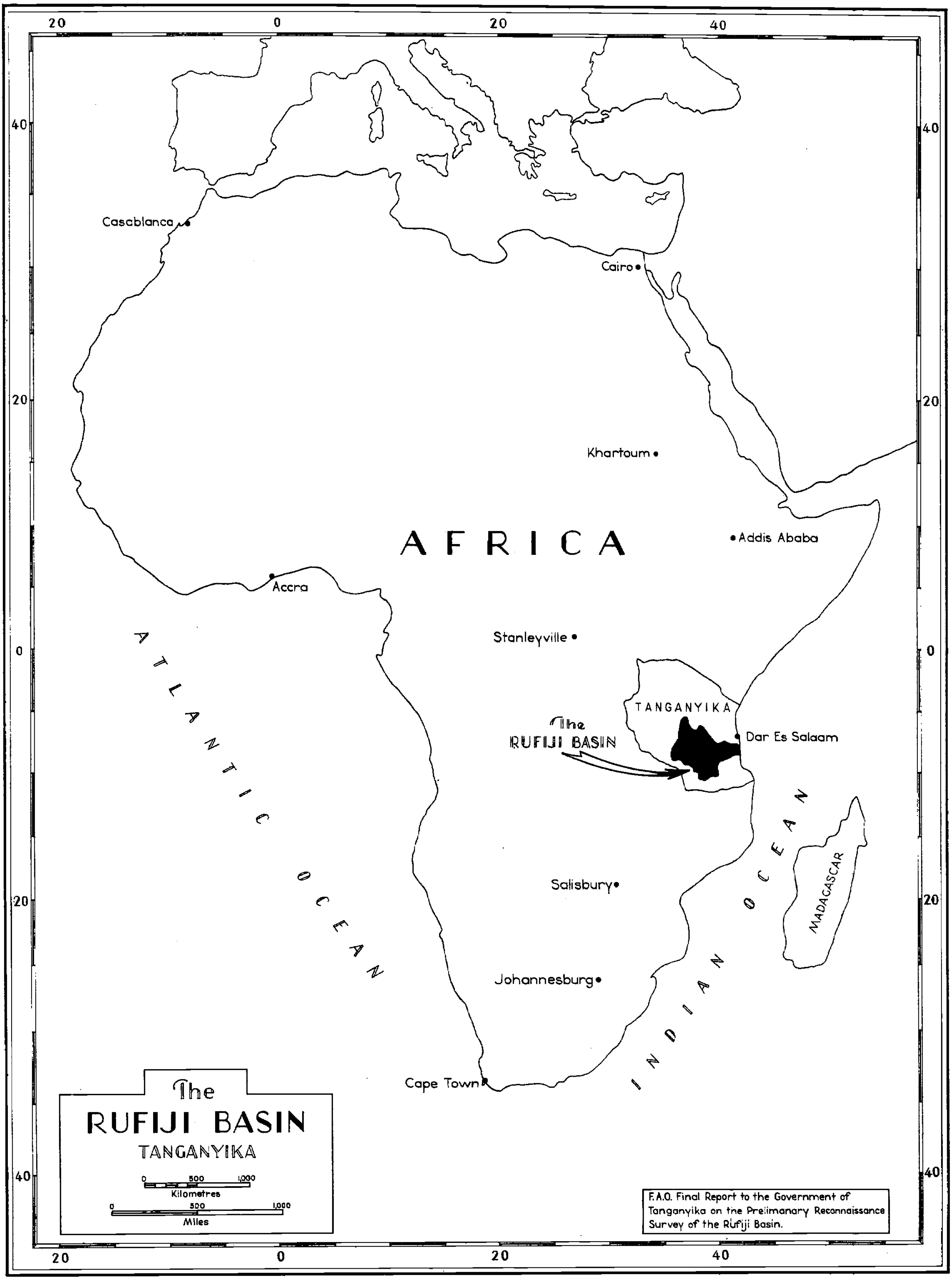
Volume II - HYDROLOGY AND WATER RESOURCES

is divided into three parts
as follows:-

Part I - General Report on Hydrology, Computations and Analyses

Part 2 - Basic Data Records.

Part 3 - Map Folder.



The
RUFIJI BASIN
TANGANYIKA

F.A.O. Final Report to the Government of Tanganyika on the Preliminary Reconnaissance Survey of the Rufiji Basin.

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SUMMARY

The Hydrological investigations of the "Rufiji Basin Survey" (RBS) cover approximately 5 years, 1955 to 1960. During this period information was compiled on runoff, suspended sediment load and quality of river water, on evaporation, rainfall and other purely meteorological conditions.

No hydrological research had previously been carried out in the area, and with the exception of some rainfall data no records were available on hydrological matters. The investigations had, therefore, to start from scratch.

The survey was faced with poor economy and in the first years with troubles of getting sufficient qualified staff. Few all weather roads were in existance in the area and it was very difficult to get adequate records compiled and to maintain a close check on field work at all times of the year.

Rainfall maps were drawn for 19 years and the rainfall was compared with runoff for a calibration and better evaluation of these data. Runoff was calculated at 49 stations. Altogether 65 river gauging stations and 10 meteorological stations established by RBS were in operation at the end of the Survey in 1960.

The hydrological conditions of the Basin are discussed in separate chapters of this report and water control is discussed in brief for the Main Rufiji and for the Great Ruaha, Kilombero and Luwegu tributaries.

The hydrological work forms the subject of Volume II of the Rufiji Report and is entitled "Hydrology and Water Resources". It is divided into three parts. Part I contains the General Report on Hydrology, Computations and Analyses.

Part 2 contains all Basic Data Records on river gauging obtained during time of survey. The records are thus preserved from loss and other special analyses can be carried out if and when required.

Part 3 contains 22 maps of which Map No. 1, Hydrological Key Map, No. 2, Frequency, Monthly and Geographical Distribution of Observed Rainfall and No. 3, Runoff Map, are of particular interest.

It is obvious that a comprehensive hydrological knowledge of the Basin can not be obtained in 5 years. It is, therefore, essential that the hydrological investigations continue for many years to come. The Survey has by 1960 been entirely taken over by the Tanganyika Government, and the Water Development and Irrigation Department, which showed a great interest in the Hydrological research is now carrying on with the Rufiji investigations with good foresight and enthusiasm.

1. INTRODUCTION

The Hydrological Section of the Rufiji Basin Survey commenced its activities in September 1955 as a branch of a more widespread research on the possibilities of future development in this river catchment. The plan was to carry out an intensified survey covering a period of approximately 5 years, and to submit a report by 1960 on the results which were obtained with recommendations for further studies and development.

River gauging was an innovation in this area, the first gauging posts being established by the Water Development and Irrigation Department late in 1954. The number of stations have since then steadily increased, and by the end of the survey in 1960 regular observations were received from 65 stations.

It is obvious that a fully comprehensive hydrological knowledge of the area cannot be obtained in such a short time and, therefore, the hydrological investigations must continue for many years to come. The information given in this report is by no means final. Conclusions sometimes derived from a rather fragmental and meagre source of records, will have to be re-adjusted when more records become available and additional studies will have to be carried out on some problems before reliable conclusions can be given on all matters connected with the hydrology and water resources of the Basin. It is hoped, however, that the results obtained during 5 years of survey will provide some important and basic knowledge on which the Tanganyika Government will be able to make some decisions as regards river development.

In the Rufiji Basin area, practical difficulties arise in many directions. Instruments and implements had to be purchased from a very limited budget, and it is obvious that a great deal more research could have been carried out if the economy had been stronger. Access to a great many stations during the flood season was very difficult and there were a great many problems in finding the necessary staff with sufficient qualifications to undertake the field and computing work involved. The latter problem was partly solved by three hydrometrists employed through FAO, who worked in close co-operation with the Government staff seconded to the hydrological team.

2. PERSONNEL IN THE HYDROLOGICAL SECTION

A large number of persons worked with the Hydrological survey of the Rufiji Basin and it would not be possible to mention all by name. The following staff list includes personnel who worked with the hydrological party for a relatively long period.

FAO PERSONNEL

J. OTNES:	Chief Hydrologist, September 1955 to end of Survey 1960.
F. TABELLI:	Hydrometrist, October 1956 to December 1958. In charge of the field investigation in the Kilombero Valley.
Ø. TILREM:	Hydrometrist, September 1956 to June 1959. In charge of the field investigations in the Iringa and later also the Chimala areas.
J.F. HARTONG VAN ARK:	Hydrometrist, September 1957 to October 1958. In charge of the field investigations in the Chimala area.
S. RAADSMA:	Associated Expert, Hydrologist from January 1959. Working with the Hydrological Section from July 1956 to March 1960, mainly with sediment transport of rivers, quality of river water and evaporation.
F.T. GRIMES:	Hydrologist and Surveyor, June 1957 to end of Survey 1960. In charge of field investigations in the Kilombero Valley after December 1958. Coordinator and Liaison Officer for the R.B.S. Team.
L. HORST:	Associated Expert. January 1959 to end of Survey 1960. Part time working on Hydrology in connection with river discharge depletion studies.

GOVERNMENT PERSONNEL (Water Development and Irrigation Dept.)

B. GEMMELL:	Engineering Assistant, September 1955 to March 1960. Draughtsman, has also assisted in field survey and general office computations.
S. SKOKOWSKI:	Computor, September 1955 to March 1960. Working with computations of river discharge measurements and water level analyses.
MRS. M. DOMET-WOLF:	Computor, June 1956 to January 1960, mainly working with rainfall analyses and other meteorological computations.
MRS. J. BENNENT:	Computor, August 1957 to March 1960. Mainly working with discharge and runoff computations and compilation of these data.

P. HORN:	Engineering Assistant, September 1955 to end of Survey 1960. Part time working with field investigations.
H. SINGH CHANAL:	Engineering Assistant, December 1957 to March 1960, mainly working with field investigations, part time with general computation work in the office.
M. H. BHATT:	Engineering Assistant, December 1958 to March 1960, mainly working with field investigations, part-time with general computation work in the office.
D. J. ADES:	Engineering Assistant, August 1957 to July 1958. Mainly working with field investigations, part time with general computation work in the office.
H. SINGH MAJHAIL:	Engineering Assistant, June 1958 to March 1960. Mainly working with field investigations, part-time with general computation work in the office.

TAC PERSONNEL.

C. WALKER:	Field Officer. October 1955 to June 1958. Part-time working on Hydrometry in connection with current meter work.
G. S. TASKER:	Field Officer. February 1956 to March 1960. Part-time working on Hydrometry in connection with current meter work.
MISS P. HARDMAN:	Geographer, February 1958 to March 1960. Working with the Topographical Section on compilation of catchment maps, extraction of watershed areas and related studies.
MRS. B. WESTERN:	Clerk/Typist, July 1957 to March 1960.
A. R. SPIJKER:	Chief Draughtsman, R.B.S. Drawing Section. February 1959 to end of Survey 1960. Supervision of drawings and tracing of hydrological maps.
Y. M. KINDY:	Tracer, December 1958 to March 1960. Tracing of graphs and curves.

3. ACKNOWLEDGEMENTS

The Hydrological Section of the RBS worked in close contact and co-operation with related official Departments of Tanganyika and wishes to render thanks for service and help:-

1. To the Directors of Water Development and Irrigation Department (WD and ID) for positive collaboration in the survey. To the Executive Engineers stationed at Morogoro, Mbeya and Iringa and their technical staff for assistance in the field and to the Design Engineer, Executive Engineers and Engineering Assistants working with Hydrology in the Project Planning Section.

2. To the Government Chemist and the Chemist in charge of analyses for all help given by analyses of river water.

3. To the Directors of East African Meteorological Department (EAMD) and the Regional Representatives, Tanganyika, for kind co-operation and willingness to supply meteorological information.

4. To the Directors of East African Agriculture and Forestry Research Organization (EAAFRO) for kind help and advice.

5. To the Chairman of Tanganyika Agricultural Corporation (TAC) and the staff for administration of the survey.

Special thanks are given to the Archbishop of Dar es Salaam and to the Mission Stations in his Diocese for their help in collecting and supervising field observations.

TABLE I.

SCHEDULE OF GAUGING STATIONS

No.	River	Station	Catchment area sq. miles	Height of Gauge zero ft.	Waterlevel Observations		Suspended Sediment Load Investigations		No. of Years with chemical analyses of river water	Met. Station Est. by HBS.	Runoff Computed	Remarks
					Observations started	Observations abandoned	From	To				
1K.1	Rufiji	Ndundu	-	18.34	Nov. 1954							W.L. station only (very approx. rating curve est.)
" 2	"	Mtanza	-	115.01	Dec. 1954					X (aband.)		W.L. " "
" 3	"	Stiegler's Gorge	61 106	210.71	Nov. 1954		Nov. 1955	Continues	4	X	X	
" 4	"	Utete	-	56.21	Dec. 1953							W.L. station only; gauge not firmly fixed.
" 5	"	Zombe	-		1938							W.L. station only;
" 6	"	Mkalinso	-	316.62	1957							W.L. " "
		Mpanganya			1926	1938						Old W.L. gauge on the Rufiji.
		Beta Trial Farm								X (aband.)		Meteorological records. Ground waterlevel obs. at Mbingu. Not published.
1KA.1	Yovi	Madizini	25		Nov. 1951						X	
" 2	Little Ruaha	Iringa	1 127	5006.96	Nov. 1954		Nov. 1956	Jan.1958	1		X	
" 3	Great Ruaha	Kidatu	30 905	896.64	Oct. 1954		Nov. 1956	Oct.1959	4	X	X	
" 4	Great Ruaha	Mbuyuni	28 774	1450.21	Nov. 1954		Nov. 1956	Oct.1959	4		X	
" 5	Great Ruaha	Mtera	26 254	2209.55	Nov. 1954		Nov. 1956	Continues	3	X	X	
" 6												1KA.6 never installed.
" 7	Chimala	Chimala	85	3717.67D/S 3733.47U/S	Nov. 1954		Nov. 1956	Oct. 1959	4		X	
" 8	Great Ruaha	Gt. North Road, Chimala	328	3511.01	Nov. 1954		Nov. 1956	Oct. 1959	4		X	
" 9	Kimani	Gt. North Road	173	3511.47	Nov. 1954		Nov. 1956	Oct. 1959	4		X	
" 10	Mlombosi	Igawa	95	3648.47	Nov. 1954					X		No permanent rating. Runoff computed approx.
" 11	Mbarali	Igawa	619	3594.19	Nov. 1954		Nov. 1956	Continues	4		X	
" 12	Halali	Iyayi D/S	302		Nov. 1954		Nov. 1957	Oct. 1959	1		X	
" 13												1KA.13 never installed.
" 14	Lukosi	Mbuyuni	1 194		Nov. 1955	July 1958						No permanent rating. Readings transferred to Mtandika.
" 15	Ndembera	Ilongo	404	5449.09	Feb. 1956		Nov. 1956	Oct. 1958	2		X	
" 16	Liosi	Igorusi	30		Mar. 1956	Oct. 1958					X	Readings transferred to New Road.
" 17	Mambi	Kikanzi	32		Mar. 1952	Oct. 1958					X	
" 18	Mawiswi	Gt. North Road	36		Mar. 1956	Oct. 1958					X	
" 19	Mbarali	Trial Farm	762	3456.60	Aug. 1956		Nov. 1958	Oct. 1959	1	X	X	Approx. curve established. Sandy.
" 20	Little Ruaha	Tosamaganga	1 273		Dec. 1955						X	
" 21	Little Ruaha	Ihimbu	957		Apr. 1957		Feb. 1958	Oct. 1959	2		X	
" 22	Mtitu	Mtitu	172		May 1957						X	
" 23	Hukuni	Iyayi	118		Dec. 1956						X	
" 24	Umrobo	Ruiwa	-		Sept.1956	Oct. 1958						Abandoned.
" 25	Mhula	Rudi	-		Jan. 1958	1959						Abandoned.
" 26	Great Ruaha	Kisilwa Crossing	13 844		Nov. 1956						X	
" 27	Great Ruaha	Hausmann's Bridge (Mkopule)	7 700		Nov. 1956						X	
" 28	Great Ruaha	Utengule	-		Dec. 1956							Griffin gauge only.
" 29	Njombe	Ifumba	5 438		Feb. 1957		Nov. 1958	Oct. 1959	1		X	
" 30	Kisigo	Mlazo	-		Dec. 1956	Jan. 1959						W.L. station only.
" 31	Little Ruaha	Mawande	2 005		Nov. 1956						X	
" 32	Little Ruaha	S. H. Club	293	5894.54	June 1957						X	

TABLE I. (Continued)

SCHEDULE OF GAUGING STATIONS

No.	River	Station	Catchment area sq. miles	Height of Gauge zero ft.	Waterlevel Observations		Suspended Sediment Load Investigations		No. of Years with chemical analyses of river water	Met. Station Est. by HBS.	Runoff Computed	Remarks
					Observations started	Observations abandoned	From	To				
1KA.33	Ndembera	Madibira	707	3490.97	Sept. 1957					X	X	
" 34	Halali	Tunduma	377	3667.20	Nov. 1958							Not complete. Approximate runoff computations.
" 35	Ipwani	Tunduma	637		Jan. 1957	1958						Abandoned. Records not reliable.
" 36	Halali	Majojolo	1 014	3640.45	Nov. 1958						X	
" 37	Lukosi	Mtandika	1 117		April 1957		Aug. 1957	Oct. 1959	2		X	
" 38	Yovi	Great Ruaha Confl.	243		April 1958						X	
" 39	Little Ruaha	Iwawa	645		April 1957						X	
" 40	Chimala	Chosi Furrow	–		Oct. 1957							No rating est.
" 41	Kisigo	Ilangali	3 413		Nov. 1957					X	X	
" 42	Kisigo	Kinunguru	9 476		Nov. 1957		Nov. 1957	Oct. 1959	2		X	
" 43	Njombe	Isanga	1 457		Dec. 1957	July 1959	Nov. 1957	Oct. 1959	1		X	Abandoned.
" 44	Bubu	Chamwale	–		Jan. 1958	Aug. 1958						Not complete.
" 45	Ipatagwa	New Road	15		Nov. 1958							Not complete.
" 46	Halali	Iyayi U/S	184		Feb. 1958						X	
" 47	Masukhunde	Matumbulu	–									Never installed.
" 48	Liosi	New Road	38		Nov. 1958							
" 49	Mambi	New Road	38		Nov. 1958							
" 50	Mswiswi	New Road	42		Nov. 1958							Not complete.
" 51	Umrobo	New Road	29		Nov. 1958							Not complete.
" 52	Ndenga	Tunduma	–		March 1958							Not complete.
1KB. 1	Msolwa	Msolwa Estate	8		Aug. 1955	1957					X	Abandoned (Approx. Rating).
" 2	Kilombero	Ifakara	12 063	791.91	Nov. 1954		Nov. 1956	Oct. 1959	4		X	
" 3	Lumemo	Ifakara	165	816.48	Aug. 1955	1958	Nov. 1956	Oct. 1958	3		X	
" 4	Kilombero	Ifwema	7 048	931.47	Jan. 1955		Nov. 1956	Oct. 1959	4		X	
" 5	Luhombero	Ilonga	395		Jan. 1955		Nov. 1957	Oct. 1959	3	X	X	
" 6	Kigogo–Ruaha	Frick's Bridge	511		Feb. 1956		Nov. 1957	Oct. 1959	1		X	
" 7	Fuagi	Idege (Livalonga Bridge)	24		Feb. 1956		Nov. 1956	Oct. 1957			X	
" 8	Mpanga	Mpanga Mission	937	967.30	Dec. 1956		Nov. 1958	Oct. 1959	1		X	
" 9	Mnyera	Taveta Mission	1 950		Dec. 1956		Nov. 1958	Oct. 1959	1		X	
" 10	Ruhuji	Mwayamalungu	3 294		Dec. 1956		Nov. 1958	Oct. 1959	1		X	
" 11	Sofi	Sofi Mission	62		Dec. 1956						X	
" 12	Mchilipa	Idete	114		Dec. 1956						X	
" 13	Lumemo	Trial Farm	165		March 1957					X		W.L. station only.
" 14	Lumemo	Kibaoni	164		Jan. 1958						X	
" 15	Mgeta	Mchombe Mission	124		Nov. 1957						X	
" 16	Furua	Malinyi Mission	507		Nov. 1957		Nov. 1957	Oct. 1959	2	X	X	
" 17	Kilombero	Swero	12 915	776.38	Nov. 1957		Nov. 1957	Continues	2		X	
" 18	Ruhuji	Njombe Bridge	–		Feb. 1958							Not complete.
1KC.1	Luwegu	Damsite	9 362		Aug. 1957							Griffin gauge only.

5. THE BASIN.

The Rufiji Basin covers an area of 68500 sq.miles in Southern and Central Tanganyika. It is situated between 5° 32' and 10° 44' South, 33° 32' and 39° 25' East and has a great variation in topographic and to some extent also in climatic conditions. It is a humid and hot climate on the Coast and in the Kilombero Valley. There are very dry and hot areas in the North-Western part of the Basin and in mountainous regions the temperature can in June, July and August, fall below 40° F and even below the freezing point in extreme cases. Temperature graphs for 9 stations are enclosed at the end of this chapter.

There are three main tributaries forming the Rufiji.

1. The Great Ruaha	32424 sq.miles	43.3% of Basin area.
2. The Kilombero	15442 sq.miles	22.5% of Basin area.
3. The Luwegu	10156 sq.miles	14.8% of Basin area.

The Kilombero joins the Luwegu in a series of cascading rapids at the Shuguri falls and for the purpose of this report this is said to be the beginning of the Rufiji proper. At the confluence the Kilombero drops on a long rocky ledge into the Luwegu and immediately downstream the waters plunge over two more stages of falls. The total fall of the Kilombero waters is about 175 ft in 2½ miles. The waters of the Luwegu reach the confluence with a much more gentle slope.

Sixty river miles north eastwards from the Shuguri, the Rufiji is joined by the Great Ruaha, and 8.7 miles downstream of this confluence the water falls 75 ft in 4 miles over the Pangani Rapids. Before entering the lower plains the river passes through Stiegler's Gorge, a narrow precipitous canyon.

The concentrated drop of river in the Shuguri Falls and Pangani Rapids is a part of the "East African Fall Line"

From the outlet of the Gorge the Rufiji traverses a flat and wide plain down to the Indian Ocean, only falling about 200 ft in 140 miles. The river moves sluggishly as it approaches the sea, and due to sandy banks and environment, changes its course from year to year. As a result of the Coriolis acceleration in the southern hemisphere the Rufiji is mainly digging northwards. This can clearly be seen from Nyakasiku to some miles upstream of Utete. There are high riverbanks to the north and lower land with several old riverbeds on the southern side of the present river. From Utete to the sea the change of course seems to be of a more casual nature.

The Great Ruaha has its source in the Poroto Mountains and the Kipengere Range in the south-western corner of the Rufiji Basin. The Mtorwi peak there is the highest point in the Basin, 9711 ft. above sea level. Many perennial tributaries contribute to the headwaters of the Great Ruaha and of these the Mbarali, the Kimani and the Chimala are the most important. After entering the Usangu Plain the river travels through an increasingly dry region dropping from about 3300 ft. to 2200 ft. on its way down to Mtera. From the right the Halali, the Ndembera and the Little Ruaha join the main stream. The Halali is an intermittent river in its lower stretches and the Ndembera is drying out in some years before it reaches the Utengule Swamp. The Little Ruaha is perennial. It rises in high rainfall areas at Mufindi and runs through areas of decreasing rainfall in the Southern Highlands before reaching Great Ruaha downstream of Kimande Village where the annual recorded average is 15.88 inches only. The Great Ruaha receives a number of tributaries from the West, most of them carry only seasonal water. The largest, the Kisigo River, drains an area of 10206 sq.miles. This area is as a whole very dry. The average in some places might even be below that of the Kimande recordings. Below Mtera the Great Ruaha breaks through a mountainous region and flows in a deep narrow valley down to Kidatu. The country from there is more flat and open before the confluence with the Rufiji.

The Kilombero headwaters are situated in the Njombe district and its main tributary, the Ruhuji, flows through a steep and narrow valley before reaching the Kilombero Plains. Here it is joined by the Pitu coming from the south and a little further down by the Mnyera from the west. For the purpose of this report this is said to be the beginning of the Kilombero proper. The river now flows through a wide and fertile valley which is usually flooded for extensive periods every year. The river bifurcuates several times in the Ulanga district before it reaches Ifakara. The Kilombero receives many tributaries from the west and northwest, the more important being the Mpanga, the Kihanzi, the Mgeta, the Ruipa, the Lumemo and the Msolwa Rivers, all having their sources in high mountains and carrying discharges all the year round. There are a great number of smaller streams flowing from the south and south-east of which the Furua and the Luhombero are the only two worth mentioning here. These are both fed by rain falling on the Mahenge Massif.

The Luwegu River drains the southern part of the Basin. It is joined by the Mbarangandu draining about the same size of catchment. This is partly a hilly region and the river gradient is steeper than on the Great Ruaha and the Kilombero rivers.

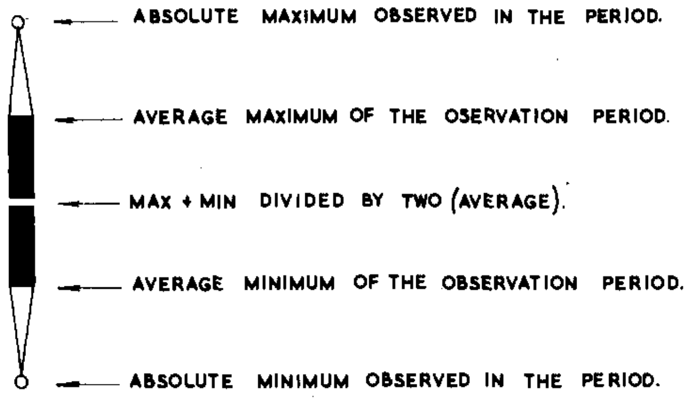
A considerable length of a mountain barrier running through the central part of the Rufiji Basin from south-west to north-east forms the watershed between the Great Ruaha and Kilombero sub-catchments. It also divides the Rufiji Basin into two almost equal areas. The highest points in the chain are found in the Mufindi and Uzungwa Mountains with summits in the latter even topping 7000 ft. The chain continues in the same direction through the Udekwa Mountains bending more northwards at the northern boundary of the Rufiji Basin. These mountains rise from a very flat and wide plain in the Kilombero region and slopes on the south-eastern side are generally very abrupt. The ridge rises from about 1000 ft to more than 6000 ft in a few miles and is highly exposed to moisture- laden monsoon winds. Along the slopes of this escarpment the highest rainfall areas within the Basin are found. Rainfall on an average reaches over 70 inches in a year. Only on the Mahenge Massif, south of Kilombero, equally high rainfall has been observed. These mountains, catching comparatively much rain and giving high runoff to the Kilombero, are the most apparent hydrological features which separate this river basin from the dry areas of the Middle Great Ruaha.

The Rufiji Basin is mostly covered with grass, bushland and forest, and by burning in the dry season Africans are doing a great deal of harm to their land. Fires are started mainly for clearing purposes on their farms and for protection against game, but little attempt is ever made to restrict them. Consequently, the ground becomes more and more exposed and both soil erosion and loss of water by evaporation increase enormously.

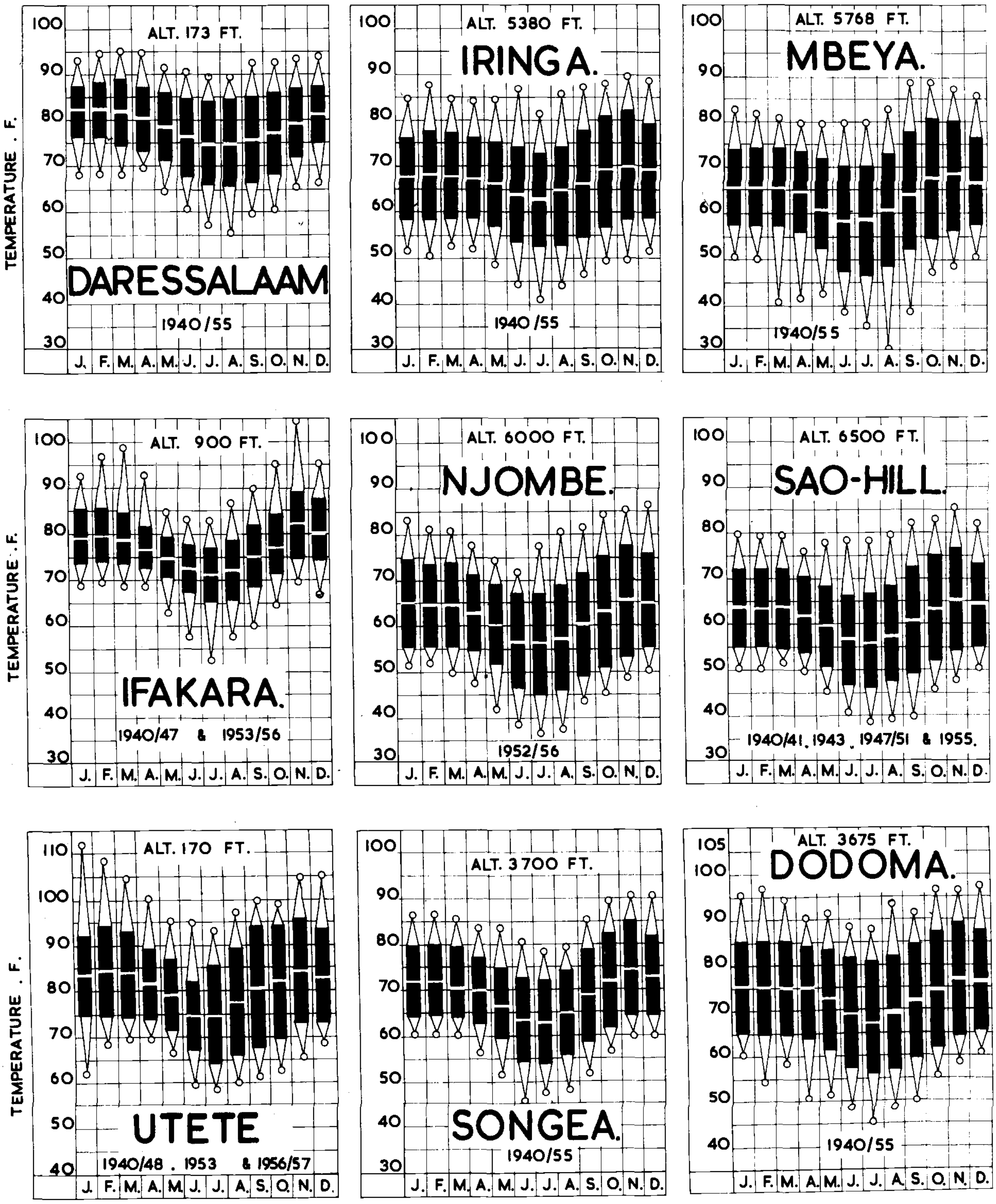
Areas with dense tropical rain forest and jungle occur in heavy rain areas, principally on mountain slopes surrounding the Kilombero Valley. Strictly speaking there are no arid regions in the Rufiji Basin. However, the north-western region, the Kisigo sub-catchment and the areas between this river and the Great Ruaha must be regarded as semi-arid with rainfall, on an average, less than 20 inches a year.

VARIATION OF TEMPERATURE FOR A SELECTED NUMBER OF STATIONS WITHIN OR ADJACENT TO THE RUFIJI BASIN.

GRAPH DESCRIPTION÷



COMPILED FROM INFORMATION SUPPLIED BY THE METEOROLOGICAL DEPARTMENT D.S.M.



6. CATCHMENT AREAS.

a. NOTES ON COMPILATION OF CATCHMENT MAPS.

None of the areas as taken from the catchment maps can be said to be absolutely accurate, although the maps have been compiled from the best sources available - the D.O.S. 1:50,000 sheets, the Tanganyika Series at 1:125,000, the 1:500,000 military map, and photo print laydowns. A combination of two or more of these sources was usually used in each compilation. These sub-catchment maps were continually revised as new 1/50,000 D.O.S. sheets become available.

In all cases such a combination of material means varying accuracy over the map compiled.

The 1:500,000 maps are on the whole unreliable publications for the purpose of measuring catchment areas but unfortunately for about half the basin, they provide the only cover. The photo print laydowns are not wholly reliable because their scale is not uniform.

The 1:50,000 series which covers 37% of the basin, including important areas of the Southern Highlands Province and the Kilombero Valley, is, of course, the best source of information but a number of the sheets are preliminary plots and the lack of contour detail prohibits accurate positioning of the watersheds.

The 1:125,000 maps compiled in Tanganyika are produced from the 1:50,000 sheets and were used wherever possible for speed and convenience.

The accuracy of the maps therefore varies according to their compilation, and the reliability diagram attached to each acts as a guide in this respect.

Some of the catchments (e.g. Lukosi) and areas to Key points (e.g. to Stiegler's Gorge) have recently been revised and the areas changed slightly in consequence. The original figures, however, having been used and incorporated in Hydrological Reports for some time were retained. This also applies to the original figure for the area of the entire basin, 68,500 sq. miles. Having been in common usage for five years, it was not altered when found on re-measurement to differ by less than 1%.

b. LIST OF CATCHMENT AREAS FOR DAMSITES, GAUGING STATIONS AND WHOLE SUB-CATCHMENTS

GREAT RUAHA SUB-CATCHMENT

Sub-divisions.	Area in Sq.miles	Areas to Key points
Mbarali		
To Damsite	566	
" Igawa - gauge	619	
" Trial Farm (incl. Mlombosi)	762	
" Kimani Confluence	831	

Sub-divisions.	Area in Sq.miles	Areas to Key points
Mlombosi		
To Road crossing - gauge	95	
" Mbarali confluence	109	
Kimani		
To Damsite	170	
" Road crossing - gauge	173	
" Mbarali Confluence	233	
Great Ruaha		
To Damsite	321	
" Road crossing - gauge	328	
" Brandt Mission area	345	
Chimala		
To Road crossing - gauge	85	
" Brandt Mission area	127	
Liosi		
To New Road crossing - gauge	38	
Mambi		
To New Road crossing - gauge	38	
Mswiswi		
To New Road crossing - gauge	42	
Umrobo		
To New Road crossing - gauge	29	
Ipatagwa		
To New Road crossing - gauge	15	
Halali		
To Iyayi	184	
" Iyayi (incl. Hukuni and Lummula)	302	
" Tunduma	377	
" Majojolo (incl. Ipwani)	1,014	
" Great Ruaha Confluence	1,149	
Ipwani		
To Damsite	455	
" Halali Confluence	637	
Ndembera		
To Ilongo	404	
" Madibira	707	
" Great Ruaha Confluence	1,060	

Sub-divisions	Area in Sq.miles	Areas to Key points
GREAT RUAHA TO MKOPULE		7,700
Little Ruaha		
To S.Highlands Club, (Makalala Damsite)	293	
" Iwawa	645	
" Ihimbu (incl. Mtitu 172)	957	
" Iringa	1,127	
" Tosamanganga	1,273	
" Mawande	2,005	
" Great Ruaha Confluence	2,141	
GREAT RUAHA TO KISILWA CROSSING		13,844
Njombe		
To Isanga	1,467	
" Ifumba	5,438	
" Kisigo Confluence	5,445	
Kisigo		
To Ilangali	3,413	
" Iwimbi (incl. Njombe)	9,476	
" Great Ruaha Confluence	10,206	
Bubu-Fufu		
To Great Ruaha Confluence	1,238	
Milaka		
To Great Ruaha Confluence	393	
GREAT RUAHA TO MTERA incl. KISIGO		26,254
Mohazima		
To Great Ruaha Confluence	526	
GREAT RUAHA TO MBUYUNI		28,774
Lukosi		
To Gauge	1,117	
" Great Ruaha Confluence	1,194	
Yovi		
To Gauge	243	
" Great Ruaha Confluence	244	
GREAT RUAHA TO KIDATU		30,905
Luhombe		
To Great Ruaha Confluence	559	
GREAT RUAHA TO RUFIJI CONFLUENCE		32,424

Sub-division	Area in Sq.miles	Area to Key points
KILOMBERO SUB-CATCHMENT		
Ruhuji		
To Pitu Confluence	1,847	
" Pitu Confluence (incl. Pitu)	2,774	
" Damsite (Mkasu)	3,277	
" Gauge (incl. Mwatisi and Msima)	3,294	
" Mnyera Confluence	3,312	
Fuagi		
To Damsite (Idege)	21	
" Gauge	24	
" Kigogo-Ruaha Confluence	39	
Kigogo-Ruaha		
To Frick's Bridge	511	
" Damsite(Msana, Lugala)	529	
" Lidete Confluence	684	
Lidete Ruaha		
To Kigogo-Ruaha Confluence	1,002	
Mnyera		
To Taveta	1,950	
" Damsite (Taveta)	2,264	
" Ruhuji Confluence	2,652	
Mpanga		
To Damsite (Mdiku)	910	
" Gauge	937	
" Mnyera Confluence	1,010	
KILOMBERO TO IFWEMA		7,048
Furua		
To Gauge	507	
" Kilombero Confluence	720	
Sofi		
To Gauge	62	
" Kilombero Confluence	101	
Svasesa		
To Kilombero Confluence	99	
Alyhanya		
To Kilombero Confluence	13	
Mchilipa		
To Gauge	114	
" Kilombero Confluence	141	

Sub-division	Area in Sq.miles	Areas to Key points
Luri		
To Kilombero Confluence	191	
Kihansi		
To Damsite (Merera)	475	
" Kilombero Confluence	722	
Mgeta		
To Gauge	124	
" Kilombero Confluence	323	
Ruipa		
To Damsite (Ngonywa)	535	
" Kilombero Confluence	683	
Lumemo		
To Ifakara	165	
" Kilombero Confluence	167	
KILOMBERO TO IFAKARA		12,063
Msolwa		
To Gauge	8	
" Kilombero Confluence	476	
KILOMBERO TO SWERO		12,915
KILOMBERO TO KINGENENAS		13,121
Luhombero		
To Ilonga	395	
" Kilombero Confluence	1,508	
KILOMBERO TO LUWEGU CONFLUENCE		15,442
Mbaragandu		
To Luwegu Confluence	4,436	
Luwegu		
To Mbarangandu Confluence	4,814	
" Damsite (Njangasi)	9,382	
LUWEGU TO KILOMBERO CONFLUENCE		10,156
Rufiji		
To Great Ruaha Confluence	28,316	
" Stiegler's Gorge	61,106	
" Indian Ocean	68,500	
ENTIRE RUFIJI BASIN		68,500

7. RAINFALL

a. INTRODUCTION

In hydrological research work the study of precipitation is of very great importance. Not only is rainfall a fundamental factor for all life, natural growth and development, but since all rivers are fed by rain there will always exist a certain relationship between rainfall and runoff. Rainfall information is, therefore, a valuable guide for a synthetic extension of observation periods on runoff and most of the analyses presented in this report were carried out with the intention of supporting the runoff calculations.

In the Rufiji Basin few actual runoff observations were available, therefore average and extreme totals for river regulation purposes could not be satisfactorily computed from field data established by the Rufiji Basin Survey Team. Fortunately rainfall figures existed over much longer periods, and an indirect way of computing such figures was possible.

b. RAINFALL OBSERVATIONS

The Rufiji Basin is sparsely populated so that only with great difficulty can reliable observations be obtained. Missionaries, Farmers and Government Officials have given their voluntary services to the EAMD in erecting rainfall gauges and performing observations. The network of stations though, is still too thin and it is only in the central part, mainly in the Southern Highlands from Iringa via Mufindi to Njombe, where the expression network can be used.

In the Southern part consisting of the entire Luwegu Drainage Area, only one rain gauge, Nyamtunbu, exists at the present. The rainfall conditions here are, therefore, largely unknown and some records outside this basin have been considered when estimating isohyets on maps. The Luwegu sub-catchment comprises a large tsetse area with a very small population. There are only a few footpaths and the area is not easily accessible to motor transport, so that rainfall records are comparatively expensive.

Very little is known about rainfall in the whole Western part of the Rufiji Basin north-westwards from the Great Ruaha River to Itigi railway station on the Central Line. The area is on a whole a very dry one, and in some years is may show rainfalls of even less then ten inches. A few stations have been installed by RBS along the Kisigo River, but the observation periods to date are too short to draw any firm conclusions. It is anticipated that rainfall conditions will vary very little from one place to another inside the Kisigo basin.

Available records show periods from a few months up to several years. For some of the oldest stations inside or adjacent to the Rufiji Basin, such as Mohoro, Kilwa, Dar es Salaam and Kilosa, records began late in the last century, but these records are not always continuous. They are interrupted from a few months to one or more years of missing observations.

In 1956, when rainfall analyses commenced for the purpose of this report, 14 stations had continuous records for 15 or more years. These stations formed then the base for a synthetic evaluation of rainfall at other stations and consequently for the annual isohyetal maps drawn for the same years. Altogether there were 80 operating stations in 1956 and on an average one gauge per 860 sq. miles. The latter number, however, does not mean so very much since the geographical distribution is far from homogeneous.

The rainfall records inside the Basin which were used for the establishment of isohyetal maps are shown on page 38 to 40. The hatched part illustrates the years for which rainfall has been computed. The methods of procedure for these calculations are explained later.

c. DISTRIBUTION OF RAIN THROUGHOUT THE YEAR

In the Northern regions of Tanganyika the rainy season can be divided into two, the "short rains" in November-December and the "long rains" from March to April. The dry period in between these rainy seasons diminishes more and more towards the South and in the Rufiji Basin the sole recognisable fact is that the February average is slightly smaller than that of either January or March. It is therefore more correct to divide the year into two seasons only, the rainy season beginning in November and ending in May, and the dry season beginning in June and ending in October. Practically all the year's rain is concentrated in the seven rainy months.

The following procedure has been adopted in analysing monthly rainfall at a number of selected stations with comparatively long observation periods: the observed rainfall for each calendar month over the whole period has been arranged in diminishing series from maximum to minimum. From these series the following characteristic data have been selected for each month.

1. Maximum of observed monthly rain.
2. Upper quartile of observed monthly rain.
3. Median of observed monthly rain.
4. Lower quartile of observed monthly rain.
5. Minimum of observed monthly rain.

In addition the more commonly used arithmetical means have been computed. The results of such analyses from 30 stations inside or adjacent to the Rufiji Basin are shown in Table III, page 31 to 36 and presented graphically on page 41 to 43.

These results require further explanations. In a series arranged from maximum to minimum the median is the middle figure irrespective of the size of the figures above or below, i.e. there are 50% of instances with more and 50% with less rainfall than the median shows. Median values are often used to express normal conditions instead of the arithmetic mean. The median divides a series into two equal parts, the upper and lower half. The upper quartile can be defined as the median in the upper half of the entire series and similarly, the lower quartile for the lower half. Any value in the series has an a priori probability of $\frac{1}{2}$ of being between the two quartiles and is as likely to be inside this range as outside it. This range of dispersion is called the semi-interquartile range. The maximum and minimum of the values are commonly known and need no further explanation .

The analyses described here are also shown on Map 2 (See part 3, Map Folder). This compilation provides seasonal rainfall information in more detail than is provided on ordinary isohyetal maps. A study of the map clearly indicates the two seasons mentioned above and illustrates the parts discussed in the following chapter.

d. HYDROLOGICAL YEAR

In the Rufiji Basin the Calendar Year starts in the first half of the rainy season. From many hydrological analyses and studies false conclusions may be obtained if the calendar year is used as the basic time unit. For example, it is only necessary to mention the relation between rainfall and runoff. For this reason it is essential to establish a new unit, the Water Year, otherwise termed the Hydrological Year

There is always a lapse of time between rainfall over a catchment area and the corresponding runoff at a given point. This time may vary from a few hours to several months, or even years, depending whether the rains discharge as surface or ground water runoff. Rainfall in December will probably not discharge before January or very possibly later in the following year. At the beginning of the rains, when the ground is very dry, the ground water is then at its minimum and the infiltration rate is high. Therefore a big percentage of the precipitation is held back and will not discharge before the next year.

In most cases water level in rivers will continue to drop a little even after the first rains. This is due to the fact that the first inches of rain will be absorbed by the upper layer of ground and will not reach the ground water table from where it can discharge. A certain limit of rain must be exceeded before rivers start to rise, and this depends very much on the geological and geomorphological conditions in the catchment area.

From these observations it will be seen that the proper time to start the Hydrological Year is at the beginning of the rainy season and not when the rivers begin to rise. The Hydrological Year should be a fixed unit based on average conditions over the catchment area. It will differ from country to country and will have to be settled to meet each particular case.

Fortunately, for the Rufiji Basin, rainfall conditions as regards seasons are almost identical, and the rainfall analyses discribed in the previous chapter show quite distinctly that the rains normally start in November. The Hydrological Year will therefore be defined for the whole catchment as a YEAR STARTING 1ST NOVEMBER AND LASTING TO 31ST OCTOBER.

In order to avoid confusion, a second and slightly different term must be mentioned, THE WATER REGULATION YEAR. This term is very often used on studies of river control and is dealt with in the chapter on Summation Curve Analyses. (See also ref. 12).

All annual totals of various hydrological data computed on the Rufiji Basin Investigations and included in this report, refer to the Hydrological Year. If the Calendar Year is used, this will be specially mentioned.

e. NORMAL PERIOD

The observation period at different rainfall stations within or adjacent to the Rufiji Basin, varies from a few months to about 50 years. If the average is taken from the observed years only, a false conclusion will be reached. It is therefore necessary to select a certain fixed period in which an attempt will be made to express average conditions.

The International Normal Period, used in many countries, consists of the thirty years from 1901 to 1930. It will be observed that such a period cannot be used in this instance as there is not a single station which entirely covers it, and furthermore there are only a very few that have started their records prior to 1930. To evaluate an average figure it is obviously best to use as long a period as possible, but if for many of the stations used, observations are only available over a few years, it will be necessary to make do with a shorter period.

To avoid entering into detailed discussions on a suitable normal period, it is only necessary to state that quite reliable averages are available for a relatively large number of rainfall stations for the 15 years period 1940/41 to 1954/55. This period has therefore been selected as the NORMAL PERIOD for the Rufiji Basin Hydrological Investigations and an attempt has been made to extend the records of those stations for which observations are missing.

This period was selected in 1956 - in the early days of the Survey. Since then observations from a few more years have been compiled, but the Normal Period has been kept as was first chosen. In November 1960 observations from five more years will become available, and it will then be appropriate to extend the Normal Period to cover the 20 years from 1940/41 to 1959/60. The normal period averages, as given in this report will then be adjusted correspondingly. In 1970 a normal period covering 30 years can be established, which will then be of the same length as the international period.

As far as possible and when found necessary, the annual average of meteorological and hydrological data, presented in this report, have been related to the established normal period for general calibration.

f. MAXIMUM RAINFALL

For a number of hydrological, agricultural and engineering purposes, it is of great importance to have some knowledge of rainfall intensities, or in other words what maximum rainfall is likely to occur with certain durations. For this purpose a number of data were extracted from the EAMD's records. The heaviest showers that could be found for various durations are presented graphically for 35 stations on page 44 and 45.

Unfortunately, there are in the Basin no self recording rain gauges which cover long observation periods, and the graphs are based on ordinary rain gauge recordings only. These gauges are usually read once a day, and the information obtained for shorter periods is extracted from marginal notes made by keen observers.

The result of these 35 maximum rainfall graphs are summarized in illustration page 46. For certain selected durations the observed rainfall has been arranged in falling series from maximum to minimum and the characteristic data of dispersion (maximum, minimum, quartiles and median) have been extracted. An enveloping curve has been drawn for the maximum observed data and for comparison the corresponding curves for the United States and for the whole World are given (4, p. 105 and 122).

As will be seen from a comparison of the Rufiji Basin Curve and the other two mentioned in the previous paragraph, the difference is not very large for short durations of rainfall, but this difference increases considerably over longer periods. This is to be expected, as in the Tropics many comparatively small areas have heavy but confined rains of a short duration. The average and maximum rainfall weekly, monthly, and yearly values are not exceptionally high for Tanganyika; much higher values are reached in other parts of the world, according to local prevailing conditions.

MAXIMUM RECORDED RAINFALL AT STATIONS IN THE RUFIJI BASIN

1.	10 mins.	Chunya	January 1955	1.38	inches
2.	15 "	Dodoma	March 1944	2.03	"
3.	20 "	Sofi	January 1944	2.05	"
4.	30 "	Ilembula	December 1955	2.71	"
5.	30 "	Mufindi	March 1940	2.62	"
6.	45 "	Malangali	April 1951	3.24	"
7.	1 hours	Kwiro	January 1948	3.70	"
8.	1 hours	Ulete	April 1951	3.88	"
9.	1½ "	Kwiro	March 1954	4.42	"

MAXIMUM RECORDED RAINFALL AT STATIONS IN THE RUFIJI BASIN (Cont'd)

10.	3 hours	Kwiro	December 1937	5.71	inches
11.	5 "	Chimala	January 1950	5.73	"
12.	12 "	Kwiro	December 1940	7.68	"
13.	1 day	Kisawasawa	March 1956	11.98	"
14.	2 "	Kisawasawa	March 1956	18.66	"
15.	3 "	Kisawasawa	March 1956	19.00	"
16.	10 "	Nyamtumbo	February 1955	27.00	"
17.	15 "	Nyamtumbo	February 1955	31.75	"
18	1 month	Madazini	April 1956	47.02	"

These values can and will most likely be slightly exceeded in time but it is believed that they are not so very far from what can be considered as a maximum for the Basin. E.G. Haldemann (10, p.3) quotes a very heavy rainfall in the Rungwe District near Tukuyu during the night of 9/10 April 1955. 17 inches fell within 24 hours. This is just outside the Basin and is one of the heaviest rainfall areas of Tanganyika.

g. CORRELATION OF RAINFALL

1) General Reflections. Between two or more rainfall stations lying within a certain area there may exist some sort of simple affinity, provided rainfall conditions at the stations in question are not too diverse. Stations in the same zone of environment, for example, in a monsoon belt, will very often have a close affinity if they are about equally exposed. In mountainous regions orographical influences will occur, but a station lying at the foot of the barrier can still have a marked affinity with stations at higher altitudes provided general wind conditions are fairly similar.

In this report no long theoretical dissertations will be given on the many factors influencing rainfall conditions. These are described in many books on meteorology and hydrology and as regards the Rufiji Basin a description can be found in section III paper II. Only statistical analyses are dealt with here, with the aim of supporting the runoff calculations.

2) Linear Correspondence. By plotting annual rainfall totals of two stations against each other on graph paper it will be easy to note whether some sort of correspondence exists between the respective figures. With geophysical observations of this kind a perfect conformity is only to be found in extreme cases. The different points will then lie on a curve like pearls on a string. Certain divergences will always occur and the main problem is to find the best fitting curve and to determine a suitable expression for the degree of relation between the two series of observations, the latter being a useful criterion for the selection of comparable stations.

Due to limited shower type and unequal distribution of rainfall over shorter periods, annual data have been used as basic units for the analyses. Discrepancies will always occur if short periods are used in such computations and the procedure is so laborious that it can only be used under special circumstances. However, observations of some stations are only available over a very few years and these are not always sufficiently comprehensive for accurate computations. The years have therefore been divided into two parts, thus tripling the quantity of corresponding figures. Strictly mathematically speaking, this is not quite correct, but it was found that the result obtained that way was more reliable. Such a partition of observations can only be done if the same sort of correspondence exists for the two stations the whole year round. In order to find out whether this occurs under average conditions, the following procedure has been used: the accumulated monthly average figures throughout the year for two stations concerned have been plotted against each other. If these points tend to follow a straight line it means that the same corresponding factor exists between the observations all the year round and half yearly as well as yearly values can then be used to establish a more accurate corresponding curve between the two stations.

The monthly figure curves as described and following a straight line can be used to express the average correspondence between the stations. This line will thus go through two fixed points in the co-ordination system, the origin and the point of average rainfall, from whence it might be prolonged. In simple correlation computations this line is very often used. This is especially true when missing periods at one station are filled in by using percentage values i.e. the rainfall for a certain period expressed as a percentage of the average should be approximately the same at both stations. As understood, this will be the case where the correspondence is linear and passes through the origin.

A number of the monthly figure curves will bend at certain times of the year. This happens when the corresponding factors vary seasonally. For example, one of the stations might be situated in the mountains receiving some rain all the year round, while the other in a lower region has a more or less complete dry season. In cases where this occurs it is not correct to divide the year in order to increase the number of points, but the stations may be compared provided only annual figures are used.

These cumulative monthly curves have their disadvantages. They are established from average conditions only and do not give any expression for any single divergence that will certainly occur. To establish the final correlation curves therefore, the very well known "Method of Least Squares" has been used and the assumption taken that the function is linear.

3) Discussion on Correlation Results. Stations with a complete observation period 1940/41 to 1954/55 have been called main stations, and stations with shorter observation periods have been compared with a main station until a satisfactory correlation factor was found.

The Mahenge observations are very representative, not only for the near surrounding district but also for stations far apart. Sometimes this correspondence is even better than that with a main station in the environment.

Most of the main stations among themselves have a good correspondence, which means that the distribution of rain throughout the basin follows almost the same laws from year to year. This is very fortunate and makes the correlation computations much easier.

There are exceptions from this general correspondence. The Lower Rufiji for example, does not give very good results when compared with up-country stations. The correlation is sometimes inverse, which means that there might be years with comparatively high, and low rainfalls over the main part of the Basin, while the Lower Rufiji shows low, and high rainfalls in the same seasons. The explananation might be found in variations in the moisture-laden monsoon winds, determining whether the rain precipitates in the Coastal belt or in the inland regions of the Basin.

The Itigi station in the north western corner of the Rufiji Basin shows also a poor correspondence with other stations. This might be explained by the fact that the Western part of Tanganyika inclusive parts of the Rufiji are influenced also by moisture laden winds from the Atlantic Ocean which cause rain that might disturb an otherwise good correlation with more Eastern areas.

There are a few other stations where a good correspondence could not be found. These are Kinoga, Ifinga and Itembula. The correlation factor was so small that the stations had to be eliminated from extended use.

As a proof of the reliability of the correlation computations 10 examples are listed in table IV. These are stations with long observation periods, but only five years have been used for the establishment of the correlation equation. The rainfall for the other years have been computed and the percentage error calculated for a 15 year period 1940/41 to 1954/55 and also for all other years available. As will be seen the maximum average error obtained is - 7.2%. This result must be regarded as good and means that the computed averages as given can be used without big errors. The divergences for single years can, of course, be somewhat bigger but are very seldom found to exceed 20%.

It will be seen from the table that there is not always a conformity between the correlation factor and the percentage error. The reason might be that the five years used for the establishment of the correlation equation are the five years from 1950/51 to 1954/55. The observations have certainly improved in the last few years and the explanation for this disagreement might be that observations previous to this are not all reliable.

h. ISOHYETAL MAPS

From the observed and synthetically computed annual values 15 isohyetal maps were drawn, one for each year of the normal period 1940/41 to 1954/55. As the survey progressed maps were also drawn for the four years 1955/56 to 1958/59. These 19 maps together with an average isohyetal map for the normal period, the Hydrological Map, are included in the Map Folder, Part 3 of this report.

The maps were based on all rainfall information available and the isohyets were always drawn by the same hand. Map contours were taken into consideration as far as possible and it is felt that the main patterns of annual rainfall distribution are comprehensible enough for a preliminary study. But the maps lack a considerable amount of detail and a great many more rainfall gauges will have to be established for future detailed studies.

The Hydrological Key Map indicates how the rainfall is distributed throughout the Basin, and it is briefly described as follows: there is high rainfall, as a maximum averaging more than 70 inches a year along the south-eastern slopes of the Central Mountain Chain in the north of the Kilombero Valley. From there the rainfall decreases in a north-west direction towards the Great Ruaha and the Kisigo Rivers, where the average rainfall over a large area is less than 20 inches a year. The minimum is observed at Kimande village on the Great Ruaha, 15.88 inches as an annual average. High rainfall is observed on the Mahenge Mountains, and the Kilombero Valley lies in a rain shadow behind this barrier.

In areas close to the coast the rainfall is over 40 inches a year, but a little inland there is a rainfall depression. At Mtanza, 100 miles from the coast, the average annual rainfall is only 27 inches.

i. RAINFALL VOLUMETRIC COMPUTATIONS

The mean rainfall for various sub-catchments and for parts of sub-catchments to established discharge gauging stations and proposed dam sites was planimetered for 63 different areas of the Basin. For this purpose the annual isohyets were transferred from the Key Map on to specially drawn sub-catchment maps designed for this purpose. These maps were mostly on the scale 1:50000 and isohyetal lines could be drawn and planimetering of smaller areas could be done in more detail than were possible on the Key Map, which is at a scale of 1:1,000,000.

The planimetering was first done for each year of the normal period and the average map was checked to correspond with the averages of these 15 years. Altogether, rainfall computations were done for 19 years and taking into account the average year planimeterings were done for 1260 area-years.

Rainfall Hypsometric Curves for the entire Rufiji Basin and for the main tributaries and parts of these are shown on page 47 to 48 . It will be seen that the depth of rainfall on the Great Ruaha and Luwegu sub-catchments is much lower than on the Kilombero. The area of the Great Ruaha sub-catchment however, is much larger and the volume of rainfall is about of the same order as for the Kilombero, 33% and 35% of the total rainfall covering the entire Basin.

These rainfall volumetric computations were done to support the runoff data and results are tabulated together with runoff, table VI. Some additional computations are given in table VII.

TABLE III - CHARACTERISTIC MONTHLY RAINFALL DATA

1. DAR ES SALAAM - Registration No: 36/3900 - Altitude: 30 - Period of Observation: 1892-1912 and 1920-1957

	J	F	M	A	M	J	J	A	S	O	N	D
Maximum	10.24	7.93	13.61	23.76	23.61	6.82	3.38	4.24	3.00	8.03	10.57	12.60
Upper Quartile	4.01	4.05	6.14	13.77	10.45	1.59	1.51	1.29	1.40	2.05	3.99	4.99
Median	2.38	1.95	5.05	10.55	7.42	0.66	0.93	0.81	0.99	1.11	2.15	2.47
Lower Quartile	0.83	0.75	2.59	7.29	4.18	0.29	0.32	0.43	0.46	0.63	0.86	1.50
Minimum	0.00	0.00	0.71	1.72	0.44	0.00	0.00	0.02	0.00	0.07	0.16	0.02
Arithmetic Mean	2.78	2.58	5.18	10.80	7.80	1.22	1.08	0.98	1.08	1.70	2.86	3.42

2. UTETE - Registration No: 98/3802 - Altitude: 170 - Period of Observation: 1922-1957

	J	F	M	A	M	J	J	A	S	O	N	D
Maximum	10.25	13.74	14.09	14.32	11.11	2.19	1.10	1.66	2.20	4.49	9.83	9.17
Upper Quartile	6.19	5.32	7.83	9.22	4.84	0.64	0.17	0.32	1.02	1.40	4.53	5.94
Median	4.08	3.00	6.12	7.88	2.76	0.20	0.02	0.02	0.20	0.74	2.68	3.62
Lower Quartile	2.48	1.37	4.37	5.61	1.22	0.00	0.00	0.00	0.08	0.08	0.59	2.55
Minimum	0.31	0.68	1.87	1.68	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Arithmetic Mean	4.25	3.52	6.26	7.53	2.76	0.52	0.17	0.21	0.47	0.90	2.86	4.08

3. MOHORO - Registration No: 98/3903 - Altitude: 30 - Period of Observation: 1896-1911 and 1938-1956

	J	F	M	A	M	J	J	A	S	O	N	D
Maximum	16.68	10.71	13.28	19.09	23.66	4.61	1.75	4.22	2.69	4.31	10.08	11.74
Upper Quartile	7.51	3.89	9.65	13.31	6.74	0.80	0.45	1.20	0.65	2.13	5.15	8.87
Median	4.59	3.45	5.79	11.79	3.14	0.23	0.05	0.32	0.32	0.72	2.48	5.27
Lower Quartile	2.65	1.75	4.14	6.91	1.78	0.00	0.00	0.04	0.12	0.41	1.44	2.26
Minimum	0.57	0.87	1.00	1.89	0.70	0.00	0.00	0.00	0.00	0.00	0.54	0.00
Arithmetic Mean	5.85	4.23	6.74	10.75	4.74	0.69	0.03	0.73	0.49	1.17	3.69	3.84

4. KILWA - Registration No: 98/3900 - Altitude: 30 - Period of Observation: 1891-1912-1957

	J	F	M	A	M	J	J	A	S	O	N	D
Maximum	21.35	18.01	29.82	25.70	7.84	2.54	1.65	2.20	1.89	2.44	6.22	10.26
Upper Quartile	8.27	6.74	10.01	8.81	2.83	0.24	0.25	0.32	0.75	0.75	2.50	6.16
Median	5.74	4.75	6.45	5.47	1.54	0.00	0.00	0.04	0.20	0.39	1.15	3.82
Lower Quartile	3.21	2.63	3.87	3.05	0.67	0.00	0.00	0.00	0.00	0.00	0.55	2.09
Minimum	0.04	0.59	0.70	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Arithmetic Mean	6.14	5.14	7.46	7.05	2.22	0.26	0.22	0.31	0.46	0.51	1.88	3.97

5. IFAKARA - Registration No: 98/3600 - Altitude: 900 - Period of Observation: 1927-1957

	J	F	M	A	M	J	J	A	S	O	N	D
Maximum	14.97	12.64	19.56	28.45	10.33	3.77	1.42	0.66	1.42	2.44	9.42	13.26
Upper Quartile	10.52	8.76	12.69	17.58	7.73	1.13	0.55	0.34	0.46	1.05	2.67	6.88
Median	7.41	5.13	10.52	11.01	4.99	0.67	0.12	0.18	0.18	0.15	1.30	5.17
Lower Quartile	4.88	2.99	7.31	8.52	3.42	0.10	0.00	0.00	0.00	0.00	0.23	1.90
Minimum	1.34	0.00	4.18	4.02	0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Arithmetic Mean	7.00	4.90	10.60	12.15	4.75	0.73	0.26	0.21	0.29	0.50	1.91	4.79

TABLE III - CHARACTERISTIC MONTHLY RAINFALL DATA

6. KILOSA - Registration No: 96/3701 - Altitude: 1611 - Period of Observation: 1894-1913 and 1922-1957

	J	F	M	A	M	J	J	A	S	O	N	D
Maximum	12.28	11.05	12.80	15.37	8.33	2.38	2.35	2.28	2.68	4.88	13.41	12.28
Upper Quartile	6.05	6.47	8.13	9.59	4.17	0.57	0.49	0.70	0.74	1.55	3.75	6.24
Median	4.49	5.00	5.90	7.33	2.57	0.35	0.10	0.32	0.30	0.69	1.40	4.31
Lower Quartile	3.31	2.05	4.48	5.29	1.60	0.08	0.00	0.11	0.10	0.16	0.81	2.18
Minimum	1.03	0.00	1.52	0.89	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.55
Arithmetic Mean	4.82	4.89	6.49	7.66	2.92	0.51	0.27	0.48	0.46	1.15	2.58	4.69

7. KISAWASAWA - Registration No: 97/3602 - Altitude: 900 - Period of Observation: 1939-1957

	J	F	M	A	M	J	J	A	S	O	N	D
Maximum	22.76	17.17	29.19	33.94	12.35	5.53	2.05	1.56	2.64	2.80	10.81	27.14
Upper Quartile	15.93	10.84	17.53	19.63	9.64	1.44	0.76	0.88	1.15	1.02	5.27	9.75
Median	8.94	8.29	13.46	17.54	6.92	0.55	0.49	0.25	0.61	0.50	2.16	6.45
Lower Quartile	4.48	4.65	11.15	12.54	5.65	0.22	0.04	0.04	0.07	0.15	0.50	3.24
Minimum	2.04	0.95	9.74	6.35	2.26	0.00	0.00	0.00	0.00	0.00	0.00	0.62
Arithmetic	10.24	7.96	15.73	16.91	7.11	1.01	0.56	0.43	0.83	0.74	3.42	7.14

8. KWIRO - Registration No: 98/3602 - Altitude: 3300 - Period of Observation: 1934-1957

	J	F	M	A	M	J	J	A	S	O	N	D
Maximum	27.58	17.33	24.06	20.36	12.76	3.41	1.40	2.83	4.41	3.83	10.37	15.91
Upper Quartile	20.17	12.47	18.95	16.66	7.16	0.71	0.74	0.74	1.04	1.92	4.58	12.23
Median	11.94	7.50	15.51	14.66	4.39	0.36	0.12	0.25	0.61	0.93	2.28	8.62
Lower Quartile	9.18	4.86	13.32	12.75	3.78	0.11	0.05	0.06	0.15	0.60	0.77	4.42
Minimum	3.46	1.05	11.64	6.45	2.28	0.00	0.00	0.00	0.04	0.01	0.24	0.75
Arithmetic Mean	13.38	8.70	16.15	14.60	5.55	0.61	0.39	0.67	0.90	1.27	3.12	8.99

9. MAHENGE - Registration No: 98/3601 - Altitude: 3630 - Period of Observation: 1903-1957

	J	F	M	A	M	J	J	A	S	O	N	D
Maximum	25.79	21.25	26.06	25.42	13.52	7.05	5.05	3.05	5.40	11.49	10.18	22.39
Upper Quartile	17.15	13.28	20.19	16.75	5.72	0.94	0.56	0.71	1.02	1.93	4.94	12.99
Median	13.36	9.68	16.07	13.97	4.29	0.50	0.10	0.27	0.28	0.63	2.32	9.25
Lower Quartile	8.63	6.66	12.16	9.29	2.70	0.00	0.00	0.04	0.10	0.15	0.59	4.85
Minimum	2.69	0.00	7.17	5.70	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.50
Arithmetic Mean	13.21	9.80	15.80	13.50	4.58	0.80	0.50	0.50	0.70	1.28	2.85	9.49

10. RUAHA - Registration No: 98/3603 - Altitude: 1400 - Period of Observation: 1930-1957

	J	F	M	A	M	J	J	A	S	O	N	D
Maximum	28.56	18.93	21.66	21.85	8.72	1.91	1.67	3.99	2.19	3.91	9.83	21.59
Upper Quartile	16.77	12.95	16.96	13.32	4.04	0.45	0.26	0.97	0.51	0.74	4.20	12.74
Median	9.46	7.98	14.40	11.57	3.18	0.22	0.10	0.26	0.17	0.49	1.84	8.22
Lower Quartile	7.04	5.31	9.24	9.38	2.61	0.04	0.00	0.07	0.00	0.02	0.32	6.51
Minimum	4.94	1.11	7.81	5.82	1.58	0.00	0.00	0.00	0.00	0.00	0.00	0.85
Arithmetic Mean	12.15	9.05	13.90	11.92	3.88	0.36	0.23	0.70	0.43	0.63	2.64	10.05

TABLE III - CHARACTERISTIC MONTHLY RAINFALL DATA

11. IGOTA - Registration No: 98/3605 - Altitude: 1300 - Period of Observation: 1939-1957

	J	F	M	A	M	J	J	A	S	O	N	D
Maximum	15.85	13.36	18.18	24.34	9.12	1.91	0.88	0.67	1.09	1.06	11.00	11.14
Upper Quartile	12.09	9.22	10.99	15.57	7.00	0.93	0.42	0.27	0.51	0.41	3.92	7.64
Median	7.84	6.24	8.60	13.33	4.42	0.22	0.00	0.10	0.17	0.12	0.65	5.26
Lower Quartile	3.98	2.71	6.66	11.07	3.67	0.00	0.00	0.00	0.00	0.00	0.08	1.67
Minimum	1.37	0.00	4.66	7.09	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.14
Arithmetic Mean	8.15	6.30	9.45	13.42	4.79	0.47	0.18	0.13	0.31	0.28	2.59	5.06

12. SOFI - Registration No: 98/3604 - Altitude: 1200 - Period of Observation: 1938-1957

Maximum	21.00	10.83	14.93	20.04	8.80	1.88	0.09	0.74	0.78	2.19	9.56	13.74
Upper Quartile	9.41	8.55	11.96	13.52	4.80	0.39	0.03	0.45	0.30	0.61	3.12	6.57
Median	7.27	6.36	9.26	10.67	3.20	0.10	0.00	0.00	0.07	0.04	2.38	5.12
Lower Quartile	4.92	3.59	8.34	8.19	2.30	0.00	0.00	0.00	0.03	0.00	0.33	3.81
Minimum	2.24	1.48	5.85	6.26	1.24	0.00	0.00	0.00	0.00	0.00	0.00	0.79
Arithmetic Mean	7.78	6.13	10.10	11.10	3.58	0.35	0.01	0.19	0.18	0.43	2.32	5.52

13. MVUMI - Registration No: 96/3503 - Altitude: 3500 - Period of Observation: 1924-1957

Maximum	11.99	13.23	10.48	10.37	2.45	1.60	0.00	0.00	1.66	1.71	4.49	10.22
Upper Quartile	7.04	5.67	6.13	3.47	0.63	0.00	0.00	0.00	0.00	0.00	0.26	5.56
Median	5.59	3.87	4.11	1.26	0.08	0.00	0.00	0.00	0.00	0.00	0.00	4.14
Lower Quartile	3.48	2.95	2.42	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.04
Minimum	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Arithmetic Mean	5.52	4.34	4.16	2.08	0.35	0.05	0.00	0.00	0.04	0.10	0.53	4.02

14. IRINGA - Registration No: 97/3500 - Altitude: 5380 - Period of Observation: 1903-1912 and 1922-1957

Maximum	13.76	10.68	13.79	10.65	5.79	0.74	0.05	0.26	1.24	1.84	7.47	10.85
Upper Quartile	8.32	6.79	8.61	4.40	0.83	0.01	0.00	0.00	0.04	0.32	2.17	6.44
Median	6.39	4.69	7.08	2.91	0.33	0.00	0.00	0.00	0.00	0.11	0.84	5.23
Lower Quartile	4.32	3.81	4.25	2.09	0.11	0.00	0.00	0.00	0.00	0.00	0.41	2.65
Minimum	1.84	1.79	2.65	0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.69
Arithmetic Mean	6.37	5.15	6.70	3.23	0.40	0.13	0.01	0.02	0.10	0.20	1.01	5.08

15. MUFINDI - Registration No: 98/3507 - Altitude: 6200 - Period of Observation: 1930-1954

Maximum	17.19	17.01	26.47	39.89	18.43	10.68	2.22	3.12	2.58	2.82	16.37	16.88
Upper Quartile	12.99	12.25	17.06	26.11	12.23	1.69	1.45	0.92	1.17	1.17	4.09	15.31
Median	10.28	7.76	15.00	19.81	9.24	0.68	0.51	0.57	0.37	0.16	2.52	10.58
Lower Quartile	8.37	5.93	11.92	14.98	5.17	0.28	0.17	0.23	0.08	0.00	0.76	6.17
Minimum	5.28	1.92	5.52	8.70	2.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Arithmetic Mean	10.60	8.65	14.80	19.79	9.30	1.48	0.76	0.64	0.67	0.57	3.34	8.72

TABLE III - CHARACTERISTIC MONTHLY RAINFALL DATA

16. KIBWELE - Registration No. 98/3509 - Altitude: 6100 - Period of Observation: 1941 - 1957

	J	F	M	A	M	J	J	A	S	O	N	D
Maximum	13.53	13.00	17.96	21.34	22.65	6.41	1.13	1.82	1.79	2.44	10.95	9.50
Upper Quartile	8.94	8.15	10.12	16.50	9.57	1.09	0.77	0.62	0.66	0.36	2.84	8.73
Median	8.08	6.54	7.54	13.67	6.31	0.56	0.50	0.23	0.28	0.04	1.39	6.55
Lower Quartile	6.39	5.02	5.83	11.44	3.71	0.17	0.04	0.08	0.08	0.00	0.32	4 53
Minimum	4.55	3.39	3.77	7.67	1.87	0.00	0.00	0.00	0.00	0.00	0.00	0.17
Arithmetic Mean	8.20	7.90	8.12	14.12	8.05	0.98	0.47	0.45	0.46	0.28	2.78	6.31

17. SONGEA - Registration No. 100/3500 - Altitude: 3783 - Period of Observation: 1908 - 1912 and 1922 - 1956

	J	F	M	A	M	J	J	A	S	O	N	D
Maximum	21.46	17.64	19.10	8.34	1.92	0.61	0.15	1.31	0.63	2.43	5.10	17.43
Upper Quartile	13.78	11.26	12.39	5.20	0.82	0.07	0.03	0.06	0.14	0.33	3.49	8.98
Median	11.00	8.67	10.04	4.19	0.50	0.00	0.00	0.00	0.02	0.00	1.70	7.09
Lower Quartile	7.85	6.82	7.44	2.98	0.16	0.00	0.00	0.00	0.00	0.00	0.28	4.31
Minimum	2.77	3.93	3.25	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29
Arithmetic Mean	10.90	8.96	9.91	3.96	0.54	0.04	0.01	0.09	0.15	0.27	1.74	6.75

18. IFINGA - Registration No. 99/3502 - Altitude: 2600 - Period of Observation: 1940 - 1957

	J	F	M	A	M	J	J	A	S	O	N	D
Maximum	18.98	23.45	19.88	25.42	6.81	1.50	1.17	0.98	2.12	8.57	13.38	17.95
Upper Quartile	13.18	11.77	14.23	17.71	4.89	0.27	0.08	0.49	0.70	1.19	5.47	12.77
Median	11.21	8.40	12.15	15.02	4.27	0.02	0.01	0.00	0.40	0.27	1.76	6.44
Lower Quartile	10.06	5.24	11.22	10.49	2.55	0.00	0.00	0.00	0.03	0.02	1.23	3.19
Minimum	4.54	0.35	5.30	5.78	0.90	0.00	0.00	0.00	0.00	0.00	0.09	0.00
Arithmetic Mean	11.40	9.25	12.30	14.27	3.60	0.25	0.16	0.23	0.54	1.11	3.51	7.21

19. SAO HILL - Registration No. 98/3508 - Altitude: 6500 - Period of Observation: 1935 - 1954

	J	F	M	A	M	J	J	A	S	O	N	D
Maximum	14.07	9.55	13.05	7.99	3.19	0.94	0.31	0.54	1.28	2.09	7.17	12.54
Upper Quartile	9.07	8.66	9.30	4.05	0.84	0.18	0.08	0.10	0.10	0.77	3.76	9.28
Median	7.36	6.89	7.67	3.17	0.73	0.12	0.02	0.00	0.03	0.36	2.42	7.08
Lower Quartile	6.21	5.92	6.66	2.30	0.28	0.02	0.01	0.00	0.00	0.03	1.36	5.73
Minimum	2.90	1.44	2.63	0.98	0.17	0.00	0.00	0.00	0.00	0.00	0.30	2.56
Arithmetic Mean	7.65	6.76	7.95	3.38	0.72	0.15	0.07	0.07	0.10	0.91	2.79	7.19

20. MKEWE - Registration No: 98/3511 - Altitude: 6184 - Period of Observation: 1941 - 1957

	J	F	M	A	M	J	J	A	S	O	N	D
Maximum	10.70	13.61	13.40	8.37	2.13	1.59	0.02	0.09	0.57	2.01	7.72	10.91
Upper Quartile	8.48	7.53	9.37	4.20	0.34	0.00	0.00	0.00	0.00	0.50	4.27	9.39
Median	7.17	6.31	8.26	2.47	0.18	0.00	0.00	0.00	0.00	0.24	2.22	6.93
Lower Quartile	6.54	4.83	6.39	1.22	0.08	0.00	0.00	0.00	0.00	0.00	1.40	5.57
Minimum	1.82	3.71	4.61	0.26	0.04	0.00	0.00	0.00	0.00	0.00	1.00	1.11
Arithmetic Mean	7.50	8.73	8.20	2.42	0.47	0.12	0.01	0.05	0.05	0.51	3.28	6.92

TABLE III - CHARACTERISTIC MONTHLY RAINFALL DATA

	J	F	M	A	M	J	J	A	S	O	N	D
21. NJOMBE - Registration No: 99/3401 - Altitude: 6000 - Period of Observation: 1927 - 1957												
Maximum	17.23	14.91	20.07	12.35	2.62	1.10	0.38	0.55	2.09	3.81	10.11	13.14
Upper Quartile	12.99	8.97	10.55	6.90	1.56	0.09	0.06	0.12	0.39	0.35	2 50	10.04
Median	9.50	7.69	9.72	5.30	0.98	0.00	0.00	0.01	0.02	0.11	0.50	3.85
Lower Quartile	7.24	5.88	7.68	3.62	0.70	0.00	0.00	0.00	0.00	0.00	0.16	4.11
Minimum	3.72	3.44	4.31	1.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30
Arithmetic Mean	9.75	7.50	9.38	5.96	1.08	0.12	0.03	0.08	0.18	0.25	1.47	6.43
22. KIPINGERE - Registration No: 99/3408 - Altitude: 7100 - Period of Observation: 1940 - 1957												
Maximum	12.30	10.99	15.69	9.19	4.48	0.70	0.55	0.75	0.44	1.72	8.94	11.63
Upper Quartile	9.83	7.42	10.55	5.84	2.07	0.02	0.00	0.15	0.03	1.08	4.30	9.57
Median	7.92	5.94	8.38	4.62	1.22	0.00	0.00	0.00	0.00	0.17	3.01	6.92
Lower Quartile	5.89	3.70	6.06	2.93	0.87	0.00	0.00	0.00	0.00	0.00	0.69	4.44
Minimum	5.11	2.40	4.94	1.61	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.33
Arithmetic Mean	8.08	6.27	8.17	4.91	1.67	0.10	0.04	0.11	0.06	0.56	3.09	7.56
23. MALANGALI - Registration No: 98/3401 - Altitude: 5000 - Period of Observation: 1922 - 1957												
Maximum	12.79	12.58	16.15	8.52	1.20	0.18	0.00	0.41	0.49	1.27	7.42	12.83
Upper Quartile	8.13	7.84	9.02	2.80	0.34	0.00	0.00	0.00	0.00	0.20	3.30	8.90
Median	6.85	6.55	6.11	1.54	0.08	0.00	0.00	0.00	0.00	0.00	1.60	6.60
Lower Quartile	5.35	4.81	5.23	1.07	0.00	0.00	0.00	0.00	0.00	0.00	0.40	3.93
Minimum	1.99	2.93	2.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.28
Arithmetic Mean	6.79	6.38	7.25	2.16	0.19	0.01	0.00	0.02	0.03	0.15	1.79	6.23
24. MADIBIRA - Registration No: 98/3400 - Altitude: 3800 - Period of Observation: 1923 - 1957												
Maximum	11.28	12.23	10.55	13.92	2.63	0.67	0.13	0.00	1.22	1.18	4.96	9.90
Upper Quartile	6.90	6.98	6.58	4.02	0.88	0.00	0.00	0.00	0.00	0.18	1.82	4.85
Median	5.04	3.83	4.62	2.65	0.25	0.00	0.00	0.00	0.00	0.00	1.08	3.73
Lower Quartile	3.30	2.27	3.39	1.91	0.07	0.00	0.00	0.00	0.00	0.00	0.17	2.66
Minimum	0.00	0.67	1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Arithmetic Mean	5.22	4.44	4.95	3.27	0.48	0.02	0.01	0.00	0.01	0.01	1.25	3.96
25. LUPEMBE - Registration No: 99/3504 - Altitude: 5300 - Period of Observation: 1894 - 1914 and 1922 - 1957												
Maximum	20.06	17.92	19.93	23.52	5.49	2.42	0.86	2.61	4.98	11.08	13.02	19.42
Upper Quartile	13.47	10.47	14.63	12.74	4.39	0.40	0.31	0.88	1.32	1.45	4.84	11.54
Median	12.40	8.96	11.84	9.04	2.14	0.10	0.06	0.34	0.71	0.70	2.20	7.92
Lower Quartile	8.13	6.66	9.48	6.88	1.40	0.00	0.00	0.00	0.20	0.26	1.22	3.93
Minimum	4.17	2.76	7.08	3.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.40
Arithmetic Mean	11.68	9.39	12.35	10.36	2.84	0.34	0.21	0.56	1.01	1.36	3.24	9.15

TABLE III - CHARACTERISTIC MONTHLY RAINFALL DATA

26. RUJEWA - Registration No: 98/3403 - Altitude: 3500 - Period of Observation: 1942 - 1957

	J	F	M	A	M	J	J	A	S	O	N	D
Maximum	9.91	9.58	11.25	4.58	0.30	0.00	0.00	0.15	0.22	1.93	2.95	7.87
Upper Quartile	7.19	6.71	6.42	3.42	0.21	0.00	0.00	0.00	0.00	0.05	1.65	6.42
Median	6.37	4.86	4.38	1.40	0.07	0.00	0.00	0.00	0.00	0.00	0.46	5.35
Lower Quartile	4.57	2.95	3.11	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.35
Minimum	1.58	1.27	2.74	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09
Arithmetic Mean	5.95	5.02	5.27	1.91	0.10	0.00	0.00	0.01	0.02	0.14	0.73	4.39

27. IRAMBO - Registration No: 98/3310 - Altitude: 6710 - Period of Observation: 1942 - 1957

Maximum	16.64	14.34	15.78	18.06	5.22	0.55	0.17	0.52	0.79	2.98	8.22	17.11
Upper Quartile	12.90	11.39	12.55	15.08	3.76	0.14	0.00	0.00	0.50	1.08	5.40	11.61
Median	9.15	8.44	8.19	11.23	2.91	0.00	0.00	0.00	0.00	0.58	2.88	8.50
Lower Quartile	8.13	7.57	7.06	9.25	1.62	0.00	0.00	0.00	0.00	0.27	1.46	6.54
Minimum	5.19	3.06	4.96	6.17	0.25	0.00	0.00	0.00	0.00	0.00	0.33	1.30
Arithmetic Mean	10.18	8.96	9.44	11.68	2.52	0.01	0.01	0.05	0.21	0.80	3.16	8.40

28. ITIGI - Registration No: 95/3401 - Altitude: 4278 - Period of Observation: 1936 - 1957

Maximum	9.95	10.20	9.76	12.15	1.50	1.75	0.00	0.00	0.30	2.95	8.28	12.10
Upper Quartile	8.00	5.39	5.60	3.99	0.50	0.42	0.00	0.00	0.00	0.00	2.45	7.94
Median	5.74	3.23	3.54	1.76	0.00	0.00	0.00	0.00	0.00	0.00	1.57	5.60
Lower Quartile	3.27	0.98	0.75	1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.40
Minimum	1.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Arithmetic Mean	5.59	3.31	3.22	2.32	0.20	0.11	0.00	0.00	0.01	0.15	1.63	5.93

29. KITUNDA - Registration No: 96/3300 - Altitude: 4500 - Period of Observation: 1934 - 1956

Maximum	12.72	9.63	13.08	15.01	1.39	0.18	0.00	0.40	0.84	3.12	6.59	14.12
Upper Quartile	7.17	6.77	8.37	5.89	0.77	0.00	0.00	0.00	0.00	0.39	4.85	9.39
Median	6.05	5.44	6.02	3.87	0.20	0.00	0.00	0.00	0.00	0.08	1.93	6.76
Lower Quartile	5.55	3.49	4.19	2.10	0.00	0.00	0.00	0.00	0.00	0.00	0.69	4.09
Minimum	2.80	0.87	1.07	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.02	1.37
Arithmetic Mean	6.25	5.64	5.99	4.46	0.30	0.01	0.00	0.02	0.04	0.85	2.30	6.70

30. MBEYA - Registration No: 98/3301 - Altitude: 5800 - Period of Observation: 1931 - 1956

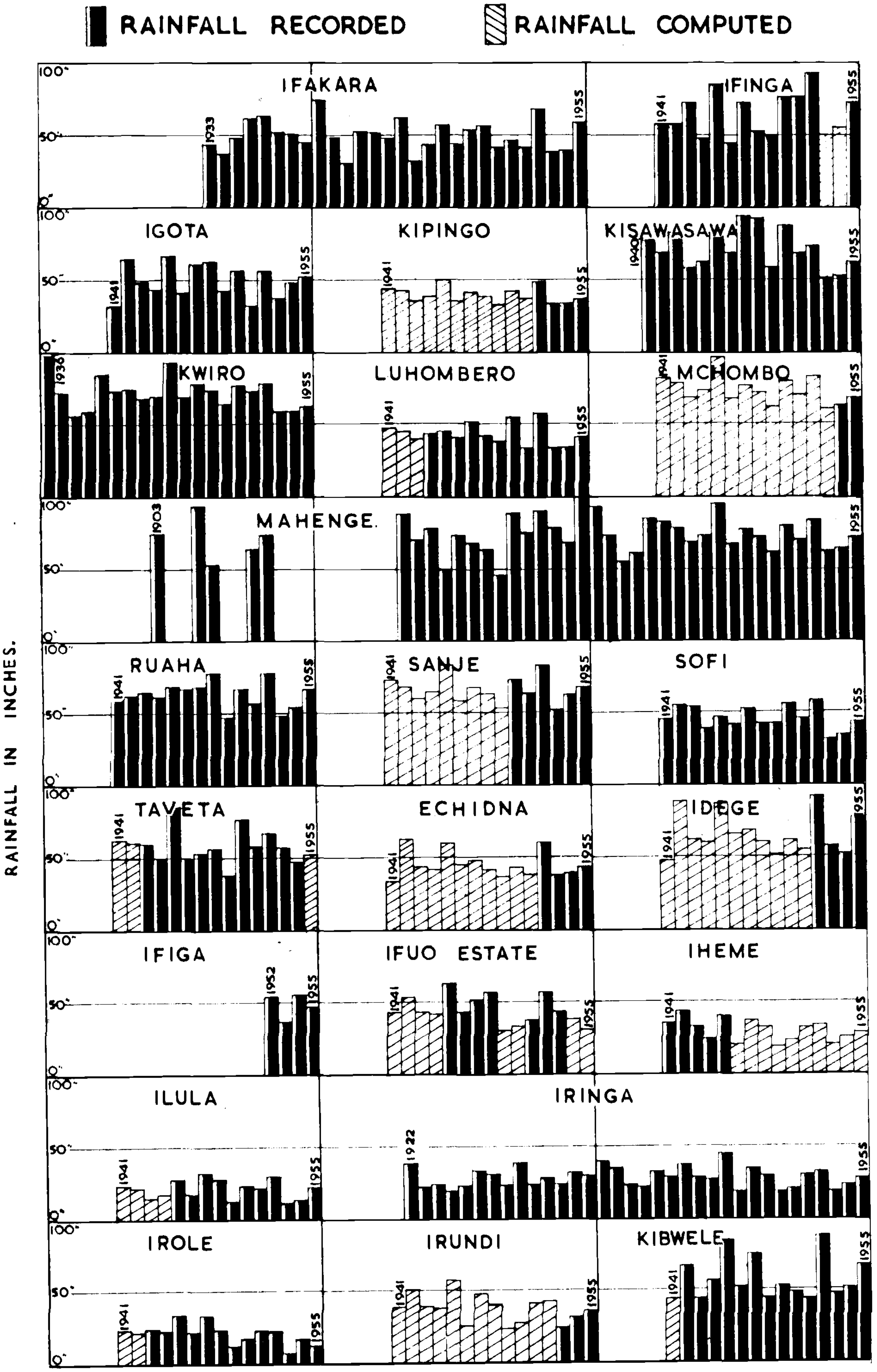
Maximum	13.41	10.51	10.50	11.94	2.14	0.35	1.24	0.56	1.10	2.52	10.59	11.31
Upper Quartile	9.37	8.63	8.64	5.03	1.39	0.03	1.02	0.06	0.13	1.12	2.30	6.55
Median	7.23	6.32	5.64	4.51	0.62	0.00	0.00	0.00	0.01	0.28	1.62	5.51
Lower Quartile	6.38	5.30	4.86	3.67	0.26	0.00	0.00	0.00	0.00	0.08	0.84	4.13
Minimum	4.33	1.44	1.41	1.77	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.31
Arithmetic Mean	7.66	6.34	6.10	4.69	0.71	0.04	0.02	0.04	0.10	0.51	2.05	5.36

TABLE IV - RELIABILITY OF THE CORRELATION COMPUTATIONS

Stations with an observation period of 15 years or more compared with one another by using only 5 years, 1950/51-1954/55, for establishing the correlation curve. The other observed yearly values are compared with the computed ones in order to find the percent error between observed and computed mean.

Name of Station		Compared with	Correlation factor	Comparison 1940/41-1954/55			Comparison for all the years available			
				Observed mean	Computed mean	% error	No. of years	Observed mean	Computed mean	% error
1.	Iringa	Mahenge	0.98	28.57	30.17	+ 5.6	33	28.61	30.56	+ 6.8
2.	Mufindi	"	0.99	77.44	79.52	+ 2.7	24	83.92	85.66	+ 2.0
3.	Kwiro	"	0.99	71.52	69.86	- 2.3	22	72.23	71.58	- 0.9
4.	Ifakara	"	0.99	48.29	51.10	+ 5.7	27	49.15	51.80	+ 5.4
5.	Njombe	"	0.94	41.90	43.99	+ 4.8	25	42.55	45.60	+ 7.0
6.	Kibiti	Utete	0.95	40.56	40.30	- 0.6	15			
7.	Ruaha	Iringa	0.84	63.90	64.91	+ 1.6	15			
8.	Ifakara	Utete	0.91	48.29	51.16	+ 5.8	28	49.45	50.69	+ 2.5
9.	Mahenge	Ifakara	0.99	74.17	68.81	- 7.2	28	75.32	70.06	- 7.0
10.	Igota	Mahenge	0.98	49.66	52.52	+ 5.7				

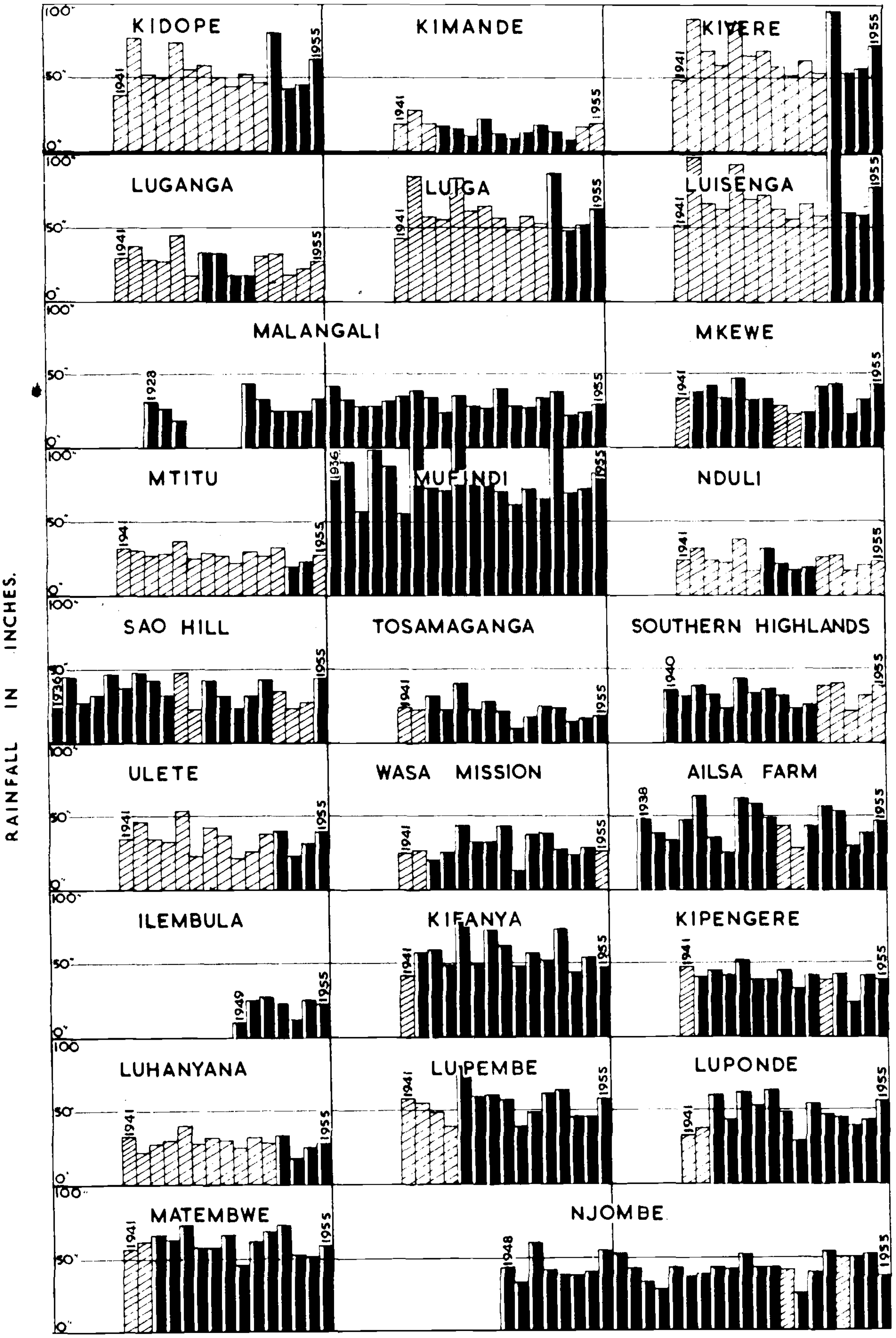
GRAPHICAL COMPILATION OF OBSERVED AND SYNTHETIC ANNUAL RAINFALL FOR STATIONS INSIDE THE RUFIJI BASIN



SHEET .1.

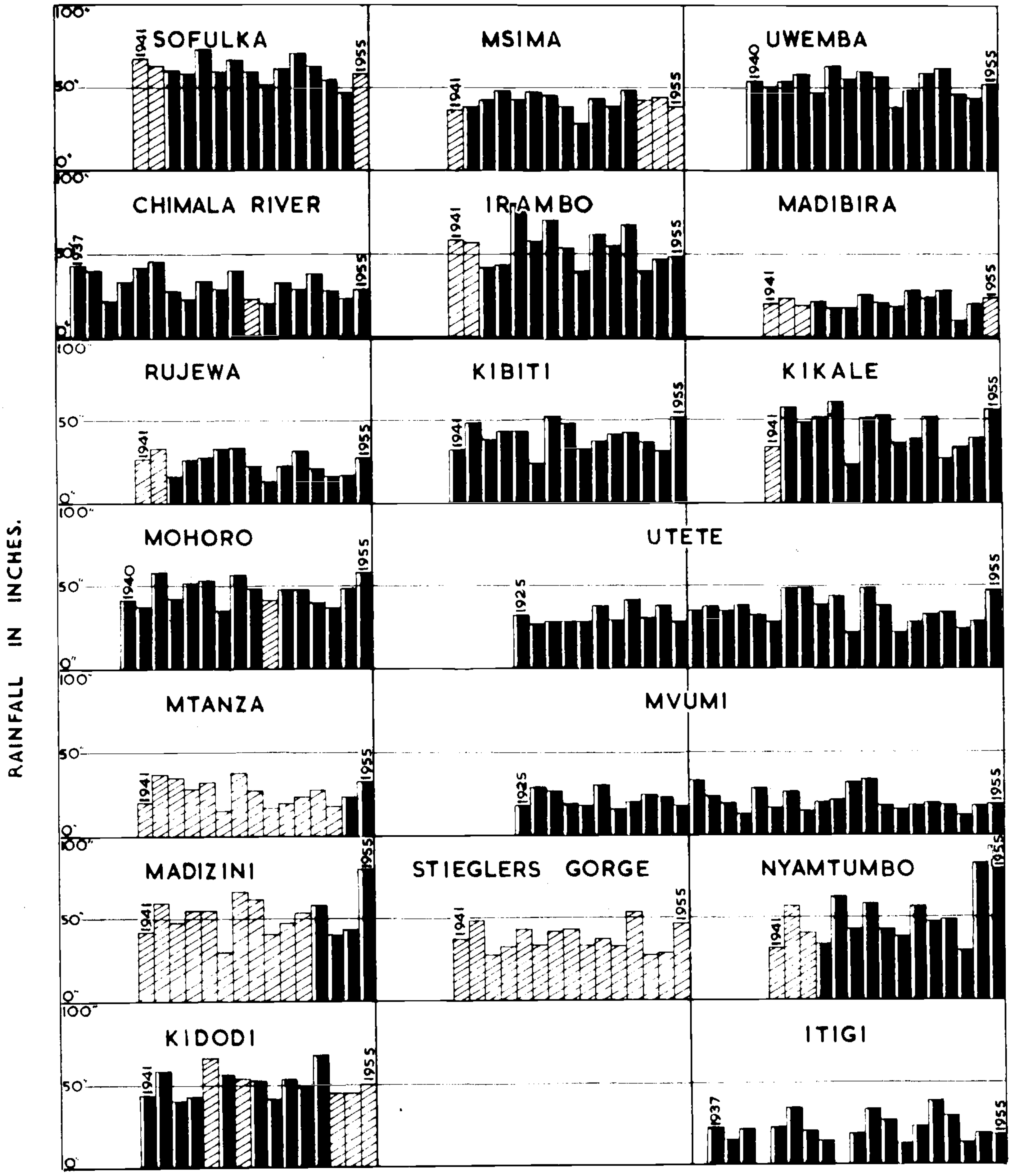
GRAPHICAL COMPILATION OF OBSERVED AND SYNTHETIC ANNUAL RAINFALL FOR STATIONS INSIDE THE RUFIJI BASIN.

▮ RAINFALL RECORDED ▨ RAINFALL COMPUTED



GRAPHICAL COMPILATION OF OBSERVED AND SYNTHETIC ANNUAL RAINFALL FOR STATIONS INSIDE THE RUFIJI BASIN.

▮ RAINFALL RECORDED ▨ RAINFALL COMPUTED



THIS GRAPHICAL COMPILATION INCLUDES RAINFALL RECORDS PRIOR TO 1954/55 AND ALSO THE SYNTHETIC ANNUAL VALUES COMPUTED FOR MISSING YEARS OF THE ESTABLISHED 15 YEAR NORMAL PERIOD; 1940/41 TO 1954/55.

FOR YEARS AFTER 1954/55 NEARLY ALL STATIONS HAD COMPLETE SERIES OF RECORDS.

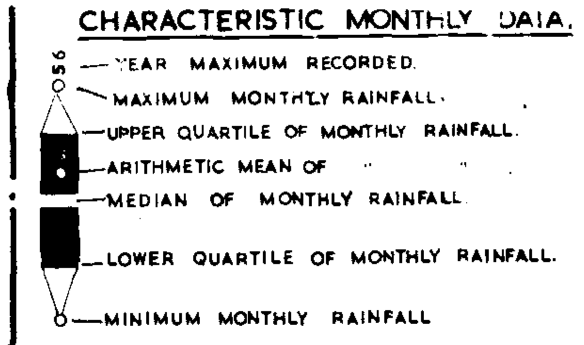
ALL DATA REFER TO THE HYDROLOGICAL YEAR 1st NOVEMBER TO 31st OCTOBER.

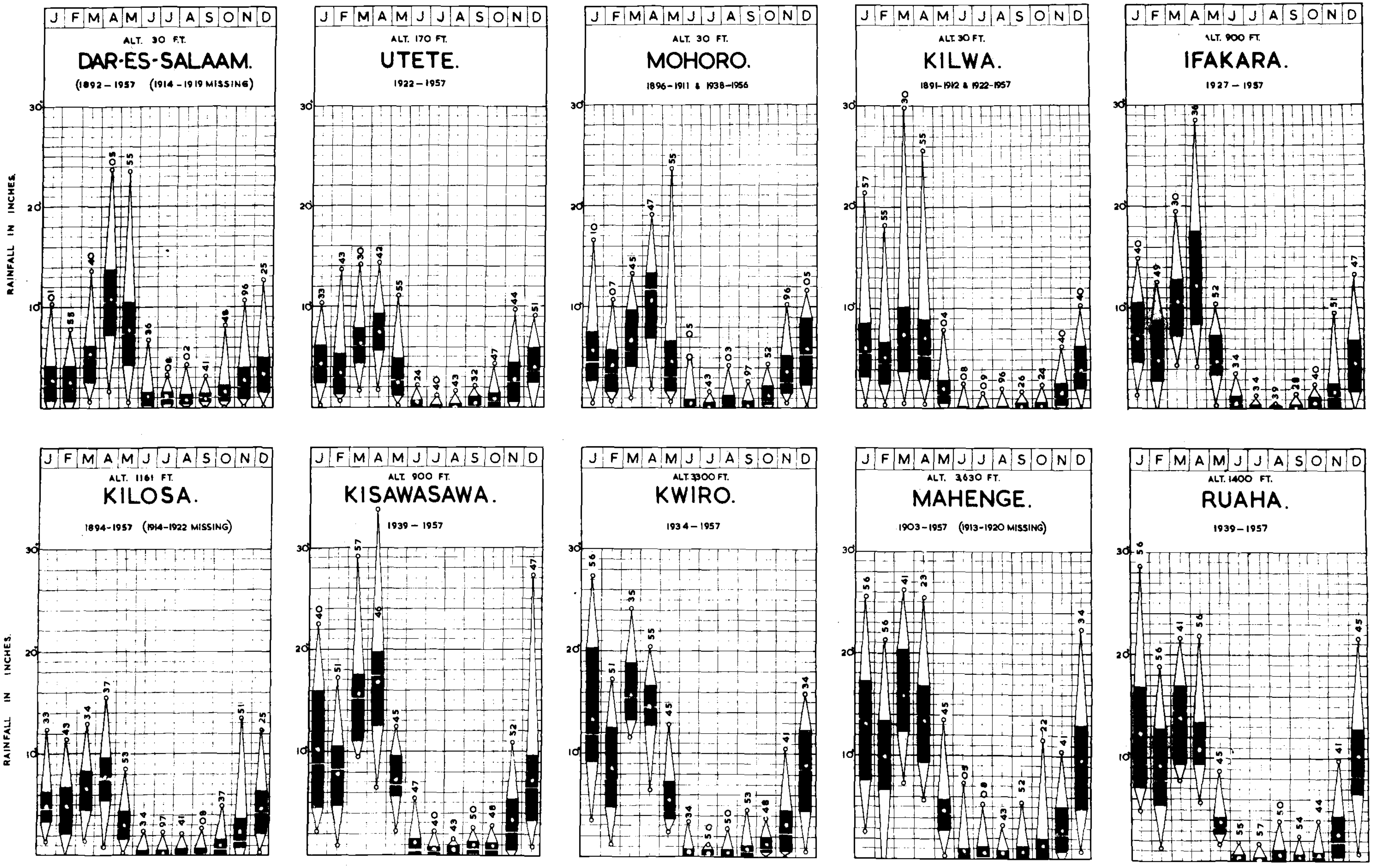
SHEET 3.

VARIATION OF MONTHLY RAINFALL FOR A NUMBER OF STATIONS WITH LONGER OBSERVATION PERIODS INSIDE OR ADJACENT TO THE RUFIJI BASIN.

IN ORDER FROM EAST TO WEST.

SHEET I.

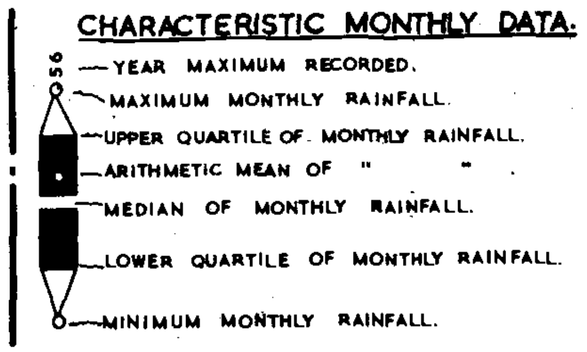


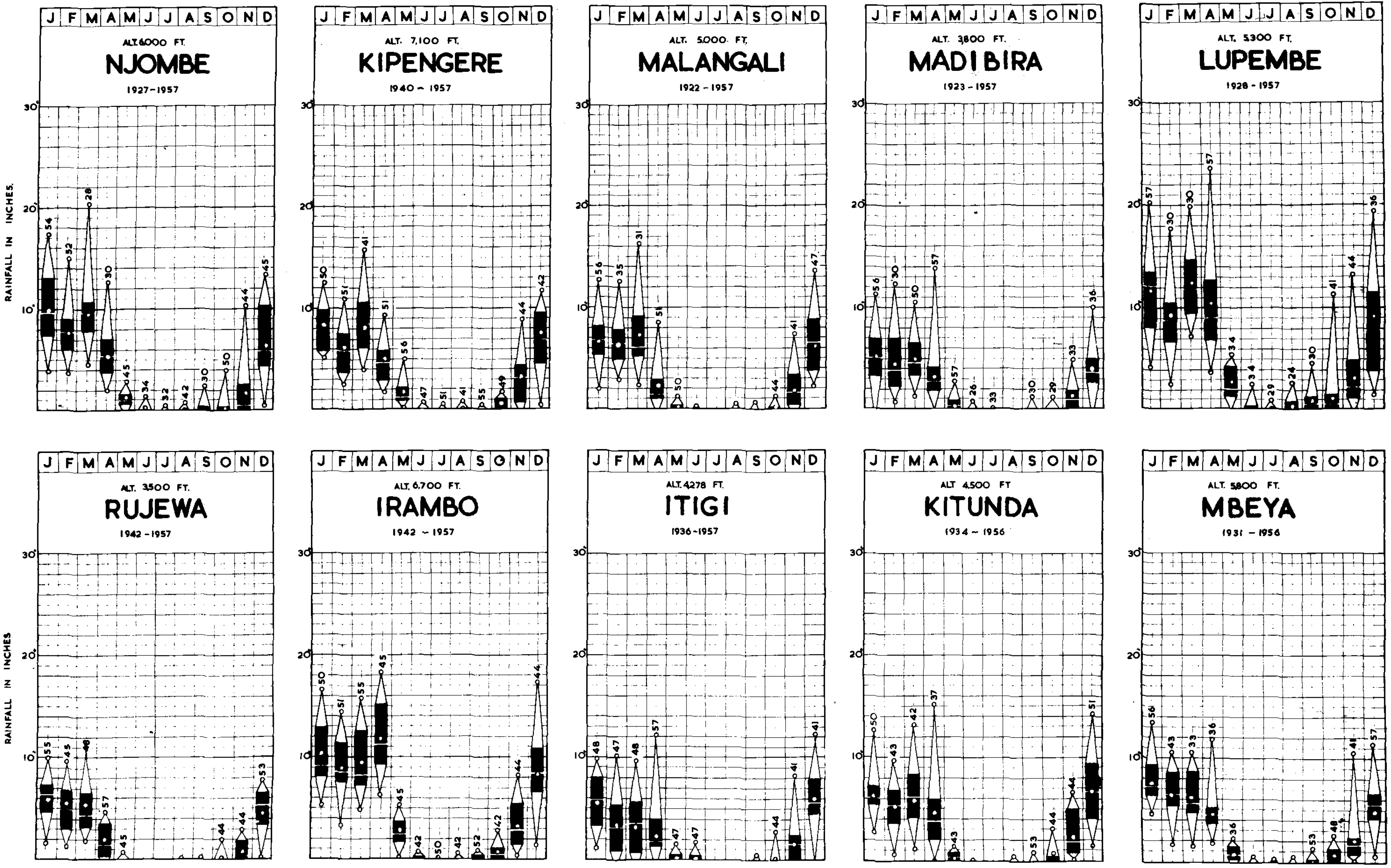


VARIATION OF MONTHLY RAINFALL FOR A NUMBER OF STATIONS WITH LONGER OBSERVATION PERIODS INSIDE OR ADJACENT TO THE RUFIJI BASIN.

IN ORDER FROM EAST TO WEST.

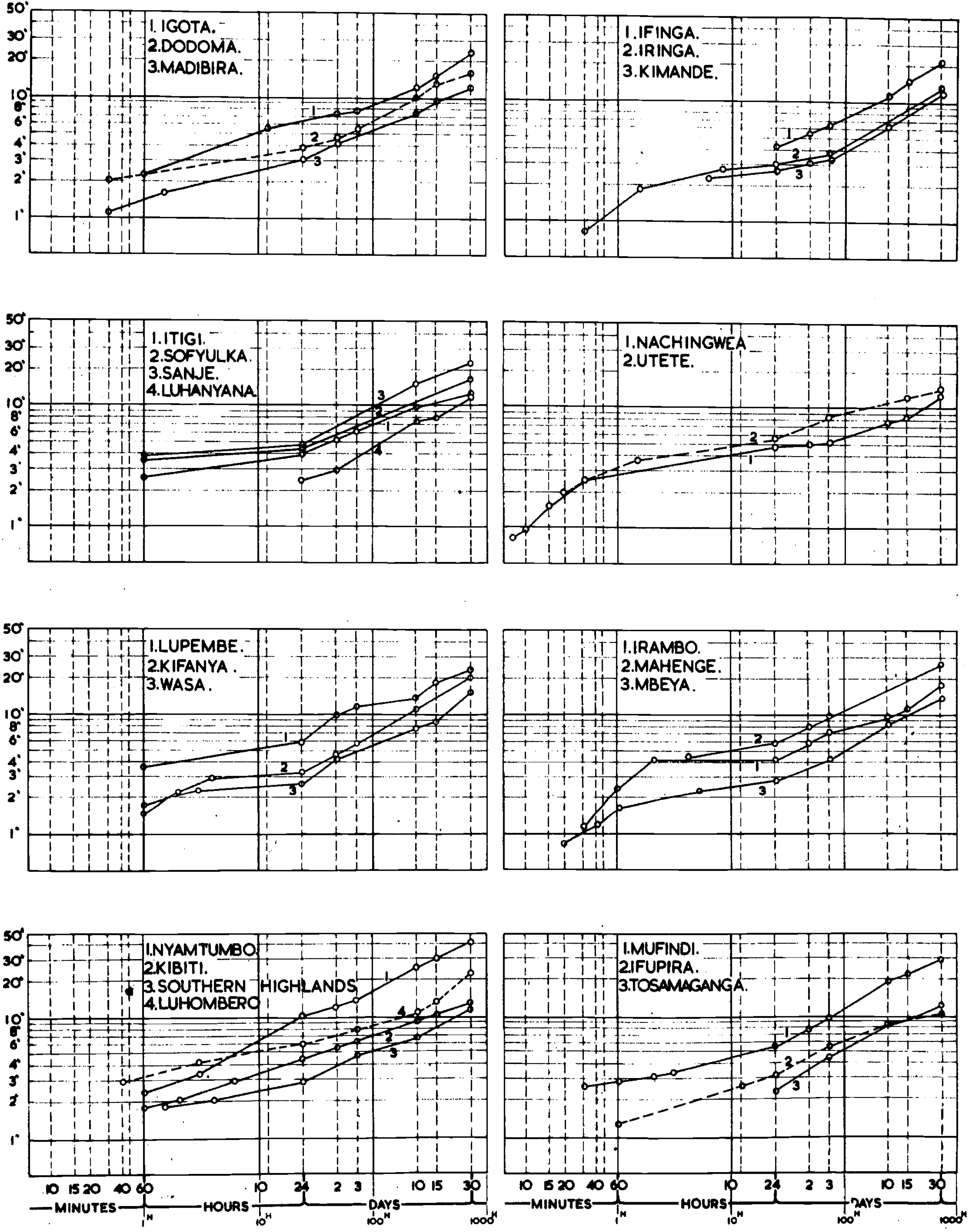
SHEET 3.





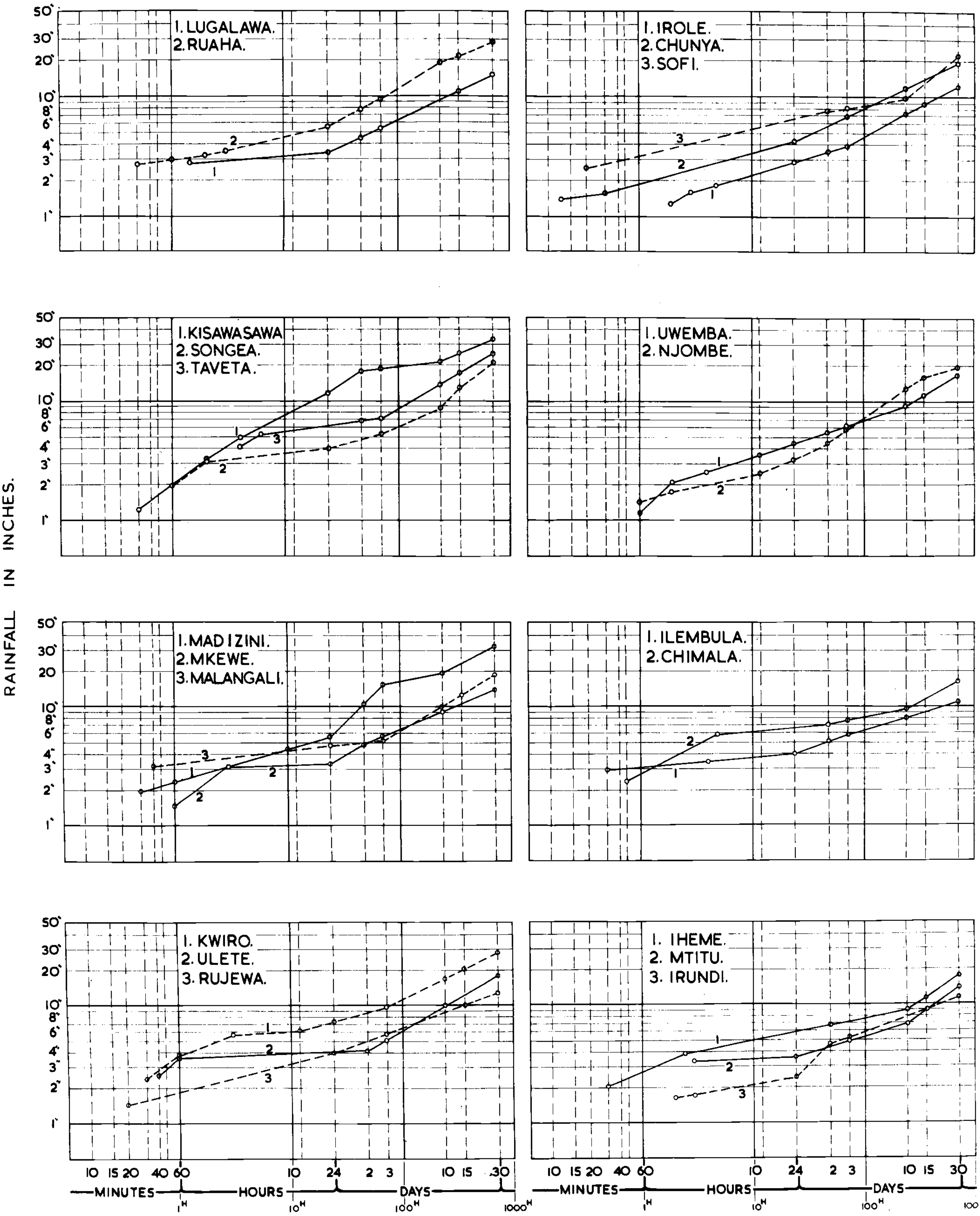
RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION
NOVEMBER 1957.

MAXIMUM OBSERVED RAINFALL PLOTTED AGAINST TIME FOR STATIONS WITHIN OR ADJACENT TO THE RUFIJI BASIN.



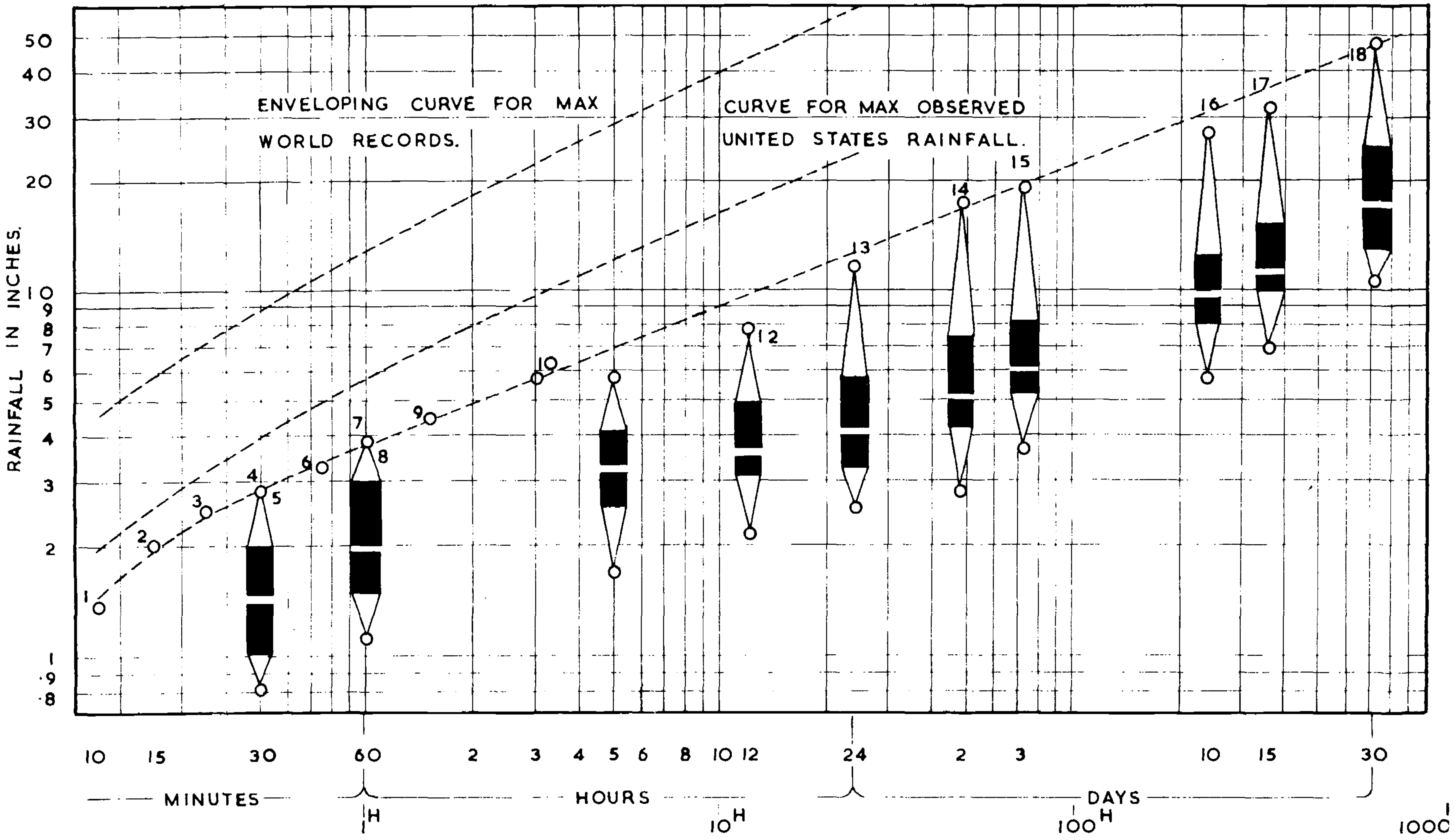
RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION
NOVEMBER 1957.

MAXIMUM OBSERVED RAINFALL PLOTTED AGAINST TIME FOR STATIONS WITHIN OR ADJACENT TO THE RUFIJI BASIN.



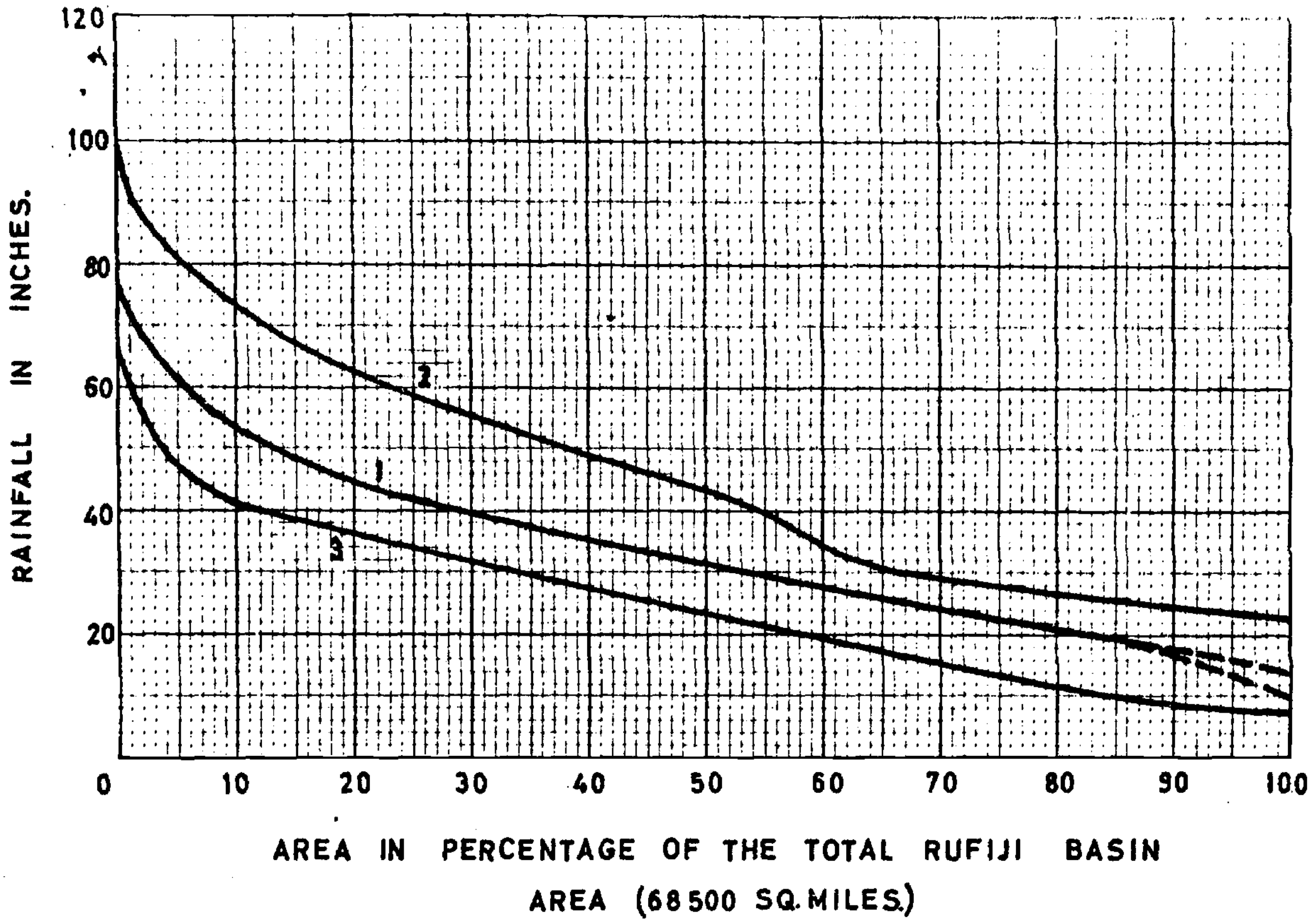
RUFIJI BASIN

HYDROLOGICAL SECTION



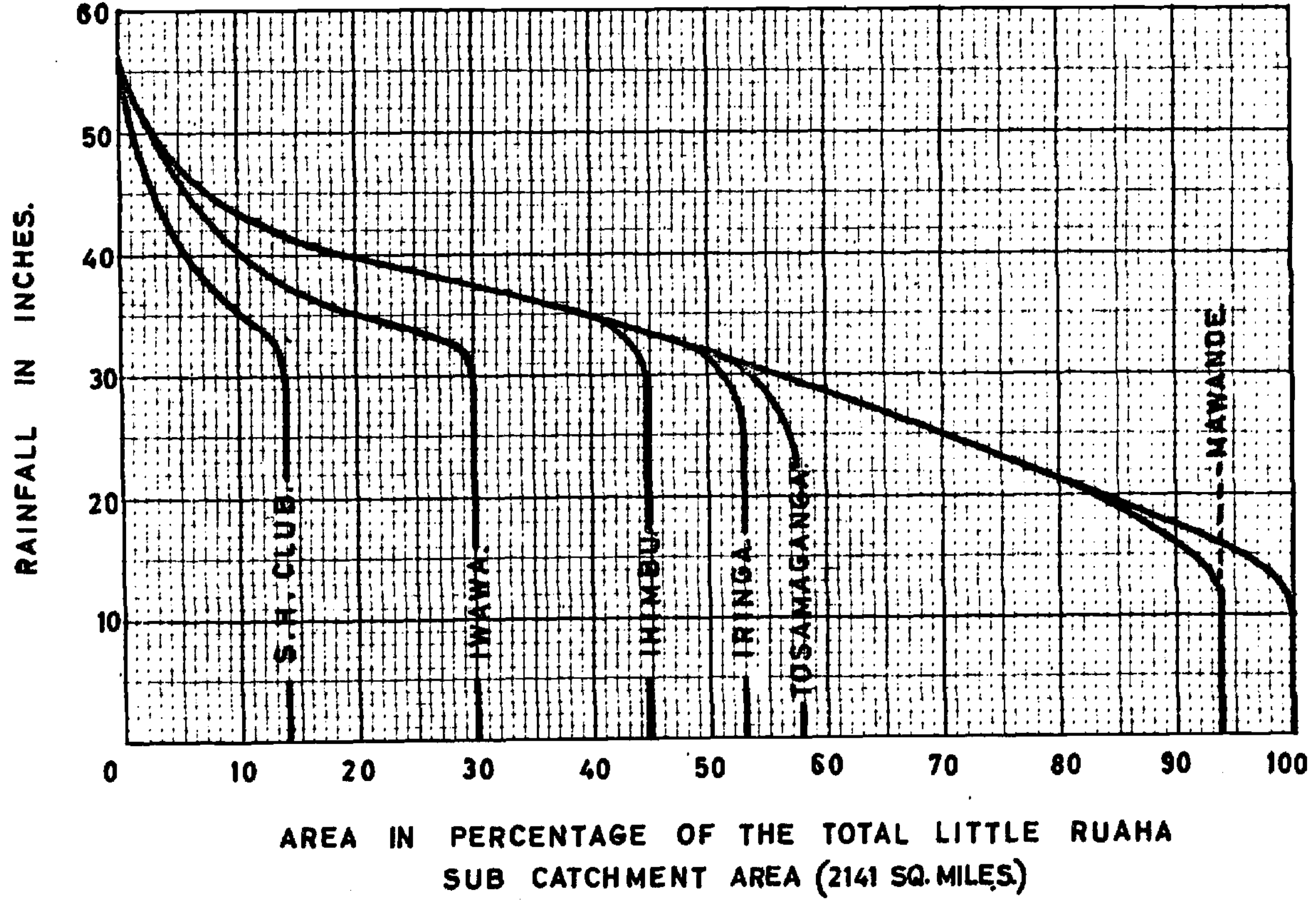
CHARACTERISTIC VARIATION DATA OF MAXIMUM RAINFALL

FOR 35 STATIONS WITHIN OR ADJACENT TO RUFIJI BASIN.

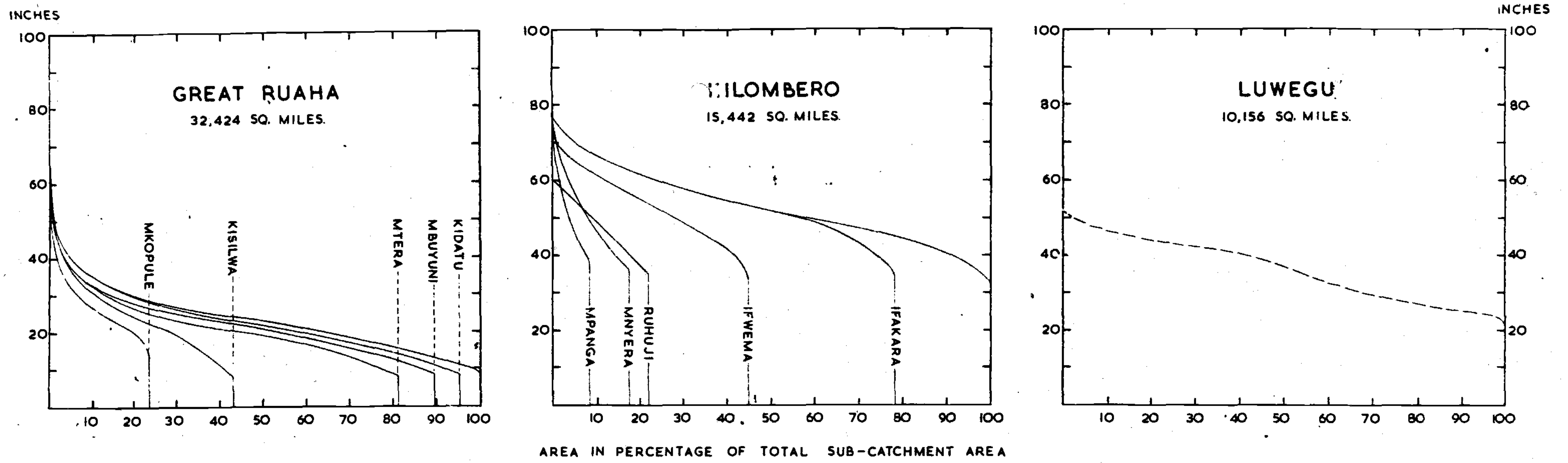


RAINFALL HYPSOMETRIC CURVES FOR THE ENTIRE RUFIJI BASIN.

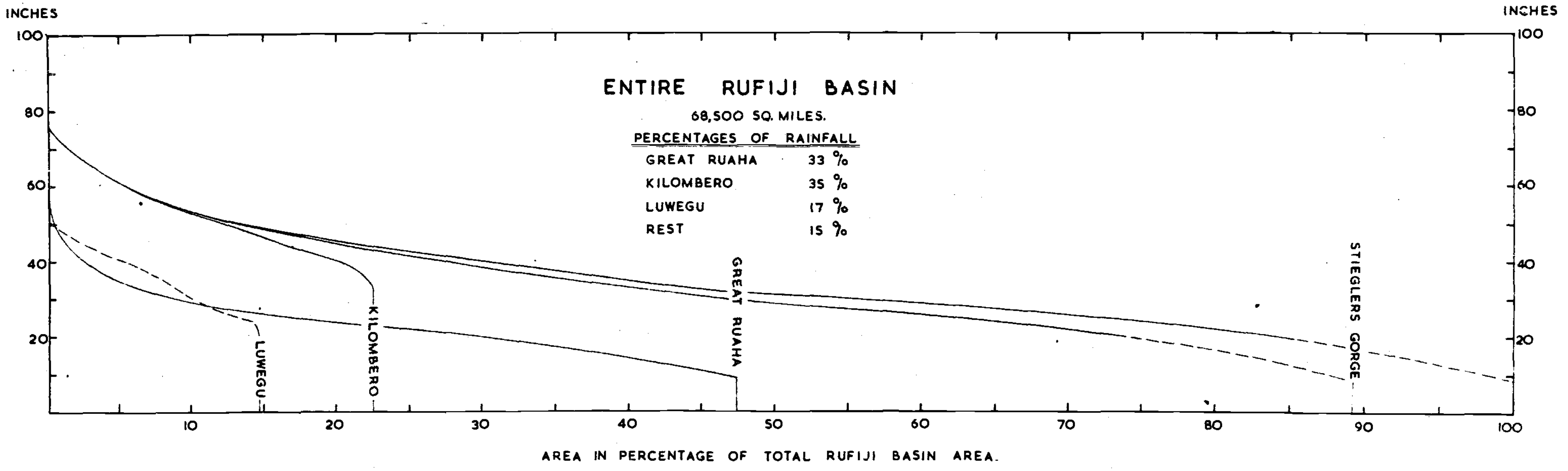
1. AVERAGE CURVE FOR THE PERIOD 1940/41 to 1954/55.
2. CURVE FOR THE MAXIMUM OBSERVED YEAR, 1955/56.
3. CURVE FOR THE MINIMUM OBSERVED YEAR, 1948/49.



AVERAGE RAINFALL HYPSOMETRIC CURVES FOR THE LITTLE RUAHA SUB-CATCHMENT



AVERAGE RAINFALL HYPSOMETRIC CURVES FOR THE GREAT RUAHA, KILOMBERO AND LUWEGU



AVERAGE RAINFALL HYPSOMETRIC CURVES FOR THE GREAT RUAHA, KILOMBERO AND LUWEGU COMPARED WITH THE SAME CURVE FOR STIEGLER'S GORGE AND FOR THE ENTIRE RUFIJI BASIN

8. RUNOFF

a. INTRODUCTION

The term runoff is understood as the total amount of water going into a river channel and passing a given point in a given time. Runoff can be subdivided into two main groups: A. Surface Runoff, which is the water finding its way to the river without infiltration and percolation down to the ground water table, and B. Sub-surface runoff, which is the water reaching the river channel after percolation through the ground.

Information on runoff and river behaviour is of very great importance for all river development, but unfortunately no records were available for the Rufiji Basin when the survey commenced. To provide some knowledge on the phenomena, hydrometric stations were established on important rivers and discharge measurements were carried out for the establishment of rating curves and for runoff computations. Altogether 65 hydrometric stations were established and at 49 of these, runoffs were computed.

b. RIVER GAUGING

River gauging is tedious work which requires accuracy and skill from the observer. Without good and comprehensive field investigations it is not possible to achieve reliable results by hydrological analyses. In this report no theoretical dissertations will be given on the various methods that can be applied in river gaugings. Descriptions of methods can be found in nearly all books on Hydrology as for example (3). It would be appropriate, however, to mention some particular methods and procedures which proved to be of great value for the investigations, and also mention some of the difficulties which the Team encountered when compiling data on river behaviour.

A rocky control section was found for the water level readings on a number of rivers which means that the same rating curve can be presumed to last for years. In sandy rivers or at stations with shifting control sections the American STOUT METHOD (9, p. 398) was used. The runoff calculations were, in such cases, based on direct discharge measurements taken as frequently as possible. This method is practical only for stations with relatively easy access, or if a team can be stationed in the area.

Stations were if possible established close to proposed dam sites and at points where some utilization of the water was foreseeable. It is very important to get a network of stations, and for this purpose the gauging points should be spread as evenly as possible over the Basin. Access and possibilities of providing housing and reliable observers are factors which must be considered. It is sometimes convenient to establish gauges at bridge crossings. A bridge is often built across a rocky stretch of a river and concrete abutments may contribute to the stabilization of the control section. The water level gauge must then be established on the upstream side of the bridge and preferably at some distance from it. Current meter measurements need not necessarily be taken from the bridge, but if the section is suitable for such gaugings it is often convenient to do so.

The vertical velocity curve method (Harlacher's method) was used for river gauging whenever possible, thus reducing to a minimum the use of "The Two Point Method" and "The Six Tenth Method" (3, p. 37-39). These latter methods can be used to advantage on certain occasions, especially when compared with more comprehensive measurements. On the other hand, in certain cross-sections great errors can be made if measurements of this type only are used. For the Rufiji Basin with vast distances between stations, the measurements become expensive, and it is therefore adviseable to spend a little more time on the actual performance and the computations to get them as reliable as possible. Some work was also done for introduction of discharge measurements using salt solution (6). Experience in other countries has proved the method to be excellent in turbulent rivers where accurate measurements may be difficult to obtain with an ordinary current meter. The method was tried out in various rivers of Tanganyika by a Government Executive Engineer and good results were achieved in mountain streams with low natural salt content; but on one occasion, the Pangani River, the natural salt content was too high. The quantity of salt to be added to get readable differences in electrical conductivity was so great that it was beyond all practical and economical possibility.

Two gauges, one upstream and one downstream, are very often installed at the stations and readings taken at frequent intervals during the day. This double gauge reading system gives a certain amount of check on the observers. There will always exist a close correspondence between upstream and downstream readings. The observers are not always capable of discovering this, thus if the correspondence is found to be correct, there is a greater probability that the readings are real. The double gauge system is obviously also an advantage for certain other purposes. Surface slopes between the gauges can be determined at all stages of the river and in the event of one gauge being put out of action, readings on the other will prevent there being periods of no observations. As a whole, the African observers are found to be fairly reliable in their readings when instructions were given clearly and not made too difficult.

Automatic water level recorders are installed at 9 stations. A limited budget made the number of these instruments lower than was originally anticipated, and only the more important stations have been equipped with them. In larger catchments sufficient accuracy regarding volumes of water will be obtained from staff gauges, and Griffin Gauges have been erected at a number of stations for maximum flood level recordings. The Griffin Gauge is an inexpensive and very useful instrument in places where the upper flood level records are of importance. A drawing of the Griffin Gauge is given page 6 in Part II of this report.

Hydrological field work in the Rufiji Basin is not an easy and straight forward task. There are very few all-weather roads and since discharge measurements must be taken during all stages of the river it was often problematical to reach all stations during the rainy season. Land rovers were used as far as possible and during dry seasons all stations could be visited for a proper check and the necessary repairs could be carried out. During the wettest months roads were cut off at many places and the only access was on foot or by boat. For stations in the Kilombero Valley the only access during flood season was by motor boat on the river, and in the first years stations in this area were gauged by field officers travelling by a craft purchased second-hand. Due to heavy currents, the dangers and trouble with the boat this did not work out very successfully. During the flood seasons 1958 and 1959, smaller teams were stationed in the area and a number of fairly good measurements were taken. Before the flood season 1960 more money was made available and the Water Development and Irrigation Department was able to equip and staff better teams which it is hoped will succeed in compiling important data for the Kilombero. However, the river bed at many of the stations in this region is changeable, and the calibration work will therefore have to be repeated every year. The Kilombero Valley is an important area, and water control is a necessity for the utilization of the plain. Good hydrological records are of the utmost value, and it is hoped that funds can be made available for a continuation and extension of these investigations.

At the Stiegler's Gorge Station on the Rufiji a permanent camp was established with an European observer stationed from 1954. An automatic recorder and a permanent cable construction was specially manufactured by A. Ott, Kempten, Germany and established during 1956 and early 1957. The electric wire on the cableway caused some trouble and it was difficult, due to access and various other circumstances, to get reliable flood measurements. The station has, during the last year been better staffed and it is hoped that reliable records can be obtained in the future. The Gorge itself is rocky, but unfortunately there is a thick mud layer covering the river bed. This layer is shifting, and specially during floods changes may occur which will alter the stage-discharge relation. An additional gauge was therefore established last year upon the Pangani Rapids and it is hoped that this gauge will provide a better calibration of future observations. This is the key station of the Basin and for studies on storage requirements and operation for flood control of the Rufiji Valley and delta it is important to have reliable records.

The west end of the Basin was comparatively easy as regards stream-gauging. A number of gauges were established on rivers at the main road crossings between Dodoma and Mbeya and these stations could be visited and checked all the year round. Some more trouble was caused by stations on the Kisigo River and at Hausmann's Bridge on the Great Ruaha. Teams had to be stationed there continually during one flood season until the necessary gaugings had been taken.

The Luwegu River for economic reasons could not be gauged. The total runoff can, however, be computed as a proportion of the difference between Stiegler's Gorge and the total of the Great Ruaha and the Kilombero Rivers.

c. COMPARISON RAINFALL-RUNOFF

Runoff records for the various hydro-metric stations are available for periods from 2 to 5 years. It is desirable to get these years calibrated against a long time average, and for this purpose the gauged annual runoff in hydrological years were compared with rainfall on the catchment area. In this manner it was possible to determine synthetic runoff averages for the selected normal period as well as obtain some knowledge on the variation of annual runoff.

The planimetered annual rainfall totals described in the previous chapter are listed in table VI together with the corresponding runoff from the catchment. The years of actual observed runoff are very few but mostly there exists a close affinity between the two types of records. Correlation curves for 7 stations are shown on page 171 and the corresponding curves for other stations show a similar pattern.

The year 1955/56 had a very high rainfall and runoff. At many stations the 1955/56 rainfall is the maximum observed since 1940/41, the beginning of the selected normal period. For the correlation analyses this is very fortunate as the curves can then be traced more accurately in their higher regions. The year 1954/55 was close to an average year nearly all over the Basin. The years 1956/57 and 1957/58 were above the average, and the last year, 1958/59, was under average in the Kilombero region but more close to an average year in the Great Ruaha sub-catchment. The years of survey, therefore, cover a fairly wide range of annual runoff, and at stations where five years of observations are available the correlation curves are assumed to be fairly reliable. It seems that they tend to follow a series of curves, branching out from, or near, the origin and they become practically parallel for higher rainfall areas.

At stations where not even five years of corresponding data are available the correlation curves obviously become more uncertain and in such cases the curves are traced partly by analogy with other curves, as for example Swero and Ifakara, see page 171.

The annual rainfall for a catchment varies considerably from year to year and in the last 19 years it is found as high as 191% of average (Kimani) and as low as 56% (Halali). On an average for all areas investigated it varies between 142% and 70% of the mean.

The runoff, however, varies more compared with average values. On the Great Ruaha to Mtera, Mbuyuni and Kidatu the maximum is over 200% of average and it might be as low as 40% on the driest tributaries observed. The maximum and minimum values found group around 180% and 60% of average but the variation in runoff is comparatively larger on the Great Ruaha than on the Kilombero.

d. NATURAL LOSS OF WATER

The difference between rainfall and runoff gives the natural loss of water. Since the Hydrological year is used and the river discharge at the end of each year practically comes back to about the same, the computed difference should nearly correspond to the natural evapotranspiration from the catchment.

The data derived from these analyses are of interest and are listed below:-

ANNUAL LOSS OF WATER.

Computed as a difference between rainfall and runoff.
All data are in inches.

Kilombero Sub-catchment	Maximum	Average	Minimum
Kilombero to Swero	47.3	37.8	30.1
Kilombero to Ifakara	47.2	38.0	29.8
Kilombero to Ifwema	55.6	37.4	28.1
Ruhuji to Mwayamalungu	51.6	35.8	27.6
Mnyera to Taveta	54.2	37.4	27.6
Kigogo-Ruaha to Frick's Bridge	55.2	37.4	25.0
Mpanga to Mpanga Mission	54.4	39.0	28.3
Furua to Malinyi	31.2	25.2	20.7
Luhombero to Ilonga	59.5	41.9	31.2
Median for above areas	54.2	37.4	28.1
Range of dispersion	(59.5-31.2)	(41.9-25.2)	(31.2-20.7)

Great Ruaha Sub-catchment	Maximum	Average	Minimum
Great Ruaha to Great North Road	36.2	26.4	17.8
Kimani to Great N.Road	35.7	18.8	11.9
Mbarali to Igawa	30.2	22.6	14.5
Halali to Iyayi	34.5	26.0	15.5
Ndembera to Ilongo	39.1	29.1	17.3
Ndembera to Madibira	35.6	26.4	16.0
Little Ruaha to S.H.Club	43.3	30.6	18.2
Little Ruaha to Iwawa	43.0	32.3	25.0
Mtitu to Mtitu Bridge	39.4	30.9	25.8
Little Ruaha to Ihimbu	38.1	28.9	22.2
Little Ruaha to Iringa	36.7	28.2	22.0
Little Ruaha to Tosamaganga	36.1	27.4	21.0
Little Ruaha to Mawande	35.4	26.7	18.5
Great Ruaha to Mkopule	33.0	24.4	16.3
Great Ruaha to Kisilwa	30.0	22.0	14.3
Great Ruaha to Mtera	28.5	20.2	14.1
Great Ruaha to Mbuyuni	28.5	21.0	15.3
Great Ruaha to Kidatu	29.0	20.9	14.8
Median for above areas	35.7	26.4	16.3
Range of dispersion	(43.3-28.5)	(32.3-18.8)	(25.8-11.9)
Rufiji to Stiegler's Gorge	38.8	28.2	21.4

It will be seen that the loss of water is much greater on the Kilombero than on the Great Ruaha. The reason for this is obviously that more water is available for evaporation and transpiration on this catchment. The greatest loss of water takes place during the wet season.

e. TABULATION OF RESULTS

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR. TABLE V. 49 PAGES ARRANGED ACCORDING TO STATION NUMBERS.

Runoff for ten-day periods (1st to 10th, 11th to 20th and 21st to end month) for whole months and years are tabulated for the observation periods at the various stations. The annual unit runoff or specific runoff is also given expressed as acrefeet per sq. mile of catchment per year. Further are given the maximum and the minimum rate of flow observed each year together with the date of occurrance. A minimum flow may be observed over more days and in such cases the last day of occurrance only is given.

RAINFALL, RUNOFF AND LOSS OF WATER. TABLE VI. ARRANGED ACCORDING TO STATION NUMBERS.

These tables give the annual rainfall values for the 19 year period 1940/41 to 1958/59 in acrefeet, inches and percentage and the corresponding values for annual runoff and loss of water. The latter two are partly observed and partly synthetically established. Averages for the 15 year normal period are given on rainfall, runoff and loss of water.

RAINFALL. TABLE VII.
ARRANGED GEOGRAPHICALLY.

The result of rainfall planimeterings for whole sub-catchments, damsites and other points where no runoff records are available, are given in these tables. By applying reasonable runoff coefficients from the rainfall-runoff tables above annual runoff can be computed.

ANNUAL AVERAGE AND SPECIFIC RUNOFF. TABLE VIII, 3 PAGES.

In this table is given a synthetically computed 15 years average runoff for the gauging stations. These averages are divided by the corresponding catchment area and the derived average specific runoff is given in the last column of the table. The table also contains runoff contribution from partial sub-catchments between established stations.

f. RUNOFF MAP.

The average annual specific runoff values for the 15 years normal period have been plotted on a map inside their respective catchments. (See Runoff Map, Part 3 of this Report). The specific runoff stands for the runoff contribution from each sq.mile of the catchment in a year. Isopleths showing equal specific runoff, here named isohydets, are drawn for each catchment as to average the given specific runoff and at the same time to fit the conditions in adjacent catchments. The procedure of establishment of the best fitting isohydets is thus by trial and error.

Runoff from partial sub-catchments between established gauging stations is computed as a difference. This difference includes the loss of water in transit, and the derived figure will be smaller than the actual. This especially effects the driest stretches of the Great Ruaha and from the above table it will be seen that this difference is sometimes even negative. The loss of water by evaporation in this area is so great compared with the rainfall that runoff from partial sub-catchments cannot be computed this way. The isohydets are therefore partly established by applying reasonable runoff coefficients based on observations in nearby catchments and rainfall records at the few stations available.

The specific runoff records show a surprisingly good correspondence for areas in the Southern Highlands from Lukose River to the Poroto and Kipengere Mountain Ranges. For the Kilombero Valley the records are not so extensive but a good agreement was found between the various sub-catchments. No records are available for the coast area, but the runoff is most likely under 200 and possibly in the order of 150 acrefeet per square mile per year.

From the map it will be seen that there is a very high runoff, as a maximum averaging over 2000 acrefeet per square mile per year, on the south eastern slopes of the mountain chain in the north of the Kilombero Valley. It seems that the prevailing wind from the ocean precipitates its rainfall and causes high runoff from the Mahenge Massif and on the mountain slopes in the north of the Kilombero Valley. It is also clearly illustrated how the lower part of the Kilombero Valley catchment has a higher specific runoff than the upper part. The Valley Plain lies in a shadow behind the Mahenge barrier and the specific runoff is comparatively low on the plains from Luri River to the junction of the Mnyera and Nyama rivers.

Average annual runoff for any area can easily be extracted from this runoff map, and it serves a good purpose before hydrological records can become available on more rivers. As time progresses it is hoped that the records will improve and a better map can then be established and preferably be fitted into a map for the whole territory.

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st. Nov. - 31st. Oct.)

RIVER: Rufiji STATION: Stiegler's Gorge No. IK.3 CATCHMENT AREA: 61 106 SQ. MILES

Runoff in: Hundred Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st–10th	646	650	762	4802	10211	11708	15113	8944	5029	2942	1831	1148
	11th–20th	662	795	798	6903	7064	13432	12966	7332	4086	2628	1569	920
	21st–the last	694	994	1901	7205	8287	12495	11881	6172	3747	2409	1369	839
	Whole month	2002	2439	3461	18910	25562	37635	39960	22448	12862	7979	4769	2907
1955/56	1st–10th	778	634	4181	14957	13617	27503	16688	9379	4850	3221	2282	1712
	11th–20th	718	1218	6939	15860	13648	20661	14827	7288	4142	2930	2062	1548
	21th–the last	694	2099	17193	15213	15531	26178	13442	5749	3905	2867	1860	1565
	Whole month	2190	3951	28313	46030	42796	74342	44957	22416	12897	9018	6204	4825
1956/57	1st–10th	1274	936	1857	7611	5679	8771	17442	9072	4364	3016	2151	1644
	11th–20th	1136	1591	3673	6915	5777	13989	15752	6927	3717	2761	1979	1391
	21st–the last	976	1618	4891	4756	8294	16377	13402	5287	3632	2651	1814	1291
	Whole month	3386	4145	10421	19282	19750	39137	46596	21286	11713	8428	5944	4326
1957/58	1st–10th	1097	766	3838	2744	6463	14065	16557	7221	3487	2192	1590	1042
	11st–20th	969	1335	2426	6424	9426	12993	11630	5360	2954	1954	1393	905
	21st–the last	908	2312	2501	5037	14576	17415	10555	4050	2701	1981	1249	891
	Whole month	2974	4413	8765	14205	30465	44473	38742	16631	9142	6127	4232	2838
1958/59	1st–10th	693	529	2524	4504	10655	9273	8863	4537	2639	1730	1160	732
	11th–20th	614	1430	4790	5687	8239	8475	7614	3319	2394	1568	950	754
	21st–the last	554	5759	3561	5811	10433	8757	6985	2835	2179	1523	826	687
	Whole month	1861	7718	10875	16002	29327	26505	23462	10691	7212	4821	2936	2173

Characteristic Data

1954/55
Annual Runoff: 18.31 million acre feet
Unit Runoff: 300 acreft. per sq. mile per year
Max. discharge: 94 000 cusecs. Date: 8. 5. 55.
Min. discharge: 2 900 cusecs. Date: 13.12. 55.

1955/56
Annual Runoff: 29.80 million acre feet
Unit Runoff: 488 acreft. per sq. mile per year
Max. discharge: 252 000 cusecs. Date: 24. 4.56.
Min. discharge: 4 500 cusecs. Date: 6.12.56.

1956/57
Annual Runoff: 19.44 million acre feet
Unit Runoff: 318 acreft. per sq. mile per year
Max. discharge: 106 000 cusecs. Date: 18. 4.57.
Min. discharge 3 500 cusecs. Date: 9.12.57.

1957/58
Annual Runoff: 18.50 million acre feet
Unit Runoff: 303 acreft. per sq. mile per year
Max. discharge: 119 000 cusecs. Date: 2. 4.58.
Min. discharge: 2 500 cusecs. Date: 4.12.58.

1958/59
Annual Runoff: 14.36 million acre feet
Unit Runoff: 235 acreft. per sq. mile per year
Max. discharge: 60 000 cusecs. Date: 9. 3. 59.
Min. discharge: 1 810 cusecs. Date: 28.11. 59.

REMARKS: Min. discharge 1954, 2,900 cusecs, 4.12.54.

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st. Nov. - 31st. Oct.)

RIVER: Yovi STATION: Madizini Estate No. 1KA1 CATCHMENT AREA: 25 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st-10th	1027	1826	940	1029	910	1719	1240	1147	1074	1153	867	891
	11th-20th	1049	997	1049	1497	809	1274	1159	1311	1514	953	563	871
	21st-the last	1024	1034	1583	728	1748	979	2583	1059	1129	983	1382	962
	Whole month	3100	3857	3572	3254	3467	3972	4982	3517	3717	3089	2812	2724
1955/56	1st-10th	877	824	1090	1997	1678	1608	3089	1050	1063	952	899	817
	11th-20th	907	1151	1142	1364	1327	1531	1154	985	1030	920	872	800
	21th-the last	859	2393	1406	1218	1416	3453	1239	955	1112	994	832	855
	Whole month	2643	4368	3638	4579	4421	6592	5482	2990	3205	2866	2603	2472
1956/57	1st-10th	1675		1152	1469	841	1381	912	864	850	910	858	696
	11th-20th	998		894	1394	833	3254	892	850	834	970	771	653
	21st-the last	931		1363	833	925	2204	956	834	900	1000	748	728
	Whole month	3604	(4300)	3409	3696	2599	6839	2760	2548	2584	2880	2377	2077
1957/58	1st-10th	672	664										
	11st-20th	671	715										
	21st-the last	685	798										
	Whole month												
1958/59	1st-10th												
	11th-20th												
	21st-the last												
	Whole month												

Characteristic Data

		Annual Runoff (acre feet)	Unit Runoff (acreft. per sq. mile per year)	Max. discharge (cusecs.)	Date	Min. discharge (cusecs.)	Date
1954/55		42 063	1 683	325	5. 4.55.	39.4	2.11.55.
1955/56		46 079	1 843	362	27. 4.56.	38.7	4.11.56.
1956/57		39 673	1 587	417	16. 4.57.	31.0	27.10.57.
1957/58							
1958/59							

REMARKS: This is not a good station for calibration of discharge and current meter measurements have therefore not been taken after February 1957. Water level readings continue only by the management. Area of catchment is as given by Water Development and Irrigation Department.

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st.Nov. - 31st. Oct.)

RIVER: Little Ruaha STATION: Iringa No. IKA.2 CATCHMENT AREA: 1127 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st–10th	(3400)	3909	6188	10516	13459	20977	13422	8822	7217	5881	4695	3859
	11th–20th	3054	7922	6915	13251	12589	19595	10213	8728	6852	5249	4451	3475
	21st–the last	2725	7961	8619	7731	15268	15252	10833	8401	6676	5347	4186	3454
	Whole month	9179	19792	21722	31498	41316	55824	34468	25951	20745	16477	13332	10788
1955/56	1st-10th	2989	3790	13385	30682	28430	36751	24547	15592	11772	9260	6973	5471
	11th-20th	2847	5068	22261	28838	27809	26214	19942	14337	10507	8561	6503	5001
	21th–the last	2701	9125	35925	31080	34115	24156	20154	12934	10325	8361	5996	5236
	Whole month	8537	17983	71571	90600	90354	87121	64643	42863	32604	26182	19472	15708
1956/57	1st-10th	4539	5886	11589	27203	15908	32693	30345	18200	13058	10581	8127	6162
	11th-20th	4378	6410	16286	22671	15433	53716	25704	16018	12244	9614	7271	5564
	21st–the last	4105	9489	20051	15761	22734	50297	22763	14390	12659	9799	6939	5585
	Whole month	13022	21785	47926	65635	54075	136706	78812	48608	37961	29994	22337	17311
1957/58	1st–10th	4953	3817	10937	9096	16947	48546	24514	13816	10976	8452	6639	4762
	11st–20th	4653	4918	9993	17925	25865	28004	17444	12821	10125	7841	6042	4336
	21st–the last	4339	10714	10152	15169	59136	26265	16778	11527	10060	8053	5509	4179
	Whole month	13945	19449	31082	42190	101943	102815	58736	38164	31161	24346	18190	13277
1958/59	1st–10th	3321	2903	8507	15746	20230	38366	15462	9129	7760	6227	5419	4658
	11th–20th	2933	6247	10740	11268	19403	24076	13080	8433	7152	5954	5156	4423
	21st–the last	2825	11254	13597	11813	26013	17900	11664	7972	7182	6246	4895	4556
	Whole month	9079	20404	32844	38827	65646	80342	40206	25534	22094	18427	15470	13637

Characteristic Data

1954/55

Annual Runoff: 301092 acre feet
Unit Runoff: 267 acreft. per sq. mile per year
Max. discharge: 1300 cusecs. Date: 6. 4. 55.
Min. discharge: 130 cusecs. Date: 29.11. 55.

1955/56

Annual Runoff: 567638 acre feet
Unit Runoff: 503 acreft. per sq. mile per year
Max. discharge: 2600 cusecs. Date: 5. 4. 56.
Min. discharge: 199 cusecs. Date: 28.11. 56.

1956/57

Annual Runoff: 574172 acre feet
Unit Runoff: 509 acreft. per sq. mile per year
Max. discharge: 5200 cusecs. Date: 17. 4. 57.
Min. discharge 205 cusecs. Date: 30.11. 57.

1957/58

Annual Runoff: 495293 acre feet
Unit Runoff: 439 acreft. per sq. mile per year
Max. discharge: 3500 cusecs. Date: 2. 4. 58.
Min. discharge: 136 cusecs. Date: 6.12. 58.

1958/59

Annual Runoff: 382510 acre feet
Unit Runoff: 339 acreft. per sq. mile per year
Max. discharge: 2500 cusecs. Date: 7. 4. 59.
Min. discharge: 124 cusecs. Date: 21.11. 59.

REMARKS: Minimum discharge 1954: 129 cusecs, 27th and 28th November 1954.

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st. Nov. - 31st. Oct.)

RIVER: Great Ruaha STATION: Kidatu No. IKA3 CATCHMENT AREA: 30 905 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st–10th	7835	7984	8825	28775	174284	204170	173123	84719	48919	25807	16724	13515
	11th–20th	8464	8525	10361	61423	129809	190511	108360	76250	43652	20762	15516	12566
	21st–the last	7509	12641	15002	108255	149128	147648	120734	61589	41081	19970	14503	12962
	Whole month	23808	29150	34188	198453	453221	542329	402217	222558	133652	66539	46743	39043
1955/56	1st–10th	12269	9812	141620	359802	327356	297821	237746	112502	55193	35357	21990	15836
	11th–20th	11142	19875	152430	305452	265652	324804	171451	68057	46548	30005	19872	13763
	21th–the last	10678	26706	506184	338972	253846	297472	152495	69225	43328	27526	17621	14017
	Whole month	34089	56393	800234	1004226	846854	920097	561692	269784	145069	92388	59483	43616
1956/57	1st–10th	12506	12061	23389	211183	223774	142300	297534	130156	57965	36712	22903	16963
	11th–20th	11359	11364	48157	220436	169011	250025	245048	96661	49752	31053	19881	14984
	21st–the last	10329	19438	42158	167793	156570	500636	206742	74823	46806	28975	20802	15286
	Whole month	34194	42863	113704	599412	549355	892961	749324	301640	154523	96740	63586	47233
957/58	1st–10th	13061	9458	27247	30428	94905	350152	274711	89246	45716	28151	20512	14614
	11st–20th	11434	12647	18370	108899	95800	269909	159842	70000	39329	24886	18288	13474
	21st–the last	11010	17535	23054	146686	347598	328474	125056	54467	35989	25444	16609	12939
	Whole month	35505	39640	68671	288013	538303	948535	559609	213713	121034	78491	55409	41027
1958/59	1st–10th	10675	9955	29429	29333	81925	325653	172401	70442	38672	23843	17108	12332
	11th–20th	9931	11764	31570	50529	125118	163026	125199	56007	32043	20760	14956	11545
	21st–the last	9401	60395	31992	38264	235786	183683	97833	46706	29431	21808	13563	11276
	Whole month	30007	82114	92991	118126	442829	672362	395433	173155	100346	66411	45627	35155

Characteristic Data

1954/55:
Annual Runoff: 2.19 million acre feet
Unit Runoff: 70.9 acreft. per sq. mile per year
Max. discharge: 14300 cusecs. Date: 6. 5.55.
Min. discharge: 484 cusecs. Date: 11.12.55.

1955/56:
Annual Runoff: 4.83 million acre feet
Unit Runoff: 156.4 acreft. per sq. mile per year
Max. discharge: 27500 cusecs. Date: 22. 1.56.
Min. discharge: 484 cusecs. Date: 1.12.56.

1956/57:
Annual Runoff: 3.64 million acre feet
Unit Runoff: 117.5 acreft. per sq. mile per year
Max. discharge: 35800 cusecs. Date: 25. 4.57.
Min. discharge 454 cusecs. Date: 9.12.57.

957/58:
Annual Runoff: 2.99 million acre feet
Unit Runoff: 93.1 acreft. per sq. mile per year
Max. discharge: 23300 cusecs. Date: 1. 4.58.
Min. discharge: 454 cusecs. Date: 12.12.58.

1958/59:
Annual Runoff: 2.25 million acre feet
Unit Runoff: 73.0 acreft. per sq. mile per year
Max. discharge: 23000 cusecs. Date: 2. 4.59.
Min. discharge: 398 cusecs. Date: 29.11.59.

REMARKS: Minimum discharge 1953/54 - 380 cusecs date: 28/11 - 3/12/54

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st.Nov. - 31st. Oct.)

RIVER: GREAT RUAHA STATION: Mbuyuni No. IKA 4 CATCHMENT AREA: 28774 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st-10th	692	1265	2817	21137	134404	125914	74380	34745	18123	7693	3656	2226
	11th-20th	1037	2069	3466	46366	85262	96691	54218	30081	13570	5932	3250	1826
	21st-the last	656	6016	5511	82785	101027	77171	50495	24355	11136	4839	2682	1654
	Whole month	2385	9350	11794	150288	320693	299776	179093	89181	42829	18464	9588	5706
1955/56	1st-10th	1516	1124	142480	290309	257044	239422	160675	70564	33644	20352	9433	5260
	11th-20th	1351	12704	121252	253822	208628	250076	115791	54411	28265	16805	7679	4133
	21th-the last	1364	15251	460307	282621	205257	201059	100343	42953	25891	13665	6500	3861
	Whole month	4231	29079	724039	826752	670929	690557	376809	167928	87800	50922	23612	13254
1956/57	1st-10th	3381	3545	10460	200290	177143	102693	190313	89940	37090	22355	12131	8150
	11th-20th	2713	3030	39816	183125	135242	195634	171244	63889	30465	19203	10667	6650
	21st-the last	2162	7686	33671	139008	109975	443849	143059	47831	28460	16852	10112	5337
	Whole month	8256	14261	83947	522423	422360	742176	504616	201660	96015	58410	32910	20137
1957/58	1st-10th	4106	2507	18887	25411	69629	281956	180484	55765	27692	16134	9832	6162
	11st-20th	3420	3936	10988	102913	75217	216879	107994	42076	23656	13604	8286	5398
	21st-the last	2790	7980	22350	145357	344838	227115	82459	33270	21861	12428	6886	5263
	Whole month	10316	14423	52225	273681	489684	725950	370937	131111	73209	42166	25004	16823
1958/59	1st-10th	3968	2582	17945	24807	84308	262559	121610	45123	23920	12348	5915	3725
	11th-20th	3111	3816	27227	38511	126663	140326	87065	33670	19914	9971	5231	3303
	21st-the last	2701	61895	25027	32691	241369	151653	67749	27879	16901	8151	4377	2961
	Whole month	9780	68293	70199	96009	452340	554538	276424	106672	60735	30470	15523	9989

Characteristic Data

1954/55
Annual Runoff: 1.14 million acre feet
Unit Runoff: 40 acreft. per sq. mile per year
Max. discharge: 12000 cusecs. Date: 2. 4.55.
Min. discharge: 54 cusecs. Date: 12.12.55.

1955/56
Annual Runoff: 3.67 million acre feet
Unit Runoff: 128 acreft. per sq. mile per year
Max. discharge: 29000 cusecs. Date: 22. 1.56.
Min. discharge: 100 cusecs. Date: 3.12.56.

1956/57
Annual Runoff: 2.71 million acre feet
Unit Runoff: 94 acreft. per sq. mile per year
Max. discharge: 36000 cusecs. Date: 25. 4.57.
Min. discharge 115 cusecs. Date: 10.12.57.

1957/58
Annual Runoff: 2.23 million acre feet
Unit Runoff: 77 acreft. per sq. mile per year
Max. discharge: 22000 cusecs. Date: 2. 4.58.
Min. discharge: 103 cusecs. Date: 3. 4.58.

1958/59
Annual Runoff: 1.75 million acre feet
Unit Runoff: 61 acreft. per sq. mile per year
Max. discharge: 23000 cusecs. Date: 2. 4.59
Min. discharge: 83 cusecs. Date: 22.11.59.

REMARKS: Minimum discharge 1954: 33 cusecs, 8-11.11; 22.11; 3.12 and 13-14.12.54.

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st.Nov. - 31st. Oct.)

RIVER: Great Ruaha STATION: Mtera No. IKA.5 CATCHMENT AREA: 26254 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st–10th	(600)	0	4125	18775	132016	104464	56402	28339	17345	9741	7067	4692
	11th–20th	387	0	3719	41370	83156	73054	45898	22027	15314	8715	6364	4108
	21st–the last	71	0	5658	77635	102477	67547	38419	19182	13659	8766	5368	3752
	Whole month	1058	0	13502	137780	317649	245065	140719	69548	46318	27222	18799	12552
1955/56	1st-10th	2750	845	151636	255660	247485	224255	149654	63954	29954	16809	6393	5751
	11th-20th	2375	15771	126930	240101	207014	232931	112883	49593	24024	13348	7171	4696
	21th–the last	1733	17930	376261	235269	205196	185091	94679	38311	21394	11955	6359	4629
	Whole month	6858	34546	658827	731030	659695	642277	357216	151858	75372	42112	21923	15075
1956/57	1st-10th	3557	3417	11401	164256	185321	107450	181816	97535	40835	20142	12321	7440
	11th-20th	3114	3832	46469	175654	147529	184575	169033	70434	32991	17230	9367	6663
	21st–the last	2602	7138	36313	136240	124028	369889	145586	52754	29406	16522	7812	5695
	Whole month	9273	14387	94183	496150	456878	661914	496435	220723	103232	53894	29500	19798
1957/58	1st–10th	4305	2276	18694	24693	72826	238656	164367	57872	27290	15139	9724	5952
	11st–20th	3464	3116	12935	109543	74006	222100	110357	43949	22702	12616	8351	4674
	21st–the last	2993	8877	28530	132776	282457	201315	84882	34215	20080	11942	7054	4222
	Whole month	10752	14269	60159	267012	429289	662071	359606	136036	70072	39697	25129	15048
1958/59	1st–10th	2859	1730	16329	26201	78761	245502	133567	52663	25642	11632	6832	3777
	11th–20th	2335	3217	30914	39281	112419	152063	99260	40174	20946	9706	5512	3389
	21st–the last	1962	65695	24531	33526	240024	161693	78330	31401	17249	8804	4401	2759
	Whole month	7156	70642	71774	99008	431204	559458	311157	124238	63837	30142	16745	9925

Characteristic Data

1954/55:
Annual Runoff: 1.03 million acre feet
Unit Runoff: 39 acreft. per sq. mile per year
Max. discharge: 11000 cusecs. Date: 1. 4. 55.
Min. discharge: 37 cusecs. Date: 9.12.55.

1955/56:
Annual Runoff: 3.39 million acre feet
Unit Runoff: 130 acreft. per sq. mile per year
Max. discharge: 26000 cusecs. Date: 21. 1.56.
Min. discharge: 129 cusecs. Date: 30.11.56.

1956/57:
Annual Runoff: 2.65 million acre feet
Unit Runoff: 101 acreft. per sq. mile per year
Max. discharge: 32000 cusecs. Date: 24. 4.57.
Min. discharge 110 cusecs. Date: 7.12.57.

1957/58:
Annual Runoff: 2.09 million acre feet
Unit Runoff: 80 acreft. per sq. mile per year
Max. discharge: 18000 cusecs. Date: 27. 3.58.
Min. discharge: 88 cusecs. Date: 10.12.58.

1958/59:
Annual Runoff: 1.80 million acre feet
Unit Runoff: 68 acreft. per sq. mile per year
Max. discharge: 22000 cusecs. Date: 1. 4.59.
Min. discharge: 76 cusecs. Date: 28.11.59.

REMARKS: River dry in December 1954.

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st.Nov. - 31st. Oct.)

RIVER: Chimala STATION: Chimala No. 1KA7 CATCHMENT AREA: 85 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st–10th				1735	5559	6338	3761	1338	768	554	453	416
	11th–20th				1567	2913	4912	2994	1058	687	510	420	417
	21st–the last				2003	3134	4197	2063	905	689	544	407	515
	Whole month				5325	11606	15447	8818	3301	2144	1608	1280	1348
1955/56	1st–10th	485	529	3278	6750	5351	4540	4762	1887	1076	788	610	535
	11th–20th	434	1117	3675	7942	3146	3613	2951	1653	956	709	544	496
	21th–the last	499	1916	6896	9213	3046	4469	2524	1156	959	711	509	556
	Whole month	1418	3562	13849	23905	11543	12622	10237	4696	2991	2208	1663	1587
1956/57	1st–10th	631	606	1591	5843	4263	7977	4482	1634	973	788	604	480
	11th–20th	474	557	2031	5713	3052	11446	2898	1331	902	721	544	408
	21st–the last	431	717	3061	5895	4233	11021	2367	1142	943	731	496	452
	Whole month	1536	1880	6683	17451	11548	30446	9747	4097	2818	2240	1644	1340
1957/58	1st–10th	425	472	2004	852	1577	5446	3709	1150	808	710	524	403
	11st–20th	442	605	1023	1708	4629	2912	2190	975	750	676	478	369
	21st–the last	417	1611	1115	1287	9807	3075	1631	916	807	651	455	352
	Whole month	1284	2688	4142	3847	16013	11433	7530	3041	2365	2037	1457	1124
1958/59	1st–10th	301	702	1251	6528	7424	10829	3775	1461	870	642	503	498
	11th–20th	439	822	2228	5953	8231	4122	2683	1219	750	602	470	442
	21st–the last	767	2593	2936	4760	19457	4020	2112	988	726	603	481	472
	Whole month	1507	4117	6415	17241	35112	18971	8570	3668	2346	1847	1454	1412

Characteristic Data

Year				
1954/55	Annual Runoff:		acre feet	
	Unit Runoff:		acreft. per sq. mile per year	
	Max. discharge:	800	cusecs. Date:	5. 4.55.
	Min. discharge:	23	cusecs. Date:	9.12.55.
1955/56	Annual Runoff:	90 481	acre feet	
	Unit Runoff:	1 064	acreft. per sq. mile per year	
	Max. discharge:	1 600	cusecs. Date:	17. 2.56.
	Min. discharge:	21	cusecs. Date:	15.12.56.
1956/57	Annual Runoff:	91 435	acre feet	
	Unit Runoff:	1 076	acreft. per sq. mile per year	
	Max. discharge:	3 200	cusecs. Date:	18. 4.57.
	Min. discharge	18	cusecs. Date:	30.11.57.
1957/58	Annual Runoff:	56 961	acre feet	
	Unit Runoff:	670	acreft. per sq. mile per year	
	Max. discharge:	650	cusecs. Date:	18. 3.58.
	Min. discharge:	14	cusecs. Date:	7.11.58.
1958/59	Annual Runoff:	102 660	acre feet	
	Unit Runoff:	1 208	acreft. per sq. mile per year	
	Max. discharge:	2 000	cusecs. Date:	27. 3.59.
	Min. discharge:	38	cusecs. Date:	25.11.59.

REMARKS:

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st. Nov. - 31st. Oct.)

RIVER: Great Ruaha STATION: Gt.North Road (Chimala) No. 1KA8 CATCHMENT AREA: 328 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st–10th		1328	1225	9250	29676	31381	10146	4012	2514	1872	1540	1326
	11th–20th		2080	2279	10878	12140	20263	7826	3305	2192	1714	1422	1215
	21st–the last		1759	6702	14774	22978	13440	5419	2853	2117	1726	1509	1300
	Whole month	(2576)	5167	10206	34902	64794	65084	23391	10170	6823	5312	4471	3841
1955/56	1st 10th	1319	1115	13456	37145	24960	34015	17905	5544	3199	2547	1888	1633
	11th–20th	1102	4202	15486	37127	20028	20875	12264	4554	3068	2420	1816	1156
	21th–the last	1213	7217	40940	31253	20643	23844	9504	3873	3126	2454	1752	1365
	Whole month	3634	12534	69882	105525	65631	78734	39673	13971	9393	7421	5456	4154
1956/57	1st–10th	1455	1464	4118	29989	18170	32554	16482	6818	3928	2812	2133	1830
	11th–20th	1292	1606	5727	26249	12995	36691	11080	5313	3454	2552	2009	1650
	21st–the last	1339	2288	11508	22136	28696	44698	10499	4448	3461	2551	1934	1744
	Whole month	4086	5358	21353	78374	59861	113943	38061	16579	10843	7915	6076	5224
1957/58	1st–10th	1577	1777	11259	4946	13341	27283	16263	5010	3272	2253	1764	1491
	11st–20th	1627	2134	5221	24138	38591	14157	8968	4222	2859	1971	1897	1525
	21st–the last	1314	5624	6545	16329	62787	15622	7069	3650	2728	1934	1613	1521
	Whole month	4518	9535	23025	45593	114719	57062	32300	12882	8859	6158	5294	4537
1958/59	1st–10th	1598	1592	4762	22907	49533	29964	10666	6629	5336	4569	4179	4031
	11th–20th	1530	2550	11544	23616	28954	15541	8454	6099	5002	4463	4009	3793
	21st–the last	1770	11325	12800	18168	88906	14325	8086	5731	5321	4871	4118	4127
	Whole month	4898	15467	29106	64691	167393	59830	27206	18459	15661	13903	12306	11951

Characteristic Data

Annual Runoff:	236 737	acre feet		
Unit Runoff:	722	acreft. per sq. mile per year		
Max. discharge:	3 600	cusecs.	*Date:*	2. 4.55.
Min. discharge:	49	cusecs.	*Date:*	27.11.55.
Annual Runoff:	416 008	acre feet		
Unit Runoff:	1 268	acreft. per sq. mile per year		
Max. discharge:	5 300	cusecs.	*Date:*	19. 2.56.
Min. discharge:	57	cusecs.	*Date:*	12.10.56.
Annual Runoff:	367 673	acre feet		
Unit Runoff:	1 121	acreft. per sq. mile per year		
Max. discharge:	7 200	cusecs.	*Date:*	22. 4.57.
Min. discharge	62	cusecs.	*Date:*	23.12.57.
Annual Runoff:	324 482	acre feet		
Unit Runoff:	989	acreft. per sq. mile per year		
Max. discharge:	7 500	cusecs.	*Date:*	22. 3.58.
Min. discharge:	68	cusecs.	*Date:*	3.12.58.
Annual Runoff:	440 871	acre feet		
Unit Runoff:	1 344	acreft. per sq. mile per year		
Max. discharge:	20 000	cusecs.	*Date:*	27. 3.59.
Min. discharge:	165	cusecs.	*Date:*	20.11.59.

REMARKS:

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st.Nov. - 31st. Oct.)

RIVER: Kimani STATION: Gt.N.Road No. 1KA.9 CATCHMENT AREA: 173 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st-10th		(848)	922	6857	20790	20314	4672	1943	1140	794	600	488
	11th-20th		1750	2898	13761	10562	9930	3316	1596	1002	712	578	435
	21st-the last		1281	6965	12417	21145	6744	2714	1351	950	703	554	437
	Whole month	(1140)	3879	10785	33035	52497	36988	10702	4890	3092	2209	1732	1360
1955/56	1st-10th	382	315	7430	34141	16345	22116	5505	2353	1280	943	730	600
	11th-20th	334	1448	11778	26220	15088	10432	3820	1862	1094	870	665	490
	21th-the last	338	4642	29097	25918	15345	7522	3224	1540	1144	825	600	517
	Whole month	1054	6605	48305	86279	46778	40070	12549	5755	3518	2638	1995	1607
1956/57	1st-10th	417	424	1078	20116	14724	17809	7762	3078	1703	938	669	499
	11th-20th	369	381	2021	12723	10349	16795	5374	2538	1474	838	628	527
	21st-the last	347	674	4423	12920	20296	15486	4460	2008	1406	815	572	546
	Whole month	1133	1479	7522	45759	45369	50090	17596	7624	4583	2591	1869	1572
1957/58	1st-10th	446	820	5215	2363	7279	17477	4741	1689	1106	742	546	436
	11st-20th	455	715	2361	10152	18380	9469	3263	1531	966	682	497	410
	21st-the last	332	2341	3367	9775	33983	6367	2701	1333	923	683	482	362
	Whole month	1233	3876	10943	22290	59642	33313	10735	4753	2995	2107	1527	1208
1958/59	1st-10th	286	304	875	7563	17804	19311	4672	1845	1080	714	520	441
	11th-20th	293	462	5408	7159	14765	9602	3207	1505	909	644	474	395
	21st-the last	323	2521	4978	6540	36385	7012	2643	1265	876	646	426	458
	Whole month	902	3287	11261	21262	66954	35925	10522	4615	2865	2004	1420	1294

Characteristic Data

Annual Runoff: 162309 acre feet
Unit Runoff: 938 acreft. per sq. mile per year
Max. discharge: 1600 cusecs. Date: 1. 4.55.
Min. discharge: 14 cusecs. Date: 10.12.55.

Annual Runoff: 257153 acre feet
Unit Runoff: 1486 acreft. per sq. mile per year
Max. discharge: 4000 cusecs. Date: 4. 2.56.
Min. discharge: 15 cusecs. Date: 13.12.56.

Annual Runoff: 187187 acre feet
Unit Runoff: 1082 acreft. per sq. mile per year
Max. discharge: 2400 cusecs. Date: 7. 2.57.
Min. discharge 14 cusecs. Date: 14.12.57.

Annual Runoff: 154612 acre feet
Unit Runoff: 894 acreft. per sq. mile per year
Max. discharge: 3200 cusecs. Date: 22. 3.58.
Min. discharge: 13 cusecs. Date: 13.11.58.

Annual Runoff: 164311 acre feet
Unit Runoff: 950 acreft. per sq. mile per year
Max. discharge: 8400 cusecs. Date: 27. 3.59.
Min. discharge: 14 cusecs. Date: 23.11.59.

REMARKS:

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st. Nov. - 31st. Oct.)

RIVER: Mbarali STATION: Igawa No. 1KA.11 CATCHMENT AREA: 619 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st–10th			12215	14423	22170	26579	13216	9545	7187	4547	4339	2700
	11th–20th			17746	14750	12708	17542	11412	8558	6172	4832	3721	2098
	21st–the last			17374	14385	23707	16504	11122	8141	5843	5647	3310	2097
	Whole month	(6600)	(6820)	47335	43558	58585	60625	35750	26234	19201	15026	11370	6895
1955/56	1st-10th	1650	2034	12263	39654	27780	41361	17373	6584	6286	5205	4430	3276
	11th-20th	1418	12021	16574	38895	26385	21483	13354	8112	5924	5461	4083	3192
	21th–the last	1863	6752	39885	31613	28194	22574	11457	7185	5886	5448	3287	3098
	Whole month	4931	20807	68722	110162	82359	85718	42184	21881	18096	16114	11800	9566
1956/57	1st-10th	2698	3622	7249	33829	15436	37257	13504	9434	6472	5087	4167	3247
	11th-20th	2815	4244	9657	24824	14797	33384	11917	7779	5888	4790	3898	2938
	21st–the last	2843	6450	18183	19486	29421	25203	12329	7080	6016	4963	3615	3088
	Whole month	8356	14316	35089	78139	59654	95844	37750	24293	18376	14840	11680	9273
1957/58	1st–10th	3006	2915	15027	7881	15595	24871	10992	6464	5144	4304	3558	2932
	11st–20th	2763	4434	5129	17237	28043	13694	8009	6044	4832	4017	3337	2906
	21st–the last	2506	8492	10364	12186	55304	12040	7926	5525	4846	4197	3281	2708
	Whole month	8275	15841	30520	37304	98942	50605	26925	18033	14822	12518	10176	8546
1958/59	1st–10th	2499	2559	3634	8756	23049	37615	9804	6075	5035	4160	3409	3095
	11th–20th	2412	3980	20412	9376	22719	15240	7936	5631	4620	4015	3155	2866
	21st–the last	2891	10406	7760	13650	45153	12136	7449	5414	4787	4045	3139	3460
	Whole month	7802	16945	31806	31782	90921	64991	25189	17120	14442	12220	9703	9421

Characteristic Data

Annual Runoff: 337999 acre feet
Unit Runoff: 544 acreft. per sq. mile per year
Max. discharge: 3100 cusecs. Date: 31.3.55.
Min. discharge: 68 cusecs. Date: 20.11.55.

Annual Runoff: 494340 acre feet
Unit Runoff: 799 acreft. per sq. mile per year
Max. discharge: 9300 cusecs. Date: 27.1.56.
Min. discharge: 105 cusecs. Date: 26.11.56.

Annual Runoff: 410630 acre feet
Unit Runoff: 663 acreft. per sq. mile per year
Max. discharge: 7000 cusecs. Date: 5. 2.57.
Min. discharge 115 cusecs. Date: 3.12.57.

Annual Runoff: 332506 acre feet
Unit Runoff: 537 acreft. per sq. mile per year
Max. discharge: 7500 cusecs. Date: 20. 3.58.
Min. discharge: 110 cusecs. Date: 14.11.58.

Annual Runoff: 332352 acre feet
Unit Runoff: 537 acreft. per sq. mile per year
Max. discharge: 18000 cusecs. Date: 27. 3.59.
Min. discharge: 131 cusecs. Date: 17.10.59.

REMARKS:

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st. Nov. - 31st. Oct.)

RIVER: Halali STATION: Iyayi d/s No. 1KA12 CATCHMENT AREA: 302 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st-10th												
	11th-20th												
	21st-the last												
	Whole month												
1955/56	1st-10th			0	12065	4626	20503	3358	1171	438	242	145	56
	11th-20th			3570	10238	5559	5541	2801	882	354	214	119	45
	21th-the last			11937	10548	7792	4013	2014	552	311	193	77	40
	Whole month	0	10	15507	32851	17977	30057	8173	2605	1103	649	341	141
1956/57	1st-10th	48	222	476	8861	3465	5418	2529	884	412	269	138	53
	11th-20th	72	106	469	5261	4560	8483	1658	693	353	206	110	71
	21st-the last	112	296	1949	4023	5992	3835	1274	538	363	214	78	83
	Whole month	232	624	2894	18145	14017	17736	5461	2115	1128	689	326	207
1957/58	1st-10th	78	20	3395	3184	6841	6891	3461	1085	589	538	314	233
	11st-20th	53	282	703	6431	10157	4301	2044	923	519	474	245	236
	21st-the last	36	1532	4290	2370	24230	4255	1573	749	536	433	224	193
	Whole month	167	1834	8388	11985	41228	15447	7078	2757	1644	1445	783	669
1958/59	1st-10th	113	42	195	916	4063	12047	2764	1114	604	407	268	240
	11th-20th	98	135	701	1381	4336	4899	1995	809	543	400	248	219
	21st-the last	83	1019	152	4032	15880	3664	1521	694	475	345	235	236
	Whole month	294	1196	1048	6329	24279	20610	6280	2617	1622	1152	751	695

Characteristic Data

Annual Runoff:		acre feet		
Unit Runoff:		acreft. per sq. mile per year		
Max. discharge:		cusecs.	Date:	
Min. discharge:	0	cusecs.	Date:	
Annual Runoff:	109 414	acre feet		
Unit Runoff:	362	acreft. per sq. mile per year		
Max. discharge:	3 300	cusecs.	Date:	5. 4.56.
Min. discharge:	0.4	cusecs.	Date:	27.11.56.
Annual Runoff:	63 574	acre feet		
Unit Runoff:	210	acreft. per sq. mile per year		
Max. discharge:	2 000	cusecs.	Date:	7. 2.57.
Min. discharge	1.0	cusecs.	Date:	10.12.57.
Annual Runoff:	93 418	acre feet		
Unit Runoff:	309	acreft. per sq. mile per year		
Max. discharge:	1 900	cusecs.	Date:	17. 3.58.
Min. discharge:	3.0	cusecs.	Date:	12.12.58.
Annual Runoff:	66 873	acre feet		
Unit Runoff:	221	acreft. per sq. mile per year		
Max. discharge:	4 900	cusecs.	Date:	27. 3.59.
Min. discharge:	6.7	cusecs.	Date:	1.12.59.

REMARKS: The discharge figures for 1955/56 have been obtained by using a rating curve established before construction of bridge.

River was dry part of November, December 1954 and part January 1955.

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st.Nov. - 31st. Oct.)

RIVER: Ndembera STATION: Ilongo No. IKA15 CATCHMENT AREA: 404 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st-10th												
	11th-20th												
	21st-the last												
	Whole month												
1955/56	1st-10th				(10000)	10504	11874	5436	1828	1063	514	233	130
	11th-20th				9063	14713	9861	3689	1335	745	442	188	106
	21th-the last				15376	13320	7602	3003	1150	679	352	149	98
	Whole month	(100)	(500)	(11000)	34439	38537	29337	12128	4313	2487	1308	570	334
1956/57	1st-10th	88	118	2294	7824	5873	10228	9191	2657	1105	630	334	160
	11th-20th	92	120	3366	8277	4323	21841	6246	1943	888	548	240	140
	21st-the last	88	215	5755	4747	4983	30692	4395	1389	806	495	191	127
	Whole month	268	453	11415	20848	15179	62761	19832	5989	2799	1673	765	427
1957/58	1st-10th	93	81	2071	1896	3967	9724	4604	1079	482	245	166	104
	11st-20th	78	89	2071	5272	4558	7962	3100	771	386	210	142	102
	21st-the last	85	246	1385	4038	10617	5344	2032	590	336	205	124	95
	Whole month	256	416	5527	11206	19142	23030	9736	2440	1204	650	432	301
1958/59	1st-10th	58	117	3063	5040	7753	9544	3006	922	450	265	178	124
	11th-20th	122	171	4189	6082	6420	7532	2399	621	401	210	161	129
	21st-the last	125	3220	5927	4049	8219	4312	1763	463	341	231	130	128
	Whole month	305	3508	13179	15171	22397	21388	7168	2006	1192	706	469	381

Characteristic Data

1954/55

Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: ______ cusecs. Date: ______

1955/56

Annual Runoff: 135 053 acre feet
Unit Runoff: 334 acreft. per sq. mile per year
Max. discharge: 948 cusecs. Date: 20. 3.56
Min. discharge: 3.9 cusecs. Date: 28.11.56

1956/57

Annual Runoff: 142 409 acre feet
Unit Runoff: 352 acreft. per sq. mile per year
Max. discharge: 5 530 cusecs. Date: 20. 4.57
Min. discharge 3.5 cusecs. Date: 20.11.57

1957/58

Annual Runoff: 74 350 acre feet
Unit Runoff: 184 acreft. per sq. mile per year
Max. discharge: 594 cusecs. Date: 1. 4.58
Min. discharge: 2.4 cusecs. Date: 9.11.58

1958/59

Annual Runoff: 87 870 acre feet
Unit Runoff: 218 acreft. per sq. mile per year
Max. discharge: 506 cusecs. Date: 6. 4.59
Min. discharge: 4.9 cusecs. Date: 24.11.59

REMARKS: ______

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st. Nov. - 31st. Oct.)

RIVER: Liosi (Lunwa) STATION: Old Great N.Road Igorusi No. 1KA16 CATCHMENT AREA: 30 SQ. MILES

Runoff in:

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st–10th												
	11th–20th												
	21st–the last												
	Whole month												
1955/56	1st-10th					2572	2539	2139	432	190	119	61	56
	11th-20th					1716	2364	1324	268	150	90	71	49
	21th–the last					1535	3036	867	225	132	99	74	53
	Whole month					5823	7939	4330	925	472	308	206	158
1956/57	1st-10th	37	44	147	4612	1876	2369	2342	435	220	90	71	42
	11th-20th	24	27	500	2735	665	10661	1246	302	146	79	45	45
	21st–the last	22	52	958	2646	1017	9589	930	235	117	65	40	54
	Whole month	83	123	1605	9993	3558	22639	4518	972	483	234	156	141
1957/58	1st–10th	45	63	354	231	1157	3760	1298	411	129	99	64	
	11st–20th	46	96	157	972	2549	1990	867	214	115	81	59	
	21st–the last	51	125	199	1165	5017	1326	760	164	127	76	45	
	Whole month	142	284	710	2368	8723	7076	2925	769	371	256	168	(150)
1958/59	1st–10th												
	11th–20th												
	21st–the last												
	Whole month												

Characteristic Data

1954/55
Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: ______ cusecs. Date: ______

1955/56
Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: 0.7 cusecs. Date: 27.11.56

1956/57
Annual Runoff: 44 505 acre feet
Unit Runoff: 1 484 acreft. per sq. mile per year
Max. discharge: Uncertain cusecs. Date: ______
Min. discharge 2.0 cusecs. Date: 5.11.57.

1957/58
Annual Runoff: 23 962 acra feet
Unit Runoff: 799 acreft. per sq. mile per year
Max. discharge: Uncertain cusecs. Date: ______
Min. discharge: ______ cusecs. Date: ______

1958/59
Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: ______ cusecs. Date: ______

REMARKS: No observations after 1/10/58. Readings transferred to gauge at New Road, No. 1KA.48, as 1KA.16 was not a good station. The records should be more reliable at the new site where it is assumed it will be possible to establish a more accurate discharge rating curve.

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st.Nov. - 31st. Oct.)

RIVER: Mambi STATION: Old Great N.Road Kalanzi No. 1KA17 CATCHMENT AREA: 32 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st-10th												
	11th-20th												
	21st-the last												
	Whole month												
1955/56	1st-10th							1832	610	304	188	136	118
	11th-20th							1292	370	237	159	149	110
	21th-the last						2426	942	381	212	144	138	118
	Whole month							4066	1361	753	491	423	346
1956/57	1st-10th	159	100	355	4869	2318	3325	2520	748	670	211	171	146
	11th-20th	82	83	327	3545	2046	6885	1477	667	420	195	144	123
	21st-the last	75	119	2513	2909	2250	7710	1145	646	263	211	152	132
	Whole month	316	302	3195	11323	6614	17920	5142	2061	1353	617	467	401
1957/58	1st-10th	108	104	598	193	517	3740	1736	533	279	230	143	
	11st-20th	96	152	184	701	2340	1699	1075	425	237	206	141	
	21st-the last	80	277	297	719	4818	1869	773	349	222	176	118	
	Whole month	284	533	1079	1613	7675	7308	3586	1307	738	614	402	(383)
1958/59	1st-10th												
	11th-20th												
	21st-the last												
	Whole month												

Characteristic Data

1954/55	Annual Runoff:		acre feet	
	Unit Runoff:		acreft. per sq. mile per year	
	Max. discharge:		cusecs. Date:	
	Min. discharge:		cusecs. Date:	
1955/56	Annual Runoff:		acre feet	
	Unit Runoff:		acreft. per sq. mile per year	
	Max. discharge:		cusecs. Date:	
	Min. discharge:	3.4	cusecs. Date:	30.11.56
1956/57	Annual Runoff:	49 711	acre feet	
	Unit Runoff:	1 553	acreft. per sq. mile per year	
	Max. discharge:	Uncertain	cusecs. Date:	
	Min. discharge	3.5	cusecs. Date:	1.12.57
1957/58	Annual Runoff:	25 522	acre feet	
	Unit Runoff:	798	acreft. per sq. mile per year	
	Max. discharge:	Uncertain	cusecs Date:	
	Min. discharge:		cusecs. Date:	
1958/59	Annual Runoff:		acre feet	
	Unit Runoff:		acreft. per sq. mile per year	
	Max. discharge:		cusecs. Date:	
	Min. discharge:		cusecs. Date:	

REMARKS: No observations after 1/10/58. Readings transferred to gauge at New Road No. 1KA.49 as 1KA.17 was not a good station. The records should be more reliable at the new site where it is assumed it will be possible to establish a more accurate discharge rating curve.

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st. Nov. - 31st. Oct.)

RIVER: Mswiswi STATION: Old Great N. Road Kalanzi No. 1KA18 CATCHMENT AREA: 36 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st–10th												
	11th–20th												
	21st–the last												
	Whole month												
1955/56	1st-10th						2725	2817	999	573	380	279	198
	11th-20th						2355	1812	781	506	346	254	180
	21th-the last					1387	2870	1331	636	504	340	228	185
	Whole month						7951	5960	2416	1583	1066	761	563
1956/57	1st–10th	227	214	412	3602	1365	(3305)	(2820)	901	500	335	265	166
	11th–20th	237	176	487	3455	1176	(10255)	(1660)	709	439	310	285	161
	21st–the last	131	209	1297	3215	1025	(10085)	1631	577	413	286	200	175
	Whole month	495	599	2196	10269	3566	(23645)	(6111)	2187	1352	931	750	502
1957/58	1st–10th	168	146	318	197	1414	9533	6889	966	279	223	216	
	11st–20th	164	333	182	498	3466	4305	2663	491	279	221	204	
	21st–the last	141	480	459	963	8594	3582	1465	324	285	242	224	
	Whole month	473	959	959	1658	13474	17420	11017	1781	843	686	644	(533)
1958/59	1st–10th												
	11th–20th												
	21st–the last												
	Whole month												

Characteristic Data

Year				
1954/55	Annual Runoff:		acre feet	
	Unit Runoff:		acreft. per sq. mile per year	
	Max. discharge:		cusecs.	Date:
	Min. discharge:		cusecs.	Date:
1955/56	Annual Runoff:		acre feet	
	Unit Runoff:		acreft. per sq. mile per year	
	Max. discharge:		cusecs.	Date:
	Min. discharge:	5.7	cusecs.	Date: 27.11.56
1956/57	Annual Runoff:	52 603	acre feet	
	Unit Runoff:	1 462	acreft. per sq. mile per year	
	Max. discharge:	Uncertain	cusecs.	Date:
	Min. discharge	6.3	cusecs.	Date: 4.12.57.
1957/58	Annual Runoff:	50 447	acre feet	
	Unit Runoff:	1 401	acreft. per sq. mile per year	
	Max. discharge:	Uncertain	cusecs.	Date:
	Min. discharge:		cusecs.	Date:
1958/59	Annual Runoff:		acre feet	
	Unit Runoff:		acreft. per sq. mile per year	
	Max. discharge:		cusecs.	Date:
	Min. discharge:		cusecs.	Date:

REMARKS: No observations after 1/10/58. Readings transferred to gauge at New Road 1KA.50 as 1KA.18 was not a good station.

The records should be more reliable at the new site where it is assumed it will be possible to establish a more accurate discharge rating curve.

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st. Nov. - 31st. Oct.)

RIVER: Mbarali STATION: Rujewa Farm No. IKA19 CATCHMENT AREA: 762 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st–10th												
	11th–20th												
	21st–the last												
	Whole month												
1955/56	1st-10th												
	11th-20th												
	21th–the last												
	Whole month												
1956/57	1st-10th						41624	17255	10538	7109	5490	4381	3262
	11th-20th						39337	13287	8654	6437	5138	4048	2891
	21st–the last						28677	13750	7830	6544	5284	3699	3009
	Whole month						109638	44292	27022	20090	15912	12128	9162
1957/58	1st–10th	2970	2878	16863	8661	17666	28301	12266	7115	5558	4548	3635	2883
	11st–20th	2690	4695	5521	19333	32488	15253	8922	6618	5183	4195	3368	2858
	21st–the last	2401	9342	11547	13683	67420	13420	8766	6032	5141	4343	3303	2586
	Whole month	8061	16915	33931	41677	117574	56974	29954	19765	15882	13086	10306	8327
1958/59	1st–10th	2384	2493	3729	9680	26176	45615	10952	6655	5436	4372	3454	3080
	11th–20th	2307	4151	24947	10425	25668	16966	8839	6138	4965	4192	3151	2814
	21st–the last	2846	12872	8444	14515	55350	13519	8236	5883	5049	4154	3133	3454
	Whole month	7537	19516	37120	34620	107194	76100	28027	18676	15450	12718	9738	9348

Characteristic Data

1954/55
Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: ______ cusecs. Date: ______

1955/56
Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: ______ cusecs. Date: ______

1956/57
Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge 107 cusecs. Date: 3.12.57.

1957/58
Annual Runoff: 372 452 acre feet
Unit Runoff: 489 acreft. per sq. mile per year
Max. discharge: Est. 8 000 cusecs. Date: 18. 3.58.
Min. discharge: 92 cusecs. Date: 14.11.58.

1958/59
Annual Runoff: 376 044 acre feet
Unit Runoff: 493 acreft. per sq. mile per year
Max. discharge: Est.44 000 cusecs. Date: 27. 3.59.
Min. discharge: 127 cusecs. Date: 17.10.59.

REMARKS: The control section for the Rujewa Farm gauge is sandy and changeable, and as a result no permanent discharge rating curve can be established. The current meter measurements taken at Rujewa have therefore been related to water levels at Igawa, 15 miles upstream, and the run-off at Rujewa computed accordingly.

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st. Nov. - 31st. Oct.)

RIVER: Little Ruaha STATION: Tosamaganga No. IKA.20 CATCHMENT AREA: 1273 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st–10th												
	11th–20th												
	21st–the last												
	Whole month												
1955/56	1st-10th		2110	10276	32066	29843	44613	24918	14921	10571	7915	5666	4198
	11th-20th		3926	19851	29050	28449	27302	21235	13281	9207	7599	4819	3304
	21th–the last		8526	36127	38781	33391	24307	20738	11852	6867	7334	4277	4663
	Whole month	(7600)	14561	66254	99897	91683	96222	66891	40054	26645	22849	14762	12165
1956/57	1st–10th	3738	5140	10310	29730	16306	34841	30106	18693	12124	9826	6941	4890
	11th–20th	3680	5038	16232	24413	15155	55647	28598	15562	11205	9091	5548	4028
	21st–the last	3256	8308	19804	16091	23852	53507	26170	13296	11412	8642	4950	4135
	Whole month	10674	18486	46346	70234	55313	143995	84874	47551	34741	27559	17439	13053
1957/58	1st–10th	3150	2495	9953	7935	17352	42276	21745	13552	10638	8358	6790	4830
	11st–20th	2766	3155	9152	16196	21440	27353	15283	12159	10074	7800	6374	4602
	21st–the last	2670	9320	9321	15740	59596	35169	13737	11242	9872	8167	5545	4010
	Whole month	8586	14970	28426	39871	98388	104798	50765	36953	30584	24325	16709	13442
1958/59	1st–10th	3006	2794	7764	15504	16312	30302	15104	10702	9030	7210	6020	4608
	11th–20th	2635	4472	9835	13510	19767	25723	12790	9640	8233	6493	5249	4260
	21st–the last	2320	10745	12802	9852	21927	15167	12420	8827	8167	6622	4260	4338
	Whole month	7961	18011	30401	38866	58006	71192	40314	29169	25430	20325	15529	13206

Characteristic Data

1954/55

Annual Runoff: acre feet

Unit Runoff: acreft. per sq. mile per year

Max. discharge: cusecs. Date:

Min. discharge: 73 cusecs. Date: 13.12.55.

1955/56

Annual Runoff: 561583 acre feet

Unit Runoff: 441 acreft. per sq. mile per year

Max. discharge: 3500 cusecs. Date: 6. 4. 56.

Min. discharge: 159 cusecs. Date: 1.12. 56.

1956/57

Annual Runoff: 570265 acre feet

Unit Runoff: 448 acreft. per sq. mile per year

Max. discharge: 5500 cusecs. Date: 19. 4. 57.

Min. discharge: 117 cusecs. Date: 15.12. 57.

1957/58

Annual Runoff: 475737 acre feet

Unit Runoff: 374 acreft. per sq. mile per year

Max. discharge: 3400 cusecs. Date: 3. 4. 58.

Min. discharge: 117 cusecs. Date: 6.12. 58.

1958/59

Annual Runoff: 368430 acre feet

Unit Runoff: 289 acreft. per sq. mile per year

Max. discharge: 1900 cusecs. Date: 8. 4. 59.

Min. discharge: 158 cusecs. Date: 25.11.59.

REMARKS:

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st. Nov. - 31st. Oct.)

RIVER: Little Ruaha STATION: Inimbu No. IKA21 CATCHMENT AREA: 957 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st-10th												
	11th-20th												
	21st-the last												
	Whole month												
1955/56	1st-10th												
	11th-20th												
	21th-the last												
	Whole month												
1956/57	1st-10th							24832	15645	11384	9493	7241	5095
	11th-20th						36376	21173	13682	10729	8757	6399	4497
	21st-the last						35216	19773	12351	11330	8860	6096	4270
	Whole month							65778	41678	33443	27110	19736	13862
1957/58	1st-10th	3666	2939	10669	8422	15461	40168	20259	12628	10130	8066	6288	4387
	11st-20th	3346	4544	9424	17067	23541	22823	15868	11722	9498	7715	5615	4069
	21st-the last	3106	9159	9727	14037	50250	23111	15257	10699	9412	7748	4984	3844
	Whole month	10118	16642	29820	39526	89252	86102	51384	35049	29040	23529	16887	12300
1958/59	1st-10th	3182	3143	7561	14117	18349	30128	13451	8504	7611	5931	4638	3606
	11th-20th	2978	5331	9996	10027	16520	19102	11532	7934	6912	5476	3963	3270
	21st-the last	2994	9893	12180	10466	21970	15747	10683	7526	6929	5993	3701	3245
	Whole month	9154	18367	29737	34610	56839	64977	35666	23964	21452	17400	12302	10121

Characteristic Data

Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: ______ cusecs. Date: ______

Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: ______ cusecs. Date: ______

Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge 145 cusecs. Date: 10.12.57.

Annual Runoff: 439 649 acre feet
Unit Runoff: 459 acreft. per sq. mile per year
Max. discharge: 3 000 cusecs. Date: 26. 3. 58.
Min. discharge: 145 cusecs. Date: 17.11. 58.

Annual Runoff: 334 589 acre feet
Unit Runoff: 350 acreft. per sq. mile per year
Max. discharge: 4 000 cusecs. Date: 4. 4. 59.
Min. discharge: 132 cusecs. Date: 23.11. 59.

REMARKS: ______

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st.Nov. - 31st. Oct.)

RIVER: Mtitu STATION: Mtitu No. IKA.22 CATCHMENT AREA: 172 SQ. MILES

Runoff in:

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st–10th												
	11th–20th												
	21st–the last												
	Whole month												
1955/56	1st–10th												
	11th–20th												
	21th–the last												
	Whole month												
1956/57	1st–10th								2598	2092	2062	1740	1401
	11th–20th								2347	2097	1906	1519	1346
	21st–the last								2236	2420	2018	1717	1344
	Whole month								7181	6609	6006	4976	4091
1957/58	1st–10th	1294	1015	2845	1890	3758	7637	4362	2508	2133	1860	1643	1317
	11st–20th	1140	1989	1535	4353	4100	3232	2660	2363	2021	1876	1490	1269
	21st–the last	1069	2837	1986	2723	9027	5724	2780	2099	2046	2006	1440	1208
	Whole month	3505	5841	6375	8966	16885	16593	9802	6970	6200	5742	4573	3794
1958/59	1st–10th	1053	1116	1815	3308	3946	3557	2702	1552	1764	1508	1201	1196
	11th–20th	990	1778	2746	2578	3334	2719	2121	1549	1469	1366	1098	1044
	21st–the last	1048	2931	2705	2909	4599	3166	1896	1565	1558	1725	1115	1040
	Whole month	3091	5825	7266	8795	11879	9442	6719	4666	4791	4599	3414	3280

Characteristic Data

1954/55

Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: ______ cusecs. Date: ______

1955/56

Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: ______ cusecs. Date: ______

1956/57

Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge ______ cusecs. Date: ______

1957/58

Annual Runoff: 95244 acra feet
Unit Runoff: 544 acreft. per sq. mile per year
Max. discharge: 900 cusecs. Date: 1. 4. 58.
Min. discharge: 50 cusecs. Date: 11.12. 58.

1958/59

Annual Runoff: 73767 acre feet
Unit Runoff: 429 acreft. per sq. mile per year
Max. discharge: 300 cusecs. Date: 2. 4.59.
Min. discharge: 40 cusecs. Date: 23.11.59.

REMARKS:

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st. Nov. - 31st. Oct.)

RIVER: Hukuni STATION: Iyayi No. 1KA23 CATCHMENT AREA: 118 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st-10th												
	11th-20th												
	21st-the last												
	Whole month												
1955/56	1st-10th										98	51	18
	11th-20th										83	31	0
	21th-the last										73	17	0
	Whole month										254	99	18
1956/57	1st-10th	0	69	34	1469	587	1067	582	310	205	129	77	21
	11th-20th	0	3	111	839	749	1568	461	252	171	115	44	21
	21st-the last	0	63	662	573	847	689	418	232	155	130	29	48
	Whole month	0	135	807	2881	2183	3324	1461	794	531	374	150	90
1957/58	1st-10th	0	0	1178	1912	3427	2179	1288	468	288	168	73	59
	11st-20th	0	79	195	3180	4065	1459	825	421	227	143	55	54
	21st-the last	0	287	1737	848	7371	1665	741	318	226	124	54	41
	Whole month	0	366	3110	5940	14863	5303	2854	1207	741	435	182	154
1958/59	1st-10th	47	0	75	135	1048	2953	589	251	168	138	65	47
	11th-20th	18	51	189	268	1160	910	431	230	155	102	61	48
	21st-the last	0	627	73	1149	5769	706	336	214	153	75	52	46
	Whole month	65	678	337	1552	7977	4569	1356	695	476	315	178	141

Characteristic Data

1954/55:

Annual Runoff: acre feet
Unit Runoff: acreft. per sq. mile per year
Max. discharge: cusecs. Date:
Min. discharge: cusecs. Date:

1955/56:

Annual Runoff: acre feet
Unit Runoff: acreft. per sq. mile per year
Max. discharge: cusecs. Date:
Min. discharge: 0 cusecs. Date: 11.56.

1956/57:

Annual Runoff: 12 730 acre feet
Unit Runoff: 108 acreft. per sq. mile per year
Max. discharge: 240 cusecs. Date: 17. 4.57.
Min. discharge 0 cusecs. Date: 17.12.57.

1957/58:

Annual Runoff: 35 155 acre feet
Unit Runoff: 298 acreft. per sq. mile per year
Max. discharge: 860 cusecs. Date: 22. 3.58.
Min. discharge: 0 cusecs. Date: 15.12.58.

1958/59:

Annual Runoff: 18 339 acre feet
Unit Runoff: 155 acreft. per sq. mile per year
Max. discharge: 1 900 cusecs. Date: 27. 3.59.
Min. discharge: 0.9 cusecs. Date: 22.11.59.

REMARKS:

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st. Nov. - 31st. Oct.)

RIVER: Great Ruaha STATION: Kisilwa Magenzipile No. IKA.26 CATCHMENT AREA: 13344 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st–10th												
	11th–20th												
	21st–the last												
	Whole month												
1955/56	1st–10th												
	11th–20th												
	21th–the last												
	Whole month												
1956/57	1st–10th		2063	6663	97432	193537	107939	146734	89345	39822	19996	11623	7161
	11th–20th		2405	14050	112459	162202	126017	154624	68121	31412	16304	9720	6113
	21st–the last	1309	5145	23987	132462	149732	163484	144910	51930	27350	15336	8060	5092
	Whole month	(5000)	9613	44700	342353	505471	397440	446268	209396	98584	51636	29403	18366
1957/58	1st–10th	3390	2580	9983	19363	53405	195660	149154	73258	34111	15555	9816	6216
	11st–20th	3479	2885	10616	56621	67782	195328	106592	58310	26332	12778	8759	5427
	21st–the last	2891	7694	15946	56412	179769	181535	100769	43023	27424	11201	7455	4891
	Whole month	10260	13159	36545	132396	300956	572523	356515	174591	87867	39534	26030	16534
1958/59	1st–10th	3651	2530	10843	26093	60596	147339	125092	51921	23890	12371	7402	4525
	11th–20th	3086	3648	39606	38949	93067	159140	94266	39001	19011	10194	6258	4119
	21st–the last	2606	22861	23395	33675	159520	157915	78318	31141	17075	9296	5192	3668
	Whole month	9343	29039	73844	98717	313183	463394	297676	122063	59976	31861	18852	12312

Characteristic Data

1954/55
Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: ______ cusecs. Date: ______

1955/56
Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: 111 cusecs. Date: 28.11.56.

1956/57
Annual Runoff: 2158712 acre feet
Unit Runoff: 156 acreft. per sq. mile per year
Max. discharge: 10289 cusecs. Date: 7. 3.57.
Min. discharge 120 cusecs. Date: 16.12.57.

1957/58
Annual Runoff: 1769542 acre feet
Unit Runoff: 128 acreft. per sq. mile per year
Max. discharge: 9552 cusecs. Date: 22. 4.58.
Min. discharge: 126 cusecs. Date: 11.11.58.

1958/59
Annual Runoff: 1528002 acre feet
Unit Runoff: 110 acreft. per sq. mile per year
Max. discharge: 10000 cusecs. Date: 1. 4.59.
Min. discharge: ______ cusecs. Date: ______

REMARKS: ______

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY. HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st. Nov. - 31st. Oct.)

RIVER: Great Ruaha STATION: Mkopule (Hausmann's Bridge) No. 1KA27 CATCHMENT AREA: 7700 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st–10th												
	11th–20th												
	21st–the last												
	Whole month												
1955/56	1st-10th												
	11th-20th												
	21th–the last												
	Whole month												
1956/57	1st–10th		1861	3448	25899	189839	84606	121556	68920	27022	12918	6381	4829
	11th–20th		2195	4175	141609	159227	90661	118769	47186	20935	10001	5748	4340
	21st–the last		2770	7339	166980	106079	108060	105361	35591	17905	8630	5348	4114
	Whole month	(6550)	6826	14962	334488	455145	283327	345706	151697	65862	31549	17477	13283
1957/58	1st–10th	3198	2260	4687	15407	39823	175329	104093	41371	16378	8793	5559	3956
	11st–20th	2810	2647	6050	20373	50832	208383	81183	30969	15018	7037	5062	3541
	21st–the last	2492	3990	12068	22938	97218	162927	65460	23826	12625	6737	4458	3327
	Whole month	8500	8897	22805	58718	187873	546639	250736	96166	46021	22567	15079	10824
1958/59	1st–10th	2572	1998	5234	21452	43191	119223	101779	40485	18448	7346	4542	2854
	11th–20th	2108	2763	6790	28350	61814	121744	79701	30667	14267	5968	3969	2355
	21st–the last	1883	5040	12508	25694	130959	124581	64218	23752	11531	5752	3433	2096
	Whole month	6563	9801	24532	75496	235964	365548	245698	94904	44246	19066	11944	7305

Characteristic Data

1954/55
Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: ______ cusecs. Date: ______

1955/56
Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: ______ cusecs. Date: ______

1956/57
Annual Runoff: 1 726 822 acre feet
Unit Runoff: 244 acreft. per sq. mile per year
Max. discharge: 10 900 cusecs. Date: 21. 2.57.
Min. discharge 108 cusecs. Date: 11.12.57.

1957/58
Annual Runoff: 1 274 825 acre feet
Unit Runoff: 166 acreft. per sq. mile per year
Max. discharge: 10 900 cusecs. Date: 11. 4.58.
Min. discharge: 90 cusecs. Date: 3.12.58.

1958/59
Annual Runoff: 1 141 067 acre feet
Unit Runoff: 148 acreft. per sq. mile per year
Max. discharge: 9 000 cusecs. Date: 1. 4.59.
Min. discharge: ______ cusecs. Date: ______

REMARKS: ______

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st. Nov. - 31st. Oct.)

RIVER: Njombe STATION: Ifumba No. 1KA.29 CATCHMENT AREA: 5438 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st–10th												
	11th–20th												
	21st–the last												
	Whole month												
1955/56	1st·10th												
	11th–20th												
	21th–the last												
	Whole month												
1956/57	1st–10th												
	11th–20th												
	21st–the last												
	Whole month												
1957/58	1st–10th	0	0	15310	2510	9815	15752	13252	60	0	0	0	0
	11st–20th	0	0	1540	29966	8661	2370	1199	13	0	0	0	0
	21st–the last	0	0	7430	36380	53304	910	299	0	0	0	0	0
	Whole month	0	0	24280	68856	71780	19032	14750	73	0	0	0	0
1958/59	1st–10th	0	0	2053	613	42564	17782	395	1	0	0	0	0
	11th–20th	0	234	6557	2444	14442	1770	132	0	0	0	0	0
	21st–the last	0	25263	1179	3777	74062	760	30	0	0	0	0	0
	Whole month	0	25597	9789	6834	133068	20312	557	1	0	0	0	0

Characteristic Data

1954/55
Annual Runoff: ________ acre feet
Unit Runoff: ________ acreft. per sq. mile per year
Max. discharge: ________ cusecs. Date: ________
Min. discharge: ________ cusecs. Date: ________

1955/56
Annual Runoff: ________ acre feet
Unit Runoff: ________ acreft. per sq. mile per year
Max. discharge: ________ cusecs. Date: ________
Min. discharge: ________ cusecs. Date: ________

1956/57
Annual Runoff: ________ acre feet
Unit Runoff: ________ acreft. per sq. mile per year
Max. discharge: ________ cusecs. Date: ________
Min. discharge ________ cusecs. Date: ________

1957/58
Annual Runoff: 198 771 acre feet
Unit Runoff: 36.6 acreft. per sq. mile per year
Max. discharge: 6950 cusecs. Date: 22. 3.58.
Min. discharge: 0 cusecs. Date: ________

1958/59
Annual Runoff: 196 158 acre feet
Unit Runoff: 36.1 acreft. per sq. mile per year
Max. discharge: 10 400 cusecs. Date: 30. 3.59.
Min. discharge: 0 cusecs. Date: ________

REMARKS: ________

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st. Nov. - 31st. Oct.)

RIVER: Little Ruaha STATION: Mawande No. IKA.31 CATCHMENT AREA: 2005 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st–10th												
	11th–20th												
	21st–the last												
	Whole month												
1955/56	1st-10th												
	11th-20th												
	21th–the last												
	Whole month												
1956/57	1st–10th	(6123)	7058	11454	39785	17277	30500	31579	16797	11932	10286	7894	6000
	11th–20th	(5419)	7396	15045	26632	15422	57428	26636	15241	11010	9433	7296	5127
	21st–the last	4763	10664	17938	18239	21864	49989	21892	13483	11781	9507	6620	4912
	Whole month	(16305)	25118	44437	84656	54563	137917	80107	45521	34723	29226	21812	16039
1957/58	1st–10th	4010	2906	10715	8825	17666	48222	26752	14322	10831	7721	6203	4084
	11st–20th	3485	4140	9746	17430	17683	29751	18802	13177	9719	7327	5378	3755
	21st–the last	3152	9424	10356	14282	66023	27052	17550	11863	9304	7583	4306	3496
	Whole month	10647	16470	30817	40537	101572	105025	63104	39362	29854	22631	16357	11337
1958/59	1st–10th	2707	2813	7446	14286	15765	30451	14596	8586	7338	5617	4300	3188
	11th–20th	2452	4353	9527	12885	17765	24121	11733	8031	6872	5295	3918	3065
	21st–the last	2472	9279	14918	10231	25787	15436-	11002	7436	6634	5099	3455	2648
	Whole month	7631	16445	31891	37402	59317	70008	37331	24053	20844	16011	11673	8901

Characteristic Data

1954/55

Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: ______ cusecs. Date: ______

1955/56

Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: 227 cusecs. Date: 30.11.56.

1956/57

Annual Runoff: 590424 acre feet
Unit Runoff: 294 acreft. per sq. mile per year
Max. discharge: 5800 cusecs. Date: 19. 4. 57.
Min. discharge 136 cusecs. Date: 12.12. 57.

1957/58

Annual Runoff: 487743 acre feet
Unit Runoff: 243 acreft. per sq. mile per year
Max. discharge: 5600 cusecs. Date: 26. 3. 58.
Min. discharge: 116 cusecs. Date: 24.11. 58.

1958/59

Annual Runoff: 341507 acre feet
Unit Runoff: 170 acreft. per sq. mile per year
Max. discharge: 2000 cusecs. Date: 30. 3. 59.
Min. discharge: 79 cusecs. Date: 26.11. 59.

REMARKS: Runoff adjusted by Stout Method from November 24th, 1958.

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st. Nov. - 31st. Oct.)

RIVER: Little Ruaha STATION: S.H.Club No. IKA.32 CATCHMENT AREA: 293 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st-10th												
	11th-20th												
	21st-the last												
	Whole month												
1955/56	1st-10th												
	11th-20th												
	21th-the last												
	Whole month												
1956/57	1st-10th									4325	3406	2393	1483
	11th-20th									3963	3064	2121	1196
	21st-the last									4066	3006	1777	1066
	Whole month									12354	9476	6291	3745
1957/58	1st-10th	793	550	3769	3014	4804	10762	7047	4415	3456	2493	1737	992
	11st-20th	667	893	3899	5902	8429	7979	5588	4149	3228	2322	1446	866
	21st-the last	553	3312	2837	3774	12397	7561	5360	3735	3054	2272	1205	760
	Whole month	2013	4755	10505	12690	25630	26302	17995	12299	9738	7087	4388	2618
1958/59	1st-10th	522	495	2241	2900	4558	8208	4065	2361	1961	1450	1070	587
	11th-20th	441	920	2465	3045	4864	5556	3355	2175	1871	1335	873	505
	21st-the last	477	2394	2499	2782	7326	4382	3139	2078	1760	1363	713	466
	Whole month	1440	3809	7205	8727	16748	18146	10559	6634	5592	4146	2656	1558

Characteristic Data

1954/55

Annual Runoff: ______ acre feet

Unit Runoff: ______ acreft. per sq. mile per year

Max. discharge: ______ cusecs. Date: ______

Min. discharge: ______ cusecs. Date: ______

1955/56

Annual Runoff: ______ acre feet

Unit Runoff: ______ acreft. per sq. mile per year

Max. discharge: ______ cusecs. Date: ______

Min. discharge: ______ cusecs. Date: ______

1956/57

Annual Runoff: ______ acre feet

Unit Runoff: ______ acreft. per sq. mile per year

Max. discharge: ______ cusecs. Date: ______

Min. discharge 23 cusecs. Date: 1. 12. 57.

1957/58

Annual Runoff: 136020 acre feet

Unit Runoff: 464 acreft. per sq. mile per year

Max. discharge: 650 cusecs. Date: 21. 3. 58.

Min. discharge: 21 cusecs. Date: 5.12. 58.

1958/59

Annual Runoff: 87222 acre feet

Unit Runoff: 298 acreft. per sq. mile per year

Max. discharge: 500 cusecs. Date: 7. 4. 59.

Min. discharge: 13 cusecs. Date: 23.11. 59.

REMARKS: ______

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st.Nov. - 31st. Oct.)

RIVER: Ndembora STATION: Madibira Mission No. IKA.33 CATCHMENT AREA: 707 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st–10th												
	11th–20th												
	21st–the last												
	Whole month												
1955/56	1st-10th												
	11th-20th												
	21th–the last												
	Whole month												
1956/57	1st-10th		599	5267	16876	6874	13869	6114	3470	1073	556	416	657
	11th-20th		611	5535	8477	6742	32576	4373	1965	696	463	442	517
	21st–the last		1879	7808	3627	7270	19691	3407	1588	640	438	431	444
	Whole month	(1100)	3089	18610	28980	20886	66136	13894	5923	2409	1457	1289	1618
1957/58	1st-10th	360	374	7231	6480	6887	28950	7084	2520	1080	946	513	374
	11st-20th	332	743	3710	15033	16469	16438	3653	1775	1165	760	464	355
	21st- the last	340	1755	3824	7550	33305	9114	1394	1277	1256	624	393	360
	Whole month	1032	2872	14765	29063	56661	54502	12131	5572	3501	2330	1370	1089
1958/59	1st–10th	334	850	5051	11339	8704	20433	6626	2420	1210	634	481	290
	11th–20th	380	978	6131	9488	9049	16729	4223	1947	990	530	426	290
	21st–the last	687	5627	13694	5784	28943	9364	3351	1605	930	583	330	319
	Whole month	1401	7455	24876	27611	46526	46526	14200	5972	3130	1747	1237	899

Characteristic Data

1954/55
Annual Runoff: ________ acre feet
Unit Runoff: ________ acreft. per sq. mile per year
Max. discharge: ________ cusecs. Date: ________
Min. discharge: ________ cusecs. Date: ________

1955/56
Annual Runoff: ________ acre feet
Unit Runoff: ________ acreft. per sq. mile per year
Max. discharge: ________ cusecs. Date: ________
Min. discharge: ________ cusecs. Date: ________

1956/57
Annual Runoff: 165446 acre feet
Unit Runoff: 234 acreft. per sq. mile per year
Max. discharge: 3600 cusecs. Date: 17. 4.57.
Min. discharge 14.6 cusecs. Date: 12.12.56.

1957/58
Annual Runoff: 189198 acre feet
Unit Runoff: 268 acreft. per sq. mile per year
Max. discharge: 3400 cusecs. Date: 23. 3.58.
Min. discharge: 15.7 cusecs. Date: 12.12.57.

1958/59
Annual Runoff: 181750 acre feet
Unit Runoff: 257 acreft. per sq. mile per year
Max. discharge: 1700 cusecs. Date: 24. 3.59.
Min. discharge: 14.6 cusecs. Date: 20.11.59.

REMARKS: ________

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st. Nov. - 31st. Oct.)

RIVER: Halali STATION: Majojolo No. IKA36 CATCHMENT AREA: 1014 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st-10th												
	11th-20th												
	21st-the last												
	Whole month												
1955/56	1st-10th												
	11th-20th												
	21th-the last												
	Whole month												
1956/57	1st-10th												
	11th-20th												
	21st-the last												
	Whole month												
1957/58	1st-10th												
	11st-20th												
	21st-the last												
	Whole month												
1958/59	1st-10th	0	230	2559	4954	15952	40077	4903	1955	992	542	321	195
	11th-20th	0	528	3791	4245	12140	10207	3608	1523	835	485	245	117
	21st-the last	0	3481	3463	9355	46879	6299	2864	1278	690	456	185	80
	Whole month	0	4239	9813	18554	74971	56583	11375	4761	2517	1483	751	392

Characteristic Data

1954/55:

Annual Runoff: ______ acre feet

Unit Runoff: ______ acreft. per sq. mile per year

Max. discharge: ______ cusecs. Date: ______

Min. discharge: ______ cusecs. Date: ______

1955/56:

Annual Runoff: ______ acre feet

Unit Runoff: ______ acreft. per sq. mile per year

Max. discharge: ______ cusecs. Date: ______

Min. discharge: ______ cusecs. Date: ______

1956/57:

Annual Runoff: ______ acre feet

Unit Runoff: ______ acreft. per sq. mile per year

Max. discharge: ______ cusecs. Date: ______

Min. discharge ______ cusecs. Date: ______

1957/58:

Annual Runoff: ______ acre feet

Unit Runoff: ______ acreft. per sq. mile per year

Max. discharge: ______ cusecs. Date: ______

Min. discharge: ______ cusecs. Date: ______

1958/59:

Annual Runoff: 185 439 acre feet

Unit Runoff: 183 acreft. per sq. mile per year

Max. discharge: 7 800 cusecs. Date: 27. 3. 59.

Min. discharge: 2 cusecs. Date: 25.11. 59.

REMARKS: River dry November and first 5 days in December 1958.

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st. Nov. - 31st. Oct.)

RIVER: Lukosi STATION: Mtandika No. IKA.37 CATCHMENT AREA: 1117 SQ. MILES

Runoff In: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st–10th												
	11th–20th												
	21st–the last												
	Whole month												
1955/56	1st-10th												
	11th-20th												
	21th–the last												
	Whole month												
1956/57	1st–10th							27816	14995	10846	11177	8536	7966
	11th-20th							22505	12799	10566	9565	8110	7653
	21st–the last						27063	19635	12018	11785	9818	9398	8272
	Whole month							69956	39812	33197	30560	26044	23891
1957/58	1st–10th	7571	6793	10823	9639	10444	43775	30249	14582	11411	10178	9367	8490
	11st–20th	7132	9298	7103	18240	14892	14461	17712	12664	10651	9943	9166	8323
	21st–the last	7022	10372	8407	9557	41528	40899	17204	11539	11293	10999	8904	8684
	Whole month	21725	26463	26333	37436	66864	99155	65165	38805	33555	31120	27437	25497
1958/59	1st–10th	7806	8238	8992	(10000)	15140	10562	13644	8417	8624	7462	6906	6657
	11th–20th	7649	10212	10373	(12500)	11325	13997	12130	8096	7594	7137	6685	6554
	21st–the last	7863	16747	10378	10212	16172	17299	10163	7591	8160	8146	6702	7057
	Whole month	23338	35197	29743	32712	42637	41858	35937	24504	24378	22745	20293	20268

Characteristic Data

1954/55

Annual Runoff: ______ acre feet

Unit Runoff: ______ acreft. per sq. mile per year

Max. discharge: ______ cusecs. Date: ______

Min. discharge: ______ cusecs. Date: ______

1955/56

Annual Runoff: ______ acre feet

Unit Runoff: ______ acreft. per sq. mile per year

Max. discharge: ______ cusecs. Date: ______

Min. discharge: ______ cusecs. Date: ______

1956/57

Annual Runoff: ______ acre feet

Unit Runoff: ______ acreft. per sq. mile per year

Max. discharge: ______ cusecs. Date: ______

Min. discharge 337 cusecs. Date: 10.12.57.

1957/58

Annual Runoff: 499 555 acre feet

Unit Runoff: 447 acreft. per sq. mile per year

Max. discharge: 8 800 cusecs. Date: 2. 4.58.

Min. discharge: 370 cusecs. Date: 15.11.58.

1958/59

Annual Runoff: 353 610 acre feet

Unit Runoff: 317 acreft. per sq. mile per year

Max. discharge: 1 600 cusecs. Date: 29. 4.59.

Min. discharge: 310 cusecs. Date: 21.11.59.

REMARKS: This station replaces Lukosi at Mbuyuni, IKA.14, where the water level readings were influenced from Great Ruaha.

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st. Nov. - 31st. Oct.)

RIVER: Yovi STATION: Gt. Ruaha Confl. No. IKA38 CATCHMENT AREA: 243 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st–10th												
	11th–20th												
	21st–the last												
	Whole month												
1955/56	1st-10th												
	11th-20th												
	21th–the last												
	Whole month												
1956/57	1st-10th												
	11th-20th												
	21st–the last												
	Whole month												
1957/58	1st–10th								4081	2776	2055	1734	1450
	11st–20th								3279	2572	2010	1636	1424
	21st–the last							5227	2946	2549	2145	1502	1332
	Whole month								10306	7897	6210	4872	4206
1958/59	1st–10th	1287	1236	1407	1883	2708	2059	2571	1412	1207	960	760	594
	11th–20th	1200	1338	1610	1881	2010	3222	2188	1280	1200	865	660	650
	21st–the last	1160	1944	1465	1429	3352	2570	1749	1212	1152	990	610	871
	Whole month	3647	4518	4482	5193	8070	7851	6508	3904	3559	2815	2030	2115

Characteristic Data

1954/55

Annual Runoff: ______ acre feet

Unit Runoff: ______ acreft. per sq. mile per year

Max. discharge: ______ cusecs. Date: ______

Min. discharge: ______ cusecs. Date: ______

1955/56

Annual Runoff: ______ acre feet

Unit Runoff: ______ acreft. per sq. mile per year

Max. discharge: ______ cusecs. Date: ______

Min. discharge: ______ cusecs. Date: ______

1956/57

Annual Runoff: ______ acre feet

Unit Runoff: ______ acreft. per sq. mile per year

Max. discharge: ______ cusecs. Date: ______

Min. discharge ______ cusecs. Date: ______

1957/58

Annual Runoff: ______ acre feet

Unit Runoff: ______ acreft. per sq. mile per year

Max. discharge: ______ cusecs. Date: ______

Min. discharge: 48 cusecs. Date: 12.12.58

1958/59

Annual Runoff: 54 692 acre feet

Unit Runoff: 225 acreft. per sq. mile per year

Max. discharge: 500 cusecs. Date: 15. 4.59

Min. discharge: 24 cusecs. Date: 24.11.59

REMARKS: In April 1958 there was a high flood on the Yovi. This damaged bridge crossings and also the newly established staff gauge.

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st. Nov. - 31st. Oct.)

RIVER: Little Ruaha **STATION:** Iwawa **No.** IKA.39 **CATCHMENT AREA:** 645 **SQ. MILES**

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st–10th												
	11th–20th												
	21st–the last												
	Whole month												
1955/56	1st 10th												
	11th–20th												
	21th–the last												
	Whole month												
1956/57	1st–10th							20735	12302	7980	6103	4202	2988
	11th–20th						30473	17494	10314	7316	5444	3784	2670
	21st–the last						30616	16101	8951	7432	5231	3340	2550
	Whole month							54330	31567	22728	16778	11326	8208
1957/58	1st–10th	2080	1567	6619	5873	9464	28602	14658	8903	7202	5512	4203	2632
	11st–20th	1744	2218	6941	11045	20167	19417	11669	8283	6681	5176	3623	2310
	21st–the last	1653	5512	6707	10651	34731	16727	10900	7665	6624	5234	3073	2028
	Whole month	5477	9297	20267	27569	64362	64746	37227	24851	20507	15922	10899	6970
1958/59	1st–10th	1530	1317	5354	8065	11227	27059	9158	6239	5125	3982	2963	2085
	11th–20th	1312	3081	6479	5990	10222	15693	8141	5686	4990	3600	2524	1744
	21st–the last	1354	5607	7920	6138	16538	10845	7756	5311	4879	3670	2202	1539
	Whole month	4196	10005	19753	20193	37987	53597	25055	17236	14994	11252	7689	5368

Characteristic Data

1954/55
Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: ______ cusecs. Date: ______

1955/56
Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: ______ cusecs. Date: ______

1956/57
Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: 2400 cusecs. Date: 20. 4.57.
Min. discharge 71 cusecs. Date: 14.12.58.

1957/58
Annual Runoff: 308094 acre feet
Unit Runoff: 478 acreft. per sq. mile per year
Max. discharge: 2100 cusecs. Date: 26. 3.58.
Min. discharge: 61 cusecs. Date: 6.12.58.

1958/59
Annual Runoff: 227325 acre feet
Unit Runoff: 352 acreft. per sq. mile per year
Max. discharge: 1700 cusecs. Date: 5. 4.59.
Min. discharge: 51 cusecs. Date: 23.11.59.

REMARKS: ______

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st. Nov. - 31st. Oct.)

RIVER: Kisigo STATION: Ilangali No. IKA.41 CATCHMENT AREA: 3413 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st–10th												
	11th–20th												
	21st–the last												
	Whole month												
1955/56	1st–10th												
	11th–20th												
	21th–the last												
	Whole month												
1956/57	1st–10th												
	11th–20th												
	21st–the last												
	Whole month												
1957/58	1st–10th	0	0	361	218	5589	3634	149	0	0	0	0	0
	11st–20th	0	0	0	9625	1251	524	0	0	0	0	0	0
	21st–the last	0	9552	5016	12880	47666	28	0	0	0	0	0	0
	Whole month	0	9552	5377	22723	54506	9186	149	0	0	0	0	0
1958/59	1st–10th	0	0	1632	8	15316	3210	10	0	0	0	0	0
	11th–20th	0	4966	3407	86	2751	56	0	0	0	0	0	0
	21st–the last	0	29422	1631	4890	15883	2110	0	0	0	0	0	0
	Whole month	0	34388	6670	4984	33950	5376	10	0	0	0	0	0

Characteristic Data

1954/55
Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: ______ cusecs. Date: ______

1955/56
Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: ______ cusecs. Date: ______

1956/57
Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge ______ cusecs. Date: ______

1957/58
Annual Runoff: 101 493 acre feet
Unit Runoff: 29.7 acreft. per sq. mile per year
Max. discharge: 2868 cusecs. Date: 29. 3.58.
Min. discharge: 0 cusecs. Date: ______

1958/59
Annual Runoff: 85 378 acre feet
Unit Runoff: 25.0 acreft. per sq. mile per year
Max. discharge: 2822 cusecs. Date: 26.12.58.
Min. discharge: 0 cusecs. Date: ______

REMARKS: ______

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st. Nov. - 31st. Oct.)

RIVER: Kisigo STATION: Kinunguru No. IKA.42 CATCHMENT AREA: 9476 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st–10th												
	11th–20th												
	21st–the last												
	Whole month												
1955/56	1st-10th												
	11th-20th												
	21th–the last												
	Whole month												
1956/57	1st–10th												
	11th–20th												
	21st–the last												
	Whole month												
1957/58	1st–10th	0	0	15450	2658	11392	21533	13605	5	0	0	0	0
	11st–20th	0	0	1552	53271	11820	1310	1468	0	0	0	0	0
	21st–the last	0	9759	13144	51203	105654	601	405	0	0	0	0	0
	Whole month	0	9759	30146	107132	128866	23444	15478	5	0	0	0	0
1958/59	1st–10th	0	0	2824	1844	34641	31639	679	0	0	0	0	0
	11th–20th	0	1662	13518	2372	20012	1614	144	0	0	0	0	0
	21st–the last	0	31972	2212	8720	81071	2278	11	0	0	0	0	0
	Whole month	0	33634	18554	12936	135724	35531	834	0	0	0	0	0

Characteristic Data

1954/55

Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: ______ cusecs. Date: ______

1955/56

Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: ______ cusecs. Date: ______

1956/57

Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge ______ cusecs. Date: ______

1957/58

Annual Runoff: 314 830 acre feet
Unit Runoff: 33.1 acreft. per sq. mile per year
Max. discharge: 7577 cusecs. Date: 22. 3. 58.
Min. discharge: 0 cusecs. Date: ______

1958/59

Annual Runoff: 237,213 acre feet
Unit Runoff: 25.0 acreft. per sq. mile per year
Max. discharge: 9495 cusecs. Date: 31. 4. 59.
Min. discharge: 0 cusecs. Date: ______

REMARKS: ______

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st. Nov. - 31st. Oct.)

RIVER: Njombe STATION: Isanga No. IKA.43 CATCHMENT AREA: 1457 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st–10th												
	11th–20th												
	21st–the last												
	Whole month												
1955/56	1st-10th												
	11th-20th												
	21th–the last												
	Whole month												
1956/57	1st-10th												
	11th-20th												
	21st–the last												
	Whole month												
1957/58	1st–10th	0	0	0	0	118		443	9	0	0	0	0
	11st–20th	0	0	0	0		189	79	0	0	0	0	0
	21st–the last	0	0	0	(237)		139	30	0	0	0	0	0
	Whole month	0	0	0	(237)	(20000)	(5300)	553	9	0	0	0	0
1958/59	1st–10th	0	0	0	224			151	0	0	0	0	0
	11th–20th	0	0	50	226		350	45	0	0	0	0	0
	21st–the last	0	133	180	170		304	3	0	0	0	0	0
	Whole month	0	133	230	620	(37200)	(5700)	197	0	0	0	0	0

Characteristic Data

1954/55
Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: ______ cusecs. Date: ______

1955/56
Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: ______ cusecs. Date: ______

1956/57
Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge ______ cusecs. Date: ______

1957/58
Annual Runoff: 26 099 acre feet
Unit Runoff: 18 acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: 0 cusecs. Date: ______

1958/59
Annual Runoff: 44 080 acre feet
Unit Runoff: 30 acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: 0 cusecs. Date: ______

REMARKS: Due to the station being inaccessible in the wet season it has not been possible to get the rating for high water levels.
The figures in brackets have been derived by comparison with other stations on the Njombe-Kisigo system and give an approximation only for the run-off.

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st.Nov. - 31st. Oct.)

RIVER: Halali STATION: Iyayi u/s No. 1KA46 CATCHMENT AREA: 184 SQ. MILES

Runoff in: Acre Feet

	Period	*Nov.*	*Dec.*	*Jan.*	*Feb.*	*March*	*April*	*May*	*June*	*July.*	*Aug.*	*Sept.*	*Oct.*
1954/55	*1st–10th*												
	11th–20th												
	21st–the last												
	Whole month												
1955/56	*1st–10th*												
	11th–20th												
	21th–the last												
	Whole month												
1956/57	*1st–10th*												
	11th–20th												
	21st–the last												
	Whole month												
1957/58	*1st–10th*					2838	4019	1852	654	382	264	205	182
	11st–20th				2520	3628	2592	1194	542	327	243	197	179
	21st–the last				1204	12836	2326	949	439	302	231	169	170
	Whole month					19302	8937	3995	1635	1011	738	591	531
1958/59	*1st–10th*	169	152	222	850	2858	7069	1516	605	397	267	203	208
	11th–20th	176	190	452	1198	3187	2823	1039	529	333	251	199	185
	21st–the last	151	456	272	1754	9544	2131	818	459	321	247	199	198
	Whole month	496	798	946	3802	15589	12023	3373	1593	1051	765	601	591

Characteristic Data

1954/55	*Annual Runoff:*		*acre feet*	
	Unit Runoff:		*acreft. per sq. mile per year*	
	Max. discharge:		*cusecs. Date:*	
	Min. discharge:		*cusecs. Date:*	
1955/56	*Annual Runoff:*		*acre feet*	
	Unit Runoff:		*acreft. per sq. mile per year*	
	Max. discharge:		*cusecs. Date:*	
	Min. discharge:		*cusecs. Date:*	
1956/57	*Annual Runoff:*		*acre feet*	
	Unit Runoff:		*acreft. per sq. mile per year*	
	Max. discharge:		*cusecs. Date:*	
	Min. discharge		*cusecs. Date:*	
1957/58	*Annual Runoff:*		*acre feet*	
	Unit Runoff:		*acreft. per sq. mile per year*	
	Max. discharge:	1 300	*cusecs. Date:*	22. 3.58.
	Min. discharge:	5.0	*cusecs. Date:*	27.11.59.
1958/59	*Annual Runoff:*	41 628	*acre feet*	
	Unit Runoff:	226	*acreft. per sq. mile per year*	
	Max. discharge:	2 900	*cusecs. Date:*	27. 3.59.
	Min. discharge:	5.3	*cusecs. Date:*	29.11.59.

REMARKS:

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st. Nov. - 31st. Oct.)

RIVER: Msolwa STATION: Msolwa Estate No. IKB 1 CATCHMENT AREA: 8 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st–10th											384	300
	11th–20th										521	316	232
	21st–the last										454	316	162
	Whole month											1016	694
1955/56	1st-10th	382	130	288	578	1174	1522	2312	1575	566	392	144	259
	11th-20th	234	242	463	564	1918	2263	1378	1593	410	222	163	242
	21th–the last	214	220	985	521	1780	4285	1967	855	386	176	286	249
	Whole month	830	592	1736	1663	4872	8070	5657	4023	1362	790	593	750
1956/57	1st-10th												
	11th-20th												
	21st–the last												
	Whole month												
1957/58	1st-10th												
	11st-20th												
	21st–the last												
	Whole month												
1958/59	1st-10th												
	11th-20th												
	21st–the last												
	Whole month												

Characteristic Data

1954/55
Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: 4.6 cusecs. Date: 15.12.55.

1955/56
Annual Runoff: 30 938 acre feet
Unit Runoff: 3 870 acreft. per sq. mile per year
Max. discharge: 331 cusecs. Date: 25.4.56.
Min. discharge: ______ cusecs. Date: ______

1956/57
Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge ______ cusecs. Date: ______

1957/58
Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: ______ cusecs. Date: ______

1958/59
Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: ______ cusecs. Date: ______

REMARKS: Run-off 1955/56 - 72.5 inches. Rainfall at Sanje Estate 1955/56 - 98.8 inches. Rainfall presumed to be higher in the mountains. Loss of water at least 26.3 inches. The year 1955/56 had a comparitively high rainfall. The average at Sanje for the 15 years 1940/41 - 1954/55 is 67 inches. Maximum flood as given is in agreement with the observations, but it is suspected that the highest peak has not been recorded by the observer. This was not a good station and readings were abandoned.

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st. Nov. - 31st. Oct.)

RIVER: Kilombero STATION: Ifakara No. IKB.2 CATCHMENT AREA: 12063 SQ. MILES

Runoff in: Hundred Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st–10th	599	587	589	1025	1908	3491	11577	5719	2424	1401	1171	1011
	11th–20th	608	624	587	1357	2083	6369	10278	4119	1861	1277	1112	947
	21st–the last	577	711	813	1286	2676	9468	8301	3196	1715	1347	1056	969
	Whole month	1784	1922	1989	3668	6667	19328	30156	13034	6000	4025	3339	2927
1955/56	1st-10th	796	676	976	3629	7357	8639	17160	8836	3134	2006	1526	1263
	11th-20th	727	721	1373	5226	6640	9715	16366	5457	2623	1883	1422	1156
	21th-the last	703	1041	2403	6467	7045	13833	14541	3911	2470	1876	1333	1197
	Whole month	2226	2438	4752	15322	21042	32187	48067	18204	8227	5765	4281	3616
1956/57	1st–10th	1041	909	1256	1921	2574	3119	18265	10177	2562	1846	1417	1185
	11th–20th	992	994	1545	2157	2463	5259	15580	5123	2211	1727	1316	1101
	21st–the last	944	1165	1991	1884	2507	12215	12162	3402	2176	1709	1262	1153
	Whole month	2977	3068	4792	5962	7544	20593	46007	18702	6949	5282	3995	3439
1957/58	1st–10th	1008	860	1414	1244	2354	9042	14139	5235	2053	1471	1237	1094
	11st–20th	960	946	1591	1628	3029	10417	12444	3244	1822	1373	1220	1056
	21st–the last	908	1216	1527	1623	4339	11457	10779	2435	1781	1420	1173	1095
	Whole month	2876	3022	4532	4495	9722	30916	37362	10914	5656	4264	3630	3245
1958/59	1st–10th	949	888	1437	2069	2437	4089	5113	1968	1268	1123	901	748
	11th–20th	906	928	1309	2180	2808	4012	4569	1443	1223	1043	832	762
	21st–the last	885	1318	1670	1605	4220	4525	3783	1304	1319	1075	779	761
	Whole month	2740	3134	4416	5854	9465	12626	13465	4715	3810	3241	2512	2271

Characteristic Data

1954/55
Annual Runoff: 9.48 million *acre feet*
Unit Runoff: 786 *acreft. per sq. mile per year*
Max. discharge: 63 000 *cusecs. Date:* 8. 5.55.
Min. discharge: 3 289 *cusecs. Date:* 12.12.55.

1955/56
Annual Runoff: 16.61 million *acre feet*
Unit Runoff: 1 377 *acreft. per sq. mile per year*
Max. discharge: 90 000 *cusecs. Date:* 8. 5.56.
Min. discharge: 4 431 *cusecs. Date:* 5.12.56.

1956/57
Annual Runoff: 12.93 million *acre feet*
Unit Runoff: 1 072 *acreft. per sq. mile per year*
Max. discharge: 98 000 *cusecs. Date:* 1. 5.57.
Min. discharge 4 262 *cusecs. Date:* 8.12.57.

1957/58
Annual Runoff: 12.06 million *acre feet*
Unit Runoff: 1 000 *acreft. per sq. mile per year*
Max. discharge: 74 000 *cusecs. Date:* 5. 5.58.
Min. discharge: 4 431 *cusecs. Date:* 3.12.58.

1958/59
Annual Runoff: 6.82 million *acre feet*
Unit Runoff: 566 *acreft. per sq. mile per year*
Max. discharge: 28 000 *cusecs. Date:* 2. 5.59.
Min. discharge: 3 000 *cusecs. Date:* 23.11.59.

REMARKS: Lowest discharge measurement 1954: 2914 cusecs, 31.12.54.

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st. Nov. - 31st. Oct.)

RIVER: Kilombero STATION: Ifwema No. IKB.4 CATCHMENT AREA: 7048 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st-10th			43421	125836	285496	316671	193317	154974	108327	89835	73058	63950
	11th-20th			64794	182537	165102	341639	209118	140046	102880	80942	71870	58307
	21st-the last			109622	158529	193624	302386	198466	126284	102445	84146	68900	58465
	Whole month	(120000)	(200000)	217837	466904	644222	960696	600901	421304	313652	254923	213526	180722
1955/56	1st-10th	52565	59198	138510	372726	263578	353440	367676	200038	153608	128186	105059	87157
	11th-20th	48902	100873	156916	293395	299534	362319	306742	186100	141669	123809	100444	84550
	21th-the last	49496	116582	371924	278229	337848	396514	269427	167944	142915	120822	93535	88416
	Whole month	150963	276653	667350	944350	900960	1112273	943845	554082	436192	372817	299038	260123
1956/57	1st-10th	76424	79168	155760	280505	173874	332084	306046	185348	147945	116710	93891	78010
	11th-20th	71870	79574	153584	227243	171634	390377	280151	166161	137878	105772	86944	73256
	21st-the last	66524	112713	185111	167330	305522	410424	248857	159550	132300	111692	85310	73909
	Whole month	214818	271455	494455	675078	651230	1132885	835054	511059	418123	334174	266142	225175
1957/58	1st-10th	65237	72961	219314	123542	171895	368796	368122	156863	119728	97010	83586	68781
	11st-20th	63257	90366	117433	200436	282269	239037	219764	141686	107222	92200	78010	70087
	21st-the last	57597	171013	117979	141967	373053	328025	195429	126974	109715	97637	71988	68622
	Whole month	186091	334340	454726	465945	827217	935858	783315	425723	336665	286847	233584	207490
1958/59	1st-10th	60651	62286	82316	154855	243153	280140	211053	115654	88030	69356	60766	54739
	11th-20th	55896	85069	179816	148929	213952	206908	151883	105480	81498	66384	55825	54080
	21st-the last	56146	181834	159219	150528	286580	214602	144407	95672	82980	69137	53902	55997
	Whole month	172693	329191	421351	454312	743685	701650	507343	316806	252508	204877	170493	164816

Characteristic Data

1954/55

Annual Runoff: 4 594 569 acre feet
Unit Runoff: 652 acreft. per sq. mile per year
Max. discharge: 19 000 cusecs. Date: 21. 4. 55.
Min. discharge: 2 430 cusecs. Date: 2.12. 55.

1955/56

Annual Runoff: 6 920 646 acre feet
Unit Runoff: 982 acreft. per sq. mile per year
Max. discharge: 29 000 cusecs. Date: 2. 2. 56.
Min. discharge: 3 230 cusecs. Date: 27.11. 56.

1956/57

Annual Runoff: 6 029 648 acre feet
Unit Runoff: 856 acreft. per sq. mile per year
Max. discharge: 26 000 cusecs. Date: 21. 4. 57.
Min. discharge 2 760 cusecs. Date: 1.12. 57.

1957/58

Annual Runoff: 5 477 801 acre feet
Unit Runoff: 777 acreft. per sq. mile per year
Max. discharge: 24 000 cusecs. Date: 30. 4.58.
Min. discharge: 2 760 cusecs. Date: 12.12. 58.

1958/59

Annual Runoff: 4 439 927 acre feet
Unit Runoff: 630 acreft. per sq. mile per year
Max. discharge: 18 000 cusecs. Date: 4. 4. 59.
Min. discharge: 2 470 cusecs. Date: 7.11. 59.

REMARKS: Lowest discharge 1954, 2392 cusecs, 2.1.55.

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st. Nov. - 31st. Oct.)

RIVER: Luhombero STATION: Ilonga No. IKB.5 CATCHMENT AREA: 395 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st–10th				14860		19975	13594	13909	3067	1160	1040	948
	11th–20th				33772		15746	4177	13625	1715	1067	1004	907
	21st–the last			4474	13291		15780	9323	13766	1458	1144	980	979
	Whole month	(4000)	(5000)	(8000)	61923	(26000)	51503	27094	41300	6260	3371	3024	2834
1955/56	1st-10th	940	800	2772	38266		38567	14585	5876	3529	3018	2544	2215
	11th-20th	926	1114	2532	23485		40095	11173	5451	3853	2801	2350	2120
	21th–the last	857	1154	24148	6584		63833	5975	4446	3633	2924	2117	2220
	Whole month	2723	3068	29542	68335	(47800)	142495	31733	15773	11015	8743	7011	6555
1956/57	1st–10th	2028	2016	2760	4021	2729	7646	23663	5466	2964	2672	2452	2217
	11th–20th	2036	2108	2446	15475	3933	18383	15248	4496	2812	2600	2357	2140
	21st–the last	1960	2676	2748	3941	5666	46086	7075	3468	2960	2772	2290	2354
	Whole month	6024	6800	7954	23437	12328	72115	46166	13430	8736	8044	7099	6711
1957/58	1st–10th	2090	2180	3385	5000	9207	30590	27057	5673	3710	2666	2102	1540
	11st–20th	2250	2460	2463	7669	6994	9409	10313	4821	3453	2454	1852	1305
	21st–the last	2140	3870	2866	10932	13570	23223	8134	4140	3447	2508	1582	1379
	Whole month	6480	8510	8714	23601	29771	63222	45504	14634	10610	7628	5536	4224
1958/59	1st–10th	1096	950	2042	5935	12650	4472	4104	2220	1650	1290	876	510
	11th–20th	1096	1021	10479	3773	6257	2465	2959	1966	1520	1136	618	461
	21st–the last	1096	5029	3082	3751	5969	5003	2805	1780	1561	1199	510	431
	Whole month	3288	7000	15603	13459	24876	11940	9868	5966	4731	3625	2004	1402

Characteristic Data

1954/55

Annual Runoff: (240 309) acre feet
Unit Runoff: 608 acreft. per sq. mile per year
Max. discharge: 4 300 cusecs. Date: 26. 2.55
Min. discharge: 40 cusecs. Date: 12.12.55

1955/56

Annual Runoff: 377 703 acre feet
Unit Runoff: 956 acreft. per sq. mile per year
Max. discharge: 4 700 cusecs. Date: 28. 4.56
Min. discharge: 99 cusecs. Date: 12.12.56

1956/57

Annual Runoff: 218 864 acre feet
Unit Runoff: 554 acreft. per sq. mile per year
Max. discharge: 4 400 cusecs. Date: 26.4.57
Min. discharge 88 cusecs. Date: 2.12.57

1957/58

Annual Runoff: 228 434 acre feet
Unit Runoff: 578 acreft. per sq. mile per year
Max. discharge: 5 000 cusecs. Date: 3. 4.58
Min. discharge: 44 cusecs. Date: 13.12.58

1958/59

Annual Runoff: 103 762 acre feet
Unit Runoff: 263 acreft. per sq. mile per year
Max. discharge: 3 400 cusecs. Date: 5. 3.59
Min. discharge: 12 cusecs. Date: 24.11.59

REMARKS: After 28.11.56 rating has changed and adjustment for this has been made in the run-off calculations as far as discharge measurements are available.

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st.Nov. - 31st. Oct.)

RIVER: Kigogo-Ruaha STATION: Frick's Bridge No. IKB.6 CATCHMENT AREA: 511 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st–10th												
	11th–20th												
	21st–the last												
	Whole month												
1955/56	1st-10th					59462	79765	21584	9553	6457	4653	3419	2459
	11th-20th					54753	60419	13276	8171	5887	4069	3076	2332
	21th–the last				63558	81221	51339	12318	7464	5346.	4061	2719	2487
	Whole month					195346	191523	47178	25188	17690	12783	9214	7278
1956/57	1st–10th	2106	2806	3399	18378	11240			9780	6254	5434	4140	3388
	11th–20th	1776	2823	6314	13524	10929			8363	5828	5250	3742	3157
	21st–the last	1746	3215	14379	12377	16498			6835	5989	5164	3538	3129
	Whole month	5628	8844	24092	44279	38667	(73275)	(36310)	24978	18071	15848	11420	9674
1957/58	1st–10th	2473	1768	2770	10476	12739	27953	25036	10532	7528	6005	4762	3391
	11st–20th	2165	1705	9356	16990	19534	34776	17764	9236	7070	5471	4204	3178
	21st–the last	1954	2255	10125	10751	22072	29659	13854	8279	7288	5488	3816	3038
	Whole month	6612	5728	22251	38217	54345	92388	56654	28047	21886	16964	12782	9607
1958/59	1st–10th	2470	2120	5792	6870	15486	28269	11597	5183	4400	3330	2714	2243
	11th–20th	2303	4349	6143	7041	12563	13537	8032	4810	3894	3210	2443	2104
	21st–the last	2190	9053	5486	10284	21539	13834	6862	4550	3896	3354	2336	1994
	Whole month	6963	15522	17421	24195	49588	55640	26491	14543	12190	9894	7493	6341

Characteristic Data

1954/55
Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: ______ cusecs. Date: ______

1955/56
Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: 81 cusecs. Date: 26.11.56

1956/57
Annual Runoff: 311086 acre feet
Unit Runoff: 609 acreft. per sq. mile per year
Max. discharge: - cusecs. Date: ______
Min. discharge 82 cusecs. Date: 14.12.57

1957/58
Annual Runoff: 365481 acre feet
Unit Runoff: 715 acreft. per sq. mile per year
Max. discharge: 2300 cusecs. Date: 15. 4.58
Min. discharge: 93 cusecs. Date: 13.12.58

1958/59
Annual Runoff: 246281 acre feet
Unit Runoff: 482 acreft. per sq. mile per year
Max. discharge: 1900 cusecs. Date: 2. 4.59
Min. discharge: 78 cusecs. Date: 18.11.59

REMARKS: No readings for April-May 1957. Discharge figures have been computed by analogy with adjacent rivers.

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st. Nov. - 31st. Oct.)

RIVER: Fuagi STATION: Idege No. 1KB7 CATCHMENT AREA: 24 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st–10th												
	11th–20th												
	21st–the last												
	Whole month												
1955/56	1st–10th					894	1363	1152	764	667	535	385	302
	11th–20th					870	876	868	774	573	462	350	284
	21th–the last					1470	1743	661	663	589	457	321	310
	Whole month					3234	3982	2681	2201	1829	1454	1056	896
1956/57	1st–10th	275	350	489	1067			533	516	456	429	362	315
	11th–20th	267	270	820	727			773	492	449	406	341	293
	21st–the last	264	470	1430	575			699	476	447	420	389	287
	Whole month	806	1090	2739	2369	(2146)	(5598)	2005	1484	1352	1255	1092	895
1957/58	1st–10th	238	194	490	619	477	1641	902	557	456	390	341	260
	11st–20th	217	273	266	1022	516	642	553	480	439	360	307	255
	21st–the last	212	383	363	361	1948	1568	644	467	1243	500	285	236
	Whole month	667	850	1119	2002	2941	3851	2099	1504	2138	1250	933	751
1958/59	1st–10th	174	192	406	656	738	778	493	339	394	299	264	204
	11th–20th	180	491	342	390	634	580	423	347	349	295	231	212
	21st–the last	196	659	294	591	1067	653	421	367	351	316	215	228
	Whole month	550	1342	1042	1637	2439	2011	1337	1053	1094	910	710	644

Characteristic Data

1954/55

Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: ______ cusecs. Date: ______

1955/56

Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: 11 cusecs. Date: 13.12.56.

1956/57

Annual Runoff: 24 456 acre feet
Unit Runoff: 1 019 acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge 8.6 cusecs. Date: 6.12.57.

1957/58

Annual Runoff: 19 227 acre feet
Unit Runoff: 801 acreft. per sq. mile per year
Max. discharge: 264 cusecs. Date: 30. 3.58.
Min. discharge: 10 cusecs. Date: 31.11.58.

1958/59

Annual Runoff: 14 774 acre feet
Unit Runoff: 616 acreft. per sq. mile per year
Max. discharge: 92 cusecs. Date: 3. 2.59.
Min. discharge: 10 cusecs. Date: 16.11.59.

REMARKS: No reading for March/April 1957. Discharge figures have been computed by analogy with adjacent rivers.

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st. Nov. - 31st. Oct.)

RIVER: Mpanga STATION: Mpanga No. IKB8 CATCHMENT AREA: 937 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st–10th												
	11th–20th												
	21st–the last												
	Whole month												
1955/56	1st-10th												
	11th-20th												
	21th–the last												
	Whole month												
1956/57	1st-10th			28860	33879	22038	39185	56306	25621	20725	19126	15696	13978
	11th-20th		15977	26545	26211	20226	60639	39523	23280	19596	17277	14940	13303
	21st–the last		21045	34284	18486	36355	58685	34900	22825	21451	17958	15646	13621
	Whole month	(38000)	(49000)	89689	78576	76619	156709	130729	71726	61772	54363	46282	40902
1957/58	1st–10th	11982	11745	25260	20895	28719	63783	53141	23857	18771	16632	15384	13942
	11st–20th	11602	15757	15157	24642	33423	30262	26987	22086	17746	16351	14725	13599
	21st–the last	11755	20620	17473	18291	58199	73757	25084	19866	18837	17806	14352	13739
	Whole month	35339	48122	57890	63828	120341	167802	110212	65813	55354	50869	44461	41280
1958/59	1st–10th	11911	12820	17366	23498	37460	30663	27367	17416	16622	14009	12611	12671
	11th–20th	11144	19030	24514	18928	28420	26994	23192	16716	14722	13855	12352	11385
	21st–the last	11019	34242	20473	21797	31828	39719	20665	16191	15911	15412	12193	11362
	Whole month	34074	66092	62353	64223	97708	97376	71224	50323	47255	43276	37356	35418

Characteristic Data

Annual Runoff: ________ acre feet
Unit Runoff: ________ acreft. per sq. mile per year
Max. discharge: ________ cusecs. Date: ________
Min. discharge: ________ cusecs. Date: ________

Annual Runoff: ________ acre feet
Unit Runoff: ________ acreft. per sq. mile per year
Max. discharge: ________ cusecs. Date: ________
Min. discharge: 635 cusecs. Date: 13.12.56.

Annual Runoff: 898 367 acre feet
Unit Runoff: 959 acreft. per sq. mile per year
Max. discharge: 5 300 cusecs. Date: 18. 4.57.
Min. discharge 570 cusecs. Date: 15.12.57.

Annual Runoff: 861 311 acre feet
Unit Runoff: 919 acreft. per sq. mile per year
Max. discharge: 5 800 cusecs. Date: 31. 3.58.
Min. discharge: 544 cusecs. Date: 2.12.58.

Annual Runoff: 706 678 acre feet
Unit Runoff: 754 acreft. per sq. mile per year
Max. discharge: 3 600 cusecs. Date: 26. 4.59.
Min. discharge: 435 cusecs. Date: 21.12.59.

REMARKS: ________

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st. Nov. - 31st. Oct.)

RIVER: Mnyera STATION: Taveta No. 1KB9 CATCHMENT AREA: 1950 SQ. MILES

Runoff in:

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st–10th												
	11th–20th												
	21st–the last												
	Whole month												
1955/56	1st-10th												
	11th-20th												
	21th–the last												
	Whole month												
1956/57	1st-10th	20400)	21835	40159	78698	48515	97949	77871	41234	32435	29737	23124	20932
	11th-20th	17800)	19029	36307	57003	49935	125631	66367	36409	31296	28265	23119	19643
	21st–the last	16490	28283	60101	44501	70396	116633	63462	36607	35436	30224	22671	19995
	Whole month	54690)	69147	136567	180202	168846	340213	207700	114250	99167	88226	68914	60570
1957/58	1st-10th	17390	17200	61934	42135	55970	84681	100764	47311	34206	29146	25914	23342
	11st-20th	16935	25065	33260	41998	66512	60606	54677	35439	32225	26194	24921	22895
	21st–the last	15877	44056	32309	54178	189228	139972	52088	35451	32877	31677	23906	22003
	Whole month	50202	86321	127503	138311	311710	285259	207529	118201	99308	87017	74741	68240
1958/59	1st-10th	19615	20349	27354	62943	78038	69207	53023	28469	28182	21165	21385	19567
	11th-20th	18389	29094	39316	42725	56925	55215	37974	28242	25976	23607	20176	20088
	21st–the last	18425	56127	55114	37114	101945	83239	34820	27503	26791	27451	19515	19037
	Whole month	56429	105570	121784	142782	236908	207661	125817	84214	80949	72223	61076	58692

Characteristic Data

1954/55
Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: ______ cusecs. Date: ______

1955/56
Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: ______ cusecs. Date: ______

1956/57
Annual Runoff: 1 588 492 acre feet
Unit Runoff: 814 acreft. per sq. mile per year
Max. discharge: 8 700 cusecs. Date: 21. 4. 57.
Min. discharge 785 cusecs. Date: 3.12. 57.

1957/58
Annual Runoff: 1 654 342 acre feet
Unit Runoff: 848 acreft. per sq. mile per year
Max. discharge: 14 000 cusecs. Date: 24. 3. 58.
Min. discharge: 915 cusecs. Date: 11.12.58.

1958/59
Annual Runoff: 1 356 161 acre feet
Unit Runoff: 695 acreft. per sq. mile per year
Max. discharge: 7 000 cusecs. Date: 3. 4. 59.
Min. discharge: 910 cusecs. Date: 15.11. 59.

REMARKS:

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st. Nov. - 31st. Oct.)

RIVER: Ruhuji STATION: Mwayamalungu No. IKB.10 CATCHMENT AREA: 3294 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st–10th												
	11th–20th												
	21st–the last												
	Whole month												
1955/56	1st–10th												
	11th–20th												
	21th–the last												
	Whole month												
1956/57	1st–10th			65521	137770	63956	182147	252708	85817	59623	48629	38602	31541
	11th–20th			63181	105964	77115	256475	162727	73215	54501	44958	35888	29772
	21st–the last		37894	82302	66836	185471	262675	120899	66096	57500	46202	34305	30171
	Whole month	(70000)	(100000)	211004	310570	326542	701297	536334	225128	171624	139879	108795	91484
1957/58	1st–10th	26597	27085	110891	53440	96381	206600	196902	63629	49763	37941	32470	27153
	11st–20th	26074	40686	48947	102929	174678	98517	90113	58363	44839	35854	30160	26951
	21st–the last	23521	81946	50765	67637	262097	190944	80338	52955	44226	37639	28973	27266
	Whole month	76192	149717	210603	224006	533156	496061	367353	174947	138828	111434	91603	81370
1958/59	1st–10th	23847	25693	34055	61008	104117	136670	83080	41097	32986	25756	22038	21994
	11th–20th	22705	37102	117404	70546	110262	91876	58371	37678	29717	25757	21150	22266
	21st–the last	24336	84515	72689	69378	161794	91452	52156	35741	29662	25076	20480	21261
	Whole month	70888	147310	224148	200932	376173	319998	193607	114516	92365	76589	63668	65521

Characteristic Data

1954/55

Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: ______ cusecs. Date: ______

1955/56

Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: ______ cusecs. Date: ______

1956/57

Annual Runoff: 2 992 567 acre feet
Unit Runoff: 908 acreft. per sq. mile per year
Max. discharge: 15 000 cusecs. Date: 18. 4.57.
Min. discharge 1 134 cusecs. Date: 4.12.57.

1957/58

Annual Runoff: 2 657 270 acre feet
Unit Runoff: 807 acreft. per sq. mile per year
Max. discharge: 14 000 cusecs. Date: 2. 5.58.
Min. discharge: 1 134 cusecs. Date: 17.11.58.

1958/59

Annual Runoff: 1 945 715 acre feet
Unit Runoff: 591 acreft. per sq. mile per year
Max. discharge: 13 000 cusecs. Date: 16. 1.59.
Min. discharge: 822 cusecs. Date: 24.11.59.

REMARKS:

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st. Nov. - 31st. Oct.)

RIVER: Sofi STATION: Sofi Mission No. 1KB11 CATCHMENT AREA: 62 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st-10th												
	11th-20th												
	21st-the last												
	Whole month												
1955/56	1st-10th												
	11th-20th												
	21th-the last												
	Whole month												
1956/57	1st-10th	(160)	(140)	713	935	318	4038	4304	697	401	330	196	112
	11th-20th	(150)	(170)	267	612	3766	7105	2792	546	431	227	163	112
	21st-the last	(130)	382	933	253	2231	3671	1615	511	385	291	137	121
	Whole month	(460)	(692)	1913	2003	6337	14814	8711	1754	1217	848	496	345
1957/58	1st-10th	70	35	585	330	1935	5365	7206	1191	612	354	304	253
	11st-20th	49	124	144	504	3263	1991	1722	356	490	295	254	250
	21st-the last	32	860	450	738	5411	5937	1587	773	443	286	250	247
	Whole month	151	1019	1179	1572	10609	13293	10515	2320	1545	935	808	750
1958/59	1st-10th	166	129	683	1247	2259	1091	1057	541	431	314	254	185
	11th-20th	137	180	1536	934	1369	1538	1073	437	371	340	222	192
	21st-the last	125	2442	580	1764	3524	2000	611	502	374	265	162	157
	Whole month	428	2751	2799	3945	7152	4629	2741	1480	1176	919	638	534

Characteristic Data

1954/55

Annual Runoff: ________ acre feet

Unit Runoff: ________ acreft. per sq. mile per year

Max. discharge: ________ cusecs. Date: ________

Min. discharge: ________ cusecs. Date: ________

1955/56

Annual Runoff: ________ acre feet

Unit Runoff: ________ acreft. per sq. mile per year

Max. discharge: ________ cusecs. Date: ________

Min. discharge: ________ cusecs. Date: ________

1956/57

Annual Runoff: 41 580 acre feet

Unit Runoff: 671 acreft. per sq. mile per year

Max. discharge: 1 600 cusecs. Date: 17. 3.57.

Min. discharge 1.4 cusecs. Date: 10.12.57.

1957/58

Annual Runoff: 45 278 acre feet

Unit Runoff: 730 acreft. per sq. mile per year

Max. discharge: 1 900 cusecs. Date: 2. 5.58.

Min. discharge: 6.0 cusecs. Date: 18.12.58.

1958/59

Annual Runoff: 29 193 acre feet

Unit Runoff: 471 acreft. per sq. mile per year

Max. discharge: 700 cusecs. Date: 21. 3.59.

Min. discharge: 0.2 cusecs. Date: 14.11.59.

REMARKS: ________

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st. Nov. - 31st. Oct.)

RIVER: Mchilipa STATION: Idete No. 1KB12 CATCHMENT AREA: 114 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st–10th												
	11th–20th												
	21st–the last												
	Whole month												
1955/56	1st–10th												
	11th–20th												
	21th–the last												
	Whole month												
1956/57	1st–10th			452	402	560	1340	1707	810	664	675	544	364
	11th–20th			377	614	661	3591	1530	719	627	654	477	359
	21st–the last		438	692	379	1196	2188	1215	679	785	660	443	354
	Whole month	(1200)	(1400)	1521	1395	2417	7119	4452	2208	2099	1969	1464	1097
1957/58	1st–10th	298	239	319	232	406	3464	5184	1804	1237	879	650	445
	11st–20th	279	308	278	345	434	1204	2723	1561	1071	792	570	400
	21st–the last	245	392	319	255	5402	5740	2313	1403	1040	805	503	396
	Whole month	822	939	916	832	6242	10408	10220	4768	3348	2476	1723	1241
1958/59	1st–10th	383	368	381	463								
	11th–20th	380	410	383	427								
	21st–the last	378	575	559	379								
	Whole month	1141	1353	1323	1269								

Characteristic Data

1954/55:
Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: ______ cusecs. Date: ______

1955/56:
Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: ______ cusecs. Date: ______

1956/57:
Annual Runoff: 28 521 acre feet
Unit Runoff: 250 acreft. per sq. mile per year
Max. discharge: Uncertain cusecs. Date: ______
Min. discharge: 11 cusecs. Date: 9.12.57.

1957/58:
Annual Runoff: 43 985 acre feet
Unit Runoff: 386 acreft. per sq. mile per year
Max. discharge: Uncertain cusecs. Date: ______
Min. discharge: 17 cusecs. Date: 16.12.57.

1958/59:
Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: 6.2 cusecs. Date: 14.11.59.

REMARKS: ______

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st. Nov. - 31st. Oct.)

RIVER: Lumemo STATION: Kibaoni No. IKB.14 CATCHMENT AREA: 165 SQ. MILES

Runoff in: Acre. Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st-10th											4381	3487
	11th-20th										5335	3972	3106
	21st-the last										5285	3720	2955
	Whole month											12073	9548
1955/56	1st-10th	2767	1765	3291	6635	17867	23176	20642	13204	7803	5973	3973	2939
	11th-20th	2629	2618	5560	12797	13467	28846	15257	11097	6735	4215	3599	2555
	21th-the last	2113	2638	12016	14669	9560	34472	14343	9015	6991	4530	3446	2730
	Whole month	7509	7021	20867	34101	40894	86494	50242	33316	21529	14718	11018	8224
1956/57	1st-10th	2403	2300	5452	7730	3595	16233	30041	14030	8704	6270	3735	3297
	11th-20th	2243	2338	3851	4579	5764	26710	21098	11827	7980	5186	3365	3108
	21st-the last	1995	4503	10158	2364	7907	27261	19574	10139	7511	4639	3846	3955
	Whole month	6641	9141	19461	14673	17266	70204	70713	35996	24195	16095	10946	10360
1957/58	1st-10th	3117	2353	3193	2621	6406	26419	23358	9995	5807	4150	3405	2904
	11st-20th	2516	3440	2347	3361	7070	13645	16421	7669	5173	3050	3225	2778
	21st-the last	2554	4519	2691	3009	28628	45701	13270	6204	4985	4046	3038	2913
	Whole month	8187	10312	8231	8991	42104	87837	53049	24140	15965	12046	9668	8595
1958/59	1st-10th	2519	2410	2536	3601	6029	3636	5905	3060	3103	2300	2132	1787
	11th-20th	2447	2598	3413	4676	5796	5743	4630	2944	2567	2245	1998	1732
	21st-the last	2432	3715	2841	2961	7410	10330	3860	2706	2676	2732	1911	1845
	Whole month	7398	8723	8790	11238	19235	20211	15495	8612	8346	7277	6041	5364

Characteristic Data

1954/55	Annual Runoff:		acre feet		
	Unit Runoff:		acreft. per sq. mile per year		
	Max. discharge:		cusecs.	Date:	
	Min. discharge:	74	cusecs.	Date:	12.12.55.
1955/56	Annual Runoff:	335 933	acre feet		
	Unit Runoff:	2 036	acreft. per sq. mile per year		
	Max. discharge:	3 000	cusecs.	Date:	20. 2.56.
	Min. discharge:	85	cusecs.	Date:	13.12.56.
1956/57	Annual Runoff:	305 691	acre feet		
	Unit Runoff:	1 853	acreft. per sq. mile per year		
	Max. discharge:	3 100	cusecs.	Date:	16. 4.57.
	Min. discharge	113	cusecs.	Date:	9.12.57.
1957/58	Annual Runoff:	295 133	acre feet		
	Unit Runoff:	1 789	acreft. per sq. mile per year		
	Max. discharge:	6 300	cusecs.	Date:	30. 3.58.
	Min. discharge:	101	cusecs.	Date:	4. 1.59.
1958/59	Annual Runoff:	126 730	acre feet		
	Unit Runoff:	768	acreft. per sq. mile per year		
	Max. discharge:	1 600	cusecs.	Date:	27. 4.59.
	Min. discharge:	70	cusecs.	Date:	3.12.59.

REMARKS: Discharges before 1st January 1958 are observed at Ifakara, Station No. IKB3.

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st.Nov. - 31st. Oct.)

RIVER: Mgeta STATION: Mchombe No. 1KB15 CATCHMENT AREA: 124 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st-10th												
	11th-20th												
	21st-the last												
	Whole month												
1955/56	1st-10th												
	11th-20th												
	21th-the last												
	Whole month												
1956/57	1st-10th												
	11th-20th												
	21st-the last												
	Whole month												
1957/58	1st-10th		3159	4379	3536	5246			13350	7728	5227	4459	4015
	11st-20th		4080	3108	6342	6718	20568		9511	6381	5010	4234	3674
	21st-the last	2988	4723	3551	3739			19408	8959	7047	5425	4160	3785
	Whole month		11962	11038	13617				31820	21156	15663	12863	11474
1958/59	1st-10th	2940	3570	3756	4085	5568	10370	15622	7453	5866	4481	3799	3103
	11th-20th	2996	3705	4641	4438	13456	11964	13010	6988	4979	4175	3405	3376
	21st-the last	3589	7928	4524	3991	9542	27081	9481	5932	4904	4606	3156	3037
	Whole month	9525	15203	12921	12514	28566	49415	38113	20373	15749	13262	10360	9516

Characteristic Data

1954/55

Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: ______ cusecs. Date: ______

1955/56

Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: ______ cusecs. Date: ______

1956/57

Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge 143 cusecs. Date: 24.12.57.

1957/58

Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: Uncertain cusecs. Date: ______
Min. discharge: 147 cusecs. Date: 12.12.58.

1958/59

Annual Runoff: 235 517 acre feet
Unit Runoff: 1 899 acreft. per sq. mile per year
Max. discharge: Uncertain cusecs. Date: ______
Min. discharge: 127 cusecs. Date: 2.11.59.

REMARKS: This is a very good station for the recording of lower discharges, but during floods the water level at this site is influenced by flooded areas further down river. A new gauge is recommended established at rocky section upstream of road bridge where gauging conditions will be free of back water effect.

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER. DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st. Nov. - 31st. Oct.)

RIVER: Furua STATION: Malinyi No. 1KB16 CATCHMENT AREA: 507 SQ. MILES

Runoff in: Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st-10th												
	11th-20th												
	21st-the last												
	Whole month												
1955/56	1st-10th												
	11th-20th												
	21th-the last												
	Whole month												
1956/57	1st-10th												
	11th-20th												
	21st-the last												
	Whole month												
1957/58	1st-10th		3188	9991	5647	21360	57089	52730	16519	9016	6243	4465	3150
	11st-20th		4636	4286	20803	32326	30096	26572	13026	7585	5456	4080	2960
	21st-the last	3150	9733	6702	12693	64949	61181	22558	10519	6662	5441	3730	3047
	Whole month	(9000)	17557	20979	39143	118635	148366	101860	40064	23263	17140	12275	9157
1958/59	1st-10th	2965	3890	5331	14609	27346	15253	19743	6753	5470	3860	2913	2306
	11th-20th	2922	10965	37680	16145	19620	16112	11654	6445	4563	3537	2682	2233
	21st-the last	3524	29858	12662	21625	37721	27854	9568	5660	4387	3465	2439	2165
	Whole month	9411	44713	55673	52379	84687	59219	40965	18858	14420	10862	8034	6704

Characteristic Data

1954/55
Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: 0 cusecs. Date: ______

1955/56
Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge: ______ cusecs. Date: ______

1956/57
Annual Runoff: ______ acre feet
Unit Runoff: ______ acreft. per sq. mile per year
Max. discharge: ______ cusecs. Date: ______
Min. discharge 140. cusecs. Date: 3. 4.57.

1957/58
Annual Runoff: 557 439 acre feet
Unit Runoff: 1 099 acreft. per sq. mile per year
Max. discharge: 8 500 cusecs. Date: 21.3.58.
Min. discharge: 123 cusecs. Date: 5.1.59.

1958/59
Annual Runoff: 405 745 acre feet
Unit Runoff: 800 acreft. per sq. mile per year
Max. discharge: 7 200 cusecs. Date: 16. 1.59.
Min. discharge: 60 cusecs. Date: 23.11.59.

REMARKS: ______

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE V

RUFIJI RIVER SURVEY, HYDROLOGICAL SECTION

DISCHARGE AND RUNOFF SUMMARIES FOR THE HYDROLOGICAL YEAR (1st. Nov. - 31st. Oct.)

RIVER: Kilombero STATION: Swero No. 1KB.17 CATCHMENT AREA: 12915 SQ. MILES

Runoff in: Hundred Acre Feet

	Period	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July.	Aug.	Sept.	Oct.
1954/55	1st-10th												
	11th-20th												
	21st-the last												
	Whole month												
1955/56	1st-10th												
	11th-20th												
	21th-the last												
	Whole month												
1956/57	1st-10th												
	11th-20th												
	21st-the last												
	Whole month												
1957/58	1st-10th		809	1439	1282	2380	8331	12552	5772	2040	1473	1160	946
	11st-20th		914	1640	1626	3063	8792	10488	3337	1803	1345	1092	900
	21st-the last		1224	1654	1703	4826	9461	9654	2509	1793	1373	1029	932
	Whole month	(2800)	2947	4733	4611	10269	26584	32694	11618	5636	4191	3281	2778
1958/59	1st-10th	732	692	1410	2034	2576	4081	5163	2137	1317	1035	969	728
	11th-20th	734	768	1426	2242	2917	3905	4526	1499	1224	998	822	766
	21st-the last	604	1088	1772	1678	4429	4324	4034	1340	1213	1058	760	736
	Whole month	2200	2548	4608	5954	9922	12310	13723	4976	3754	3091	2460	2230

Characteristic Data

1954/55
Annual Runoff: acre feet
Unit Runoff: acreft. per sq. mile per year
Max. discharge: cusecs. Date:
Min. discharge: cusecs. Date:

1955/56
Annual Runoff: acre feet
Unit Runoff: acreft. per sq. mile per year
Max. discharge: cusecs. Date:
Min. discharge: cusecs. Date:

1956/57
Annual Runoff: acre feet
Unit Runoff: acreft. per sq. mile per year
Max. discharge: cusecs. Date:
Min. discharge 3 568 cusecs. Date: 2. 12.57.

1957/58
Annual Runoff: 11.22 million acre feet
Unit Runoff: 869 acreft. per sq. mile per year
Max. discharge: 66 000 cusecs. Date: 3. 5.58.
Min. discharge: 3 455 cusecs. Date: 8.12.58.

1958/59
Annual Runoff: 6.79 million acre feet
Unit Runoff: 526 acreft. per sq. mile per year
Max. discharge: 26 000 cusecs. Date: 4. 5. 59.
Min. discharge: 2 860 cusecs. Date: 23.11. 59.

REMARKS:

NOTE: "IF THE MINIMUM DISCHARGE OCCURS IN NOVEMBER, DECEMBER OR JANUARY IT IS ENTERED UNDER THE PREVIOUS HYDROLOGICAL YEAR"

TABLE XI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION.

RAINFALL, RUN-OFF AND LOSS OF WATER

OBSERVED AND SYNTHETIC YEARLY VALUES.

RIVER Rufiji STATION Stiegler's Gorge No. 1K3 CATCHMENT AREA 61 106 SQ. MILES

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL			RUN-OFF				LOSS OF WATER			
	ACRE FEET	% OF MEAN	INCHES	ACRE FEET	% OF MEAN	INCHES	RUN OFF COEFFICIENT	ACRE FEET	% OF MEAN	INCHES	LOSS COEFFICIENT
1940—1941	108 630 000	99	33.4	17 910 000	99	5.5	0.16	90 720 000	99	27.9	0.84
1941—1942	123 540 000	112	37.9	21 500 000	119	6.6	0.17	101 840 000	111	31.3	0.83
1942—1943	100 110 000	91	30.7	15 650 000	87	4.8	0.16	84 480 000	92	25.9	0.84
1943—1944	100 350 000	91	30.8	15 650 000	87	4.8	0.16	84 700 000	92	26.0	0.84
1944—1945	132 590 000	121	40.7	23 780 000	132	7.3	0.18	108 810 000	119	33.4	0.82
5 YEARS AVERAGE	113 040 000	103	34.7	18 890 000	105	5.8	0.17	94 110 000	103	28.9	0.83
1945—1946	99 980 000	91	30.7	15 630 000	87	4.8	0.16	84 350 000	92	25.9	0.84
1946—1947	138 010 000	126	42.4	25 080 000	139	7.7	0.18	112 930 000	123	34.7	0.82
1947—1948	116 110 000	106	35.6	19 540 000	108	6.0	0.17	96 570 000	105	29.6	0.83
1948—1949	80 370 000	73	24.7	10 750 000	60	3.3	0.13	69 620 000	76	21.4	0.87
1949—1950	121 380 000	111	37.3	20 840 000	115	6.4	0.17	100 540 000	110	30.9	0.83
5 YEARS AVERAGE	111 170 000	101	34.1	18 370 000	102	5.6	0.16	92 800 000	101	28.5	0.84
1950—1951	113 970 000	104	35.0	19 220 000	106	5.9	0.17	94 750 000	103	29.1	0.83
1651—1952	128 680 000	117	39.5	22 800 000	126	7.0	0.18	105 880 000	116	32.5	0.82
1952—1953	81 800 000	75	25.1	11 070 000	61	3.4	0.14	70 730 000	77	21.7	0.86
1953—1954	89 840 000	82	27.6	13 030 000	72	4.0	0.14	76 810 000	84	23.6	0.86
1954—1955	109 950 000	100	33.6	18 310 000	101	5.6	0.17	91 640 000	100	28.0	0.83
5 YEARS AVERAGE	104 850 000	96	32.2	16 890 000	93	5.2	0.16	87 960 000	96	27.0	0.84
15 YEARS AVERAGE	109 670 000	100	33.7	18 050 000	100	5.5	0.16	91 620 000	100	28.2	0.84
1955—1956	156 010 000	142	47.9	29 800 000	165	9.1	0.19	126 210 000	138	38.8	0.81
1956—1957	122 870 000	112	37.7	19 440 000	108	6.0	0.16	103 430 000	113	31.7	0.84
1957—1958	113 130 000	103	34.7	18 500 000	102	5.7	0.16	94 630 000	103	29.0	0.84
1958—1959	94 650 000	86	29.1	14 360 000	80	4.4	0.15	80 290 000	88	24.7	0.85
1959—1960											
5 YEARS AVERAGE											
MAXIMUM	156 010 000	142	47.9	29 800 000	165	9.1	0.19	126 210 000	138	38.8	0.81
MINIMUM	80 370 000	73	24.7	10 750 000	60	3.3	0.13	69 620 000	76	21.4	0.87

TABLE XI

RUFIJI BASIN SURVEY - HYDROLOGICAL SECTION.

RAINFALL, RUN-OFF AND LOSS OF WATER

OBSERVED AND SYNTHETIC YEARLY VALUES.

RIVER Little Ruaha STATION Iringa No. 1kA2 CATCHMENT AREA 1127 SQ. MILES

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL			RUN-OFF				LOSS OF WATER			
	ACRE FEET	% OF MEAN	INCHES	ACRE FEET	% OF MEAN	INCHES	RUN OFF COEFFICIENT	ACRE FEET	% OF MEAN	INCHES	LOSS COEFFICIENT
1940—1941	2 154 000	100	35.8	432 000	97	7.2	0.20	1 722 000	101	28.6	0.80
1941—1942	2 625 000	122	43.7	625 000	141	10.4	0.24	2 000 000	117	33.3	0.76
1942—1943	2 145 000	100	35.7	432 000	97	7.2	0.20	1 715 000	100	28.5	0.80
1943—1944	1 885 000	88	31.3	342 000	77	5.7	0.18	1 541 000	90	25.6	0.82
1944—1945	3 017 000	140	50.2	811 000	183	13.5	0.27	2 206 000	129	36.7	0.73
5 YEARS AVERAGE	2 365 000	110	39.4	528 000	119	8.8	0.22	1 837 000	107	30.6	0.78
1945—1946	1 897 000	88	31.6	348 000	78	5.8	0.18	1 549 000	91	25.8	0.82
1946—1947	2 438 000	113	40.6	553 000	125	9.2	0.23	1 885 000	110	31.4	0.77
1947—1948	2 283 000	106	38.0	487 000	110	8.1	0.21	1 796 000	105	29.9	0.79
1948—1949	1 567 000	73	26.1	246 000	55	4.1	0.16	1 321 000	77	22.0	0.84
1949—1950	1 642 000	76	27.3	270 000	61	4.5	0.16	1 372 000	80	22.8	0.84
5 YEARS AVERAGE	1 965 000	91	32.7	381 000	86	6.3	0.19	1 584 000	93	26.4	0.81
1950—1951	2 197 000	102	36.6	451 000	102	7.5	0.20	1 746 000	102	29.1	0.80
1651—1952	2 530 000	118	42.1	601 000	135	10.0	0.24	1 929 000	113	32.1	0.76
1952—1953	1 858 000	86	30.9	336 000	76	5.6	0.18	1 522 000	89	25.3	0.82
1953—1954	2 107 000	98	35.1	420 000	95	7.0	0.20	1 687 000	99	28.1	0.80
1954—1955	1 922 000	89	32.0	301 092	68	5.0	0.16	1 621 000	95	27.0	0.84
5 YEARS AVERAGE	2 123 000	99	35.3	422 000	95	7.0	0.20	1 701 000	100	28.3	0.80
15 YEARS AVERAGE	2 151 000	100	35.6	444 000	100	7.4	0.21	1 707 000	100	28.2	0.79
1955—1956	2 460 000	114	40.5	567 638	128	9.4	0.23	1 892 362	111	31.1	0.77
1956—1957	2 637 000	123	43.9	574 172	129	9.6	0.22	2 062 828	121	34.3	0.78
1957—1958	2 136 000	99	35.6	495 293	112	8.2	0.23	1 640 707	96	27.4	0.77
1958—1959	2 011 000	93	33.5	382 510	86	6.4	0.19	1 628 490	95	27.1	0.81
1959—1960											
5 YEARS AVERAGE											
MAXIMUM	3 017 000	140	50.2	811 000	183	13.5	0.27	2 206 000	129	36.7	0.73
MINIMUM	1 567 000	73	26.1	246 000	55	4.1	0.16	1 321 000	77	22.0	0.84

TABLE XI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION.

RAINFALL, RUN-OFF AND LOSS OF WATER

OBSERVED AND SYNTHETIC YEARLY VALUES

RIVER Great Ruaha STATION Kidatu No. 1KA3 CATCHMENT AREA 30905 SQ. MILES

HYDROLOGICAL YEAR 1/11 -31/10	RAINFALL			RUN-OFF				LOSS OF WATER			
	ACRE FEET	%OF MEAN	INCHES	ACRE FEET	%OF MEAN	INCHES	RUN OFF COEFFICIENT	ACRE FEET	%OF MEAN	INCHES	LOSS COEFFICIENT
1940—1941	39 292 000	107	23.9	2 650 000	110	1.60	0.067	36 662 000	107	22.30	0.933
1941—1942	45 000 000	122	27.3	3 450 000	144	2.08	0.076	41 570 000	121	25.22	0.924
1942—1943	32 917 000	90	20.0	1 880 000	79	1.14	0.057	31 037 000	90	18.86	0.943
1943—1944	31 800 000	87	19.3	1 750 000	73	1.06	0.055	30 050 000	87	18.24	0.945
1944—1945	38 585 000	105	23.4	2 520 000	105	1.53	0.065	36 065 000	105	21.87	0.935
5 YEARS AVERAGE	34 518 000	102	22.8	2 440 000	102	1.48	0.065	35 078 000	102	21.32	0.935
1945—1946	34 167 000	93	20.7	1 980 000	83	1.20	0.058	32 187 000	94	19.50	0.942
1946—1947	50 375 000	137	30.6	4 330 000	181	2.63	0.086	46 045 000	134	27 97	0.914
1947—1948	41 708 000	113	25.3	2 930 000	123	1.78	0.070	38 778 000	113	23.52	0.930
1948—1949	25 500 000	69	15.5	1 150 000	48	0.70	0.045	24 350 000	71	14.80	0.955
1949—1950	39 883 000	109	24.2	2 700 000	113	1.64	0.068	37 183 000	108	22.56	0.932
5 YEARS AVERAGE	38 327 000	104	23.3	2 620 000	110	1.59	0.068	35 707 000	104	21.71	0.932
1950—1951	39 812 000	108	24.2	2 700 000	113	1.64	0.068	37 112 000	108	22.56	0.932
1651—1952	42 916 000	117	26.1	3 130 000	131	1.90	0.073	39 786 000	116	24.20	0.927
1952—1953	25 916 000	71	15.7	1 190 000	50	0.72	0.046	24 726 000	72	14.98	0.954
1953—1954	27 083 000	74	16.4	1 280 000	54	0.78	0.048	25 803 000	75	15.62	0.952
1954- 1955	36 416 000	99	22.1	2 190 000	92	1.33	0.060	34 226 000	100	20.77	0.940
5 YEARS AVERAGE	34 429 000	94	20.9	2 100 000	88	1.27	0.061	32 329 000	94	19.63	0.939
15 YEARS AVERAGE	36 758 000	100	22.3	2 386 000	100	1.45	0.065	34 372 000	100	20.85	0.935
1955—1956	52 503 000	143	31.9	4 830 000	202	2.93	0.092	47 673 000	139	28.97	0.908
1956—1957	46 878 000	128	28.5	3 640 000	152	2.21	0.078	43 238 000	126	26.29	0.922
1957—1958	41 692 000	113	25.3	2 990 000	125	1.82	0.072	38 702 000	113	23.48	0.928
1958—1959	35 867 000	98	21.8	2 250 000	94	1.37	0.063	33 617 000	98	20.43	0.937
1959 - 1960											
5 YEARS AVERAGE											
MAXIMUM	52 503 000	143	31.9	4 830 000	202	2.93	0.092	47 673 000	139	28.97	0.908
MINIMUM	25 500 000	69	15.5	1 150 000	48	0.70	0.005	24 350 000	71	14.80	0.955

TABLE XI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION.

RAINFALL, RUN-OFF AND LOSS OF WATER

OBSERVED AND SYNTHETIC YEARLY VALUES.

RIVER Great Ruaha STATION Ibuyuni No. 1KA4 CATCHMENT AREA 28774 SQ. MILES

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL			RUN-OFF				LOSS OF WATER			
	ACRE FEET	%OF MEAN	INCHES	ACRE FEET	%OF MEAN	INCHES	RUN OFF COEFFICIENT	ACRE FEET	%OF MEAN	INCHES	LOSS COEFFICIENT
1940—1941	36 217 000	107	23.6	1 840 000	107	1.20	0.051	34 377 000	107	22.4	0.949
1941—1942	41 129 000	122	26.8	2 454 000	143	1.60	0.060	38 675 000	120	25.2	0.940
1942—1943	29 925 000	88	19.5	1 227 000	72	0.80	0.041	28 698 000	89	18.7	0.959
1943—1944	29 465 000	87	19.2	1 227 000	72	0.80	0.042	28 238 000	88	18.4	0.958
1944—1945	35 296 000	104	23.0	1 840 000	107	1.20	0.052	33 456 000	104	21.8	0.948
5 YEARS AVERAGE	34 406 000	102	22.4	1 718 000	100	1.12	0.050	32 688 000	102	21.3	0.950
1945—1946	32 380 000	96	21.1	1 534 000	90	1.00	0.047	30 846 000	96	20.1	0.953
1946—1947	46 192 000	136	30.1	3 221 000	188	2.10	0.070	42 971 000	134	28.0	0.930
1947—1948	37 905 000	112	24.7	2 147 000	125	1.40	0.057	35 758 000	111	23.3	0.943
1948—1949	24 400 000	72	15.9	920 000	54	0.60	0.038	23 480 000	73	15.3	0.962
1949—1950	36 831 000	109	24.0	1 994 000	116	1.30	0.054	34 837 000	108	22.7	0.946
5 YEARS AVERAGE	35 542 000	105	23.2	1 963 000	115	1.28	0.055	33 579 000	105	21.9	0.945
1950—1951	36 370 000	107	23.7	1 994 000	116	1.30	0.055	34 376 000	107	22.4	0.945
1651—1952	39 593 000	117	25.8	2 300 000	134	1.50	0.058	37 293 000	116	24.3	0.942
1952—1953	24 400 000	72	15.9	920 000	54	0.60	0.038	23 480 000	73	15.3	0.962
1953—1954	24 861 000	73	16.2	920 000	54	0.60	0.037	23 941 000	74	15.6	0.963
1954—1955	32 687 000	97	21.3	1 140 000	67	0.74	0.034	31 547 000	98	20.6	0.966
5 YEARS AVERAGE	31 582 000	93	20.6	1 455 000	85	0.95	0.045	30 127 000	94	19.7	0.955
15 YEARS AVERAGE	33 845 000	100	22.1	1 712 000	100	1.12	0.050	32 131 000	100	21.0	0.950
1955—1956	47 419 000	140	30.9	3 670 000	214	2.39	0.077	43 749 000	136	28.5	0.923
1956—1957	42 600 000	126	27.8	2 710 000	158	1.77	0.064	39 890 000	124	26.0	0.936
1957—1958	39 593 000	117	25.8	2 230 000	130	1.45	0.055	37 363 000	116	24.4	0.945
1958—1959	31 460 000	93	20.5	1 750 000	102	1.14	0.055	29 710 000	92	19.4	0.945
1959 – 1960											
5 YEARS AVERAGE											
MAXIMUM	47 419 000	140	30.9	3 670 000	214	2.39	0.077	43 749 000	136	28.5	0.923
MINIMUM	24 400 000	72	15.9	929 000	54	0.60	0.038	23 480 000	73	15.3	0.962

TABLE XI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION.

RAINFALL, RUN-OFF AND LOSS OF WATER

OBSERVED AND SYNTHETIC YEARLY VALUES.

RIVER Great Ruaha STATION Mtera No. 1KA5 CATCHMENT AREA 26254 SQ MILES

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL			RUN-OFF				LOSS OF WATER			
	ACRE FEET	%OF MEAN	INCHES	ACRE FEET	%OF MEAN	INCHES	RUN OFF COEFFICIENT	ACRE FEET	%OF MEAN	INCHES	LOSS COEFFICIENT
1940—1941	33 605 000	112	24.0	2 099 000	127	1.50	0.063	31 506 000	111	22.50	0.937
1941—1942	35 285 000	118	25.2	2 239 000	135	1.60	0.063	33 046 000	117	23.60	0.937
1942—1943	25 624 000	86	18.3	1 119 000	68	0.80	0.044	24 505 000	87	17.50	0.956
1943—1944	26 604 000	89	19.0	1 259 000	76	0.90	0.047	25 345 000	90	18.10	0.953
1944—1945	31 085 000	104	22.2	1 819 000	110	1.30	0.059	29 266 000	105	20.90	0.941
5 YEARS AVERAGE	30 441 000	102	21.8	1 707 000	105	1.22	0.056	28 734 000	102	20.58	0.944
1945—1946	29 404 000	98	21.0	1 559 000	95	1.10	0.052	27 865 000	99	19.90	0.948
1946—1947	42 006 000	140	30.0	3 218 000	194	2.30	0.077	38 788 000	137	27.70	0.923
1947—1948	31 645 000	106	22.6	1 819 000	110	1.30	0.058	29 826 000	105	21.30	0.942
1948—1949	21 003 000	70	15.0	700 000	42	0.50	0.033	20 303 000	72	14.50	0.967
1949—1950	29 544 000	99	21.1	1 539 000	95	1.10	0.052	28 005 000	99	20.00	0.948
5 YEARS AVERAGE	30 720 000	103	22.0	1 763 000	107	1.26	0.057	28 957 000	102	20.74	0.943
1950—1951	34 305 000	115	24.5	2 099 000	127	1.50	0.061	32 206 000	114	23.00	0.939
1651—1952	38 646 000	129	27.6	2 799 000	169	2.00	0.072	35 847 000	127	25.60	0.928
1952—1953	20 443 000	68	14.6	700 000	42	0.50	0.034	19 743 000	70	14.10	0.966
1953—1954	21 283 000	71	15.2	840 000	51	0.60	0.039	20 443 000	72	14.60	0.961
1954—1955	28 423 000	95	20.3	1 030 000	62	0.74	0.036	27 393 000	97	19.56	0.964
5 YEARS AVERAGE	28 620 000	96	20.5	1 494 000	90	1.07	0.052	27 126 000	96	19.43	0.948
15 YEARS AVERAGE	29 927 000	100	21.4	1,655 000	100	1.18	0.055	28 272 000	100	20.22	0.945
1955—1956	43 267 000	145	30.9	3 390 000	205	2.42	0.078	39 877 000	141	28.48	0.922
1956—1957	37 806 000	126	27.0	2 650 000	160	1.89	0.070	35 156 000	124	25.11	0.930
1957—1958	31 785 000	106	22.7	2 090 000	126	1.49	0.066	29 695 000	105	21.21	0.934
1958—1959	28 273 000	94	20.2	1 800 000	109	1.29	0.064	26 473 000	94	18.91	0.936
1959—1960											
5 YEARS AVERAGE											
MAXIMUM	43 267 000	145	30.9	3 390 000	205	2.42	0.078	39 877 000	141	28.48	0.922
MINIMUM	20 443 000	68	14.6	700 000	42	0.50	0.034	19 743 000	70	14.10	0.966

TABLE XI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION.

RAINFALL, RUN-OFF AND LOSS OF WATER

OBSERVED AND SYNTHETIC YEARLY VALUES.

RIVER Great Ruaha STATION Gt. North Road (Chimala) No. 1KA8 CATCHMENT AREA 328 SQ. MILES

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL			RUN-OFF				LOSS OF WATER			
	ACRE FEET	%OF MEAN	INCHES	ACRE FEET	%OF MEAN	INCHES	RUN OFF COEFFICIENT	ACRE FEET	%OF MEAN	INCHES	LOSS COEFFICIENT
1940—1941	782 000	112	44.7	278 000	117	15.9	0.36	504 000	109	28.8	0.64
1941—1942	880 000	126	50.3	330 000	139	18.9	0.38	550 000	119	31.4	0.62
1942—1943	634 000	90	36.3	201 000	84	11.5	0.32	433 000	94	24.8	0.68
1943—1944	674 000	96	38.6	222 000	93	12.7	0.33	452 000	98	25.9	0.67
1944—1945	844 000	121	48.3	311 000	131	17.8	0.37	533 000	115	30.5	0.63
5 YEARS AVERAGE	763 000	109	43.6	268 000	113	15.3	0.35	495 000	107	28.3	0.65
1945—1946	847 000	121	48.4	313 000	132	17.9	0.37	534 000	116	30.5	0.63
1946—1947	737 000	105	42.2	255 000	107	14.6	0.35	482 000	104	27.6	0.65
1947—1948	680 000	97	38.9	224 000	94	12.8	0.33	456 000	99	26.1	0.67
1948—1949	423 000	60	24.2	112 000	47	6.4	0.26	311 000	67	17.8	0.74
1949—1950	629 000	90	36.0	199 000	84	11.4	0.32	430 000	93	24.6	0.68
5 YEARS AVERAGE	663 000	95	37.9	221 000	93	12.6	0.33	442 000	96	25.3	0.67
1950—1951	790 000	113	45.2	281 000	118	16.1	0.36	509 000	110	29.1	0.64
1651—1952	745 000	106	42.6	259 000	109	14.8	0.35	486 000	105	27.8	0.65
1952—1953	473 000	68	27.1	131 000	55	7.5	0.28	342 000	74	19.6	0.72
1953—1954	659 000	94	37.7	213 000	89	12.2	0.32	446 000	97	25.5	0.68
1954—1955	710 000	101	40.6	236 737	99	13.5	0.33	473 263	102	27.1	0.67
5 YEARS AVERAGE	675 000	96	38.6	224 000	94	12.8	0.33	451 000	98	25.8	0.67
15 YEARS AVERAGE	700 000	100	40.0	238 000	100	13.6	0.34	462 000	100	26.4	0.66
1955—1956	1 050 000	150	60.0	416 000	175	23.8	0.40	633 992	137	36.2	0.60
1956—1957	944 000	135	54.0	367 673	154	21.0	0.39	576 327	125	33.0	0.61
1957—1958	858 000	123	49.1	324 482	136	18.5	0.38	533 518	115	30.6	0.62
1958—1959	738 000	105	42.2	440 871	185	25.2	0.58	297 129	64	17.0	0.42
1959 – 1960											
5 YEARS AVERAGE											

NOTE: The last year does not follow the general correspondence, which is probably due to higher rainfall than computed here.

MAXIMUM	1 050 000	150	60.0	440 871	185	25.2	-	633 992	137	36.2	0.60
MINIMUM	423 000	60	24.2	112 000	47	6.4	0.26	311 000	67	17.8	0.74

TABLE XI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION.

RAINFALL, RUN-OFF AND LOSS OF WATER

OBSERVED AND SYNTHETIC YEARLY VALUES.

RIVER Kimani STATION Great North Road No. 1KA9 CATCHMENT AREA 173 SQ. MILES

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL			RUN-OFF				LOSS OF WATER			
	ACRE FEET	%OF MEAN	INCHES	ACRE FEET	%OF MEAN	INCHES	RUN OFF COEFFICIENT	ACRE FEET	%OF MEAN	INCHES	LOSS COEFFICIENT
1940—1941	327 000	107	35.5	142 000	106	15.4	0.45	185 000	107	20.1	0.57
1941—1942	370 000	120	40.1	161 000	120	17.5	0.44	209 000	121	22.6	0.56
1942—1943	283 000	92	30.7	123 000	92	13.3	0.43	160 000	92	17.4	0.57
1943—1944	337 000	110	36.5	148 000	110	16.0	0.44	189 000	109	20.5	0.56
1944—1945	442 000	144	47.9	192 000	143	20.8	0.43	250 000	144	27.1	0.57
5 YEARS AVERAGE	352 000	115	38.1	153 000	114	16.6	0.44	199 000	115	21.5	0.56
1945—1946	345 000	112	37.4	150 000	112	16.3	0.44	195 000	113	21.1	0.56
1946—1947	309 000	101	33.5	135 000	101	14.6	0.44	174 000	101	18.9	0.56
1947—1948	263 000	86	28.5	113 000	84	12.3	0.43	150 000	87	16.2	0.57
1948—1949	194 000	63	21.0	84 000	63	9.1	0.43	110 000	64	11.9	0.57
1949—1950	336 000	109	36.4	147 000	110	15.9	0.44	189 000	109	20.5	0.56
5 YEARS AVERAGE	289 000	94	31.3	126 000	94	13.6	0.43	163 000	94	17.7	0.57
1950—1951	307 000	100	33.3	137 000	102	14.5	0.44	170 000	98	18.8	0.56
1651—1952	247 000	80	26.8	107 000	80	11.6	0.43	140 000	81	15.2	0.57
1952—1953	203 000	66	22.0	89 000	66	9.6	0.44	114 000	66	12.4	0.56
1953—1954	281 000	92	30.5	123 000	92	13.3	0.44	158 000	91	17.2	0.56
1954—1955	368 000	120	39.9	162 509	121	17.6	0.44	205 691	119	22.3	0.56
5 YEARS AVERAGE	281 000	91	30.5	124 000	92	13.4	0.44	157 000	91	17.1	0.56
15 YEARS AVERAGE	307 000	100	33.3	134 000	100	14.5	0.44	173 000	100	18.8	0.56
1955—1956	586 000	191	63.6	257 153	192	27.9	0.44	328 847	190	35.7	0.56
1956—1957	432 000	141	46.8	187 187	140	20.3	0.43	244 813	142	26.5	0.57
1957—1958	356 000	116	38.6	154 612	115	16.8	0.44	201 388	116	21.8	0.56
1958—1959	337 000	110	36.5	164 311	123	17.8	0.49	172 689	100	18.7	0.51
1959 – 1960											
5 YEARS AVERAGE											
MAXIMUM	586 000	191	63.6	257 153	192	27.9	0.44	328 847	190	35.7	0.56
MINIMUM	194 000	63	21.0	84 000	63	9.1	0.43	110 000	64	11.9	0.57

TABLE XI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION.

RAINFALL, RUN-OFF AND LOSS OF WATER

OBSERVED AND SYNTHETIC YEARLY VALUES.

RIVER Mbarali STATION Igawa No. 1KA11 CATCHMENT AREA 619 SQ. MILES

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL			RUN-OFF				LOSS OF WATER			
	ACRE FEET	%OF MEAN	INCHES	ACRE FEET	%OF MEAN	INCHES	RUN OFF COEFFICIENT	ACRE FEET	%OF MEAN	INCHES	LOSS COEFFICIENT
1940—1941	1 240 000	113	37.6	409 000	115	12.4	0.33	831 000	112	25.2	0.67
1941—1942	1 141 000	104	34.6	370 000	104	11.2	0.32	771 000	104	23.4	0.68
1942—1943	1 080 000	98	32.7	343 000	96	10.4	0.32	737 000	99	22.3	0.68
1943—1944	1 013 000	92	30.7	317 000	89	9.6	0.31	696 000	93	21.1	0.69
1944—1945	1 570 000	143	47.6	574 000	161	17.4	0.37	996 000	134	30.2	0.63
5 YEARS AVERAGE	1 209 000	110	36.6	403 000	113	12.2	0.33	806 000	108	24.4	0.67
1945—1946	1 243 000	113	37.7	412 000	115	12.5	0.33	831 000	112	25.2	0.67
1946—1947	1 140 000	104	34.6	370 000	104	11.2	0.32	770 000	103	23.4	0.68
1947—1948	1 114 000	101	33.8	356 000	100	10.8	0.32	758 000	102	23.0	0.68
1948—1949	748 000	68	22.7	224 000	63	6.8	0.30	524 000	70	15.9	0.70
1949—1950	1 118 000	102	33.9	360 000	101	10.9	0.32	758 000	102	23.0	0.68
5 YEARS AVERAGE	1 072 000	97	32.5	344 000	96	10.4	0.32	728 000	98	22.1	0.68
1950—1951	1 119 000	102	33.9	360 000	101	10.9	0.32	759 000	102	23.0	0.68
1651—1952	1 240 000	113	37.6	409 000	115	12.4	0.33	831 000	112	25.2	0.67
1952—1953	680 000	62	20.6	201 000	56	6.1	0.30	479 000	64	14.5	0.70
1953—1954	1 003 000	91	30.4	313 000	88	9.5	0.31	690 000	93	20.9	0.69
1954—1955	1 067 000	97	32.3	357 999	95	10.2	0.32	729 001	98	22.1	0.68
5 YEARS AVERAGE	1 022 000	93	31.0	324 000	91	9.8	0.32	698 000	94	21.2	0.68
15 YEARS AVERAGE	1 101 000	100	33.4	357 000	100	10.8	0.32	744 000	100	22.6	0.68
1955—1956	1 408 000	129	42.7	494 340	138	15.0	0.35	913 660	123	27.7	0.65
1956—1957	1 308 000	119	39.6	410 650	115	12.4	0.31	897 370	121	27.2	0.69
1957—1958	1 056 000	94	31.4	332 506	93	10.1	0.32	703 494	95	21.3	0.68
1958—1959	1 099 000	100	33.3	332 352	93	10.1	0.30	766 648	103	23.2	0.70
1959 - 1960											
5 YEARS AVERAGE											
MAXIMUM	1 570 000	143	47.6	574 000	161	17.4	0.37	996 000	134	30.2	0.63
MINIMUM	680 000	62	20.6	201 000	56	6.1	0.30	479 000	64	14.5	0.70

TABLE XI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION.

RAINFALL, RUN-OFF AND LOSS OF WATER

OBSERVED AND SYNTHETIC YEARLY VALUES.

RIVER Halali STATION Iyayi D/S No. 1KA12 CATCHMENT AREA 302 SQ. MILES

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL			RUN-OFF				LOSS OF WATER			
	ACRE FEET	%OF MEAN	INCHES	ACRE FEET	%OF MEAN	INCHES	RUN OFF COEFFICIENT	ACRE FEET	%OF MEAN	INCHES	LOSS COEFFICIENT
1940—1941	585 000	118	35.8	97 000	128	6.0	0.17	488 000	116	29.8	0.83
1941—1942	644 000	130	40.0	121 000	159	7.5	0.19	523 000	125	32.5	0.81
1942—1943	435 000	88	27.0	60 000	79	3.7	0.14	375 000	89	23.3	0.86
1943—1944	416 000	84	25.8	53 000	70	3.3	0.13	363 000	87	22.5	0.83
1944—1945	693 000	140	43.0	137 000	180	8.5	0.20	556 000	133	34.5	0.80
5 YEARS AVERAGE	555 000	112	34.4	94 000	123	5.8	0.17	461 000	110	28.6	0.83
1945—1946	495 000	100	30.7	72 000	95	4.5	0.15	423 000	101	26.2	0.85
1946—1947	464 000	94	28.8	66 000	87	4.1	0.14	398 000	95	24.7	0.86
1947—1948	467 000	94	29.0	66 000	87	4.1	0.14	401 000	96	24.9	0.86
1948—1949	336 000	68	20.9	35 000	46	2.2	0.11	301 000	72	18.7	0.89
1949—1950	561 000	113	34.8	92 000	121	5.7	0.16	469 000	112	29.1	0.84
5 YEARS AVERAGE	465 000	94	28.8	66 000	87	4.1	0.14	399 000	95	24.7	0.86
1950—1951	538 000	109	33.4	85 000	112	5.3	0.16	453 000	108	28.1	0.84
1651—1952	563 000	114	34.9	92 000	121	5.7	0.13	471 000	135	29.2	0.84
1952—1953	277 000	56	17.2	30 000	39	1.8	0.10	247 000	59	15.4	0.90
1953—1954	484 000	98	30.0	71 000	93	4.4	0.15	413 000	99	25.6	0.85
1954—1955	466 000	94	28.9	66 000	87	4.1	0.14	400 000	95	24.8	0.86
5 YEARS AVERAGE	466 000	94	28.9	69 000	90	4.3	0.15	397 000	95	24.6	0.85
15 YEARS AVERAGE	495 000	100	30.7	76 000	100	4.7	0.15	419 000	100	26.0	0.85
1955—1956	614 000	124	38.1	109 412	144	6.8	0.18	504 588	120	31.3	0.82
1956—1957	587 000	119	36.5	63 574	84	3.9	0.11	523 426	125	32.6	0.89
1957—1958	522 000	106	32.4	93 418	123	5.8	0.18	428 582	102	26.6	0.82
1958—1959	485 000	98	30.1	66 873	89	4.2	0.14	418 127	100	25.9	0.86
1959 – 1960											
5 YEARS AVERAGE											
MAXIMUM	693 000	140	43.0	137 000	180	8.5	0.20	556 000	133	34.5	0.80
MINIMUM	277 000	56	17.2	30 000	39	1.8	0.10	247 000	59	15.4	0.90

TABLE XI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION.

RAINFALL, RUN-OFF AND LOSS OF WATER

OBSERVED AND SYNTHETIC YEARLY VALUES.

RIVER Ndembera STATION Ilongo No. 1KA15 CATCHMENT AREA 404 SQ. MILES

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL			RUN-OFF				LOSS OF WATER			
	ACRE FEET	%OF MEAN	INCHES	ACRE FEET	%OF MEAN	INCHES	RUN OFF COEFFICIENT	ACRE FEET	%OF MEAN	INCHES	LOSS COEFFICIENT
1940—1941	646 000	90	30.0	73 000	77	3.4	0.11	573 000	92	26.6	0.89
1941—1942	764 000	106	35.5	101 000	106	4.7	0.13	663 000	106	30.8	0.87
1942—1943	689 000	96	32.0	82 000	86	3.8	0.12	607 000	97	28.2	0.88
1943—1944	650 000	90	30.2	73 000	77	3.4	0.11	577 000	92	26.8	0.89
1944—1945	1 016 000	141	47.2	174 000	183	8.1	0.17	842 000	135	39.1	0.83
5 YEARS AVERAGE	753 000	104	35.0	101 000	106	4.7	0.13	652 000	104	30.3	0.87
1945—1946	610 000	85	28.3	67 000	71	3.1	0.11	543 000	87	25.2	0.89
1946—1947	850 000	118	39.5	123 000	129	5.7	0.14	727 000	116	33.8	0.86
1947—1948	758 000	105	35.2	101 000	106	4.7	0.13	657 000	105	30.5	0.87
1948—1949	409 000	57	19.0	37 000	39	1.7	0.09	372 000	59	17.3	0.91
1949—1950	730 000	101	33.9	93 000	98	4.3	0.13	637 000	102	29.6	0.87
5 YEARS AVERAGE	671 000	93	31.2	84 000	88	3.9	0.13	587 000	94	27.3	0.87
1950—1951	859 000	119	39.9	125 000	132	5.8	0.15	734 000	117	34.1	0.85
1651—1952	769 000	107	35.7	101 000	106	4.7	0.13	668 000	107	31.0	0.87
1952—1953	476 000	66	22.1	45 000	47	2.1	0.10	431 000	69	20.0	0.90
1953—1954	636 000	88	29.5	71 000	75	3.3	0.11	565 000	90	26.2	0.89
1954—1955	948 000	131	44.0	151 000	159	7.0	0.16	797 000	127	37.0	0.84
5 YEARS AVERAGE	738 000	102	34.3	99 000	104	4.6	0.13	639 000	102	29.7	0.87
15 YEARS AVERAGE	721 000	100	33.5	95 000	100	4.4	0.13	626 000	100	29.1	0.87
1955—1956	905 000	126	42.0	135 053	142	6.3	0.15	769 947	123	35.7	0.85
1956—1957	913 000	127	42.4	142 409	150	6.6	0.16	770 591	123	35.8	0.84
1957—1958	657 000	91	30.5	74 350	78	3.5	0.11	582 650	93	27.0	0.89
1958—1959	864 000	120	40.1	87 870	92	4.1	0.10	776 130	124	36.0	0.90
1959 - 1960											
5 YEARS AVERAGE											
MAXIMUM	1 016 000	141	47.2	174 000	183	8.1	0.17	842 000	135	39.1	0.83
MINIMUM	409 000	57	19.0	37 000	39	1.7	0.09	372 000	59	17.3	0.91

TABLE XI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

RAINFALL, RUN-OFF AND LOSS OF WATER

OBSERVED AND SYNTHETIC YEARLY VALUES.

RIVER Little Ruaha STATION Tosamaganga No. 1KA20 CATCHMENT AREA 1273 SQ. MILES

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL			RUN-OFF				LOSS OF WATER			
	ACRE FEET	%OF MEAN	INCHES	ACRE FEET	%OF MEAN	INCHES	RUN OFF COEFFICIENT	ACRE FEET	%OF MEAN	INCHES	LOSS COEFFICIENT
1940—1941	2 325 000	101	34.3	434 000	99	6.4	0.19	1 891 000	101	27.9	0.81
1941—1942	2 830 000	123	41.7	617 000	141	9.1	0.22	2 213 000	119	32.6	0.78
1942—1943	2 312 000	100	34.1	434 000	99	6.4	0.19	1 878 000	101	27.7	0.81
1943—1944	2 032 000	88	29.9	346 000	79	5.1	0.17	1 686 000	90	24.8	0.83
1944—1945	3 242 000	141	47.8	794 000	181	11.7	0.24	2 448 000	131	36.1	0.76
5 YEARS AVERAGE	2 548 000	111	37.6	525 000	120	7.7	0.20	2 023 000	108	29.9	0.80
1945—1946	2 041 000	89	30.1	353 000	80	5.2	0.17	1 688 000	91	24.9	0.83
1946—1947	2 642 000	115	38.9	543 000	124	8.0	0.21	2 099 000	113	30.9	0.79
1947—1948	2 430 000	106	35.8	468 000	107	6.9	0.19	1 962 000	105	28.9	0.81
1948—1949	1 664 000	72	24.5	237 000	54	3.5	0.14	1 427 000	76	21.0	0.86
1949—1950	1 833 000	80	27.0	285 000	65	4.2	0.16	1 548 000	83	22.8	0.84
5 YEARS AVERAGE	2 122 000	92	31.3	377 000	86	5.6	0.18	1 745 000	94	25.7	0.82
1950—1951	2 354 000	102	34.7	441 000	100	6.5	0.19	1 913 000	103	28.2	0.81
1651—1952	2 741 000	119	40.4	584 000	133	8.6	0.21	2 157 000	116	31.8	0.79
1952—1953	1 883 000	82	27.7	305 000	69	4.5	0.16	1 578 000	85	23.2	0.84
1953—1954	2 100 000	91	31.0	366 000	83	5.4	0.17	1 734 000	93	25.6	0.83
1954—1955	2 117 000	92	31.2	373 000	85	5.5	0.18	1 744 000	94	25.7	0.82
5 YEARS AVERAGE	2 259 000	97	33.0	414 000	94	6.1	0.18	1 825 000	98	26.9	0.82
15 YEARS AVERAGE	2 303 000	100	33.9	439 000	100	6.5	0.19	1 864 000	100	27.4	0.81
1955—1956	2 655 000	115	39.1	561 583	128	8.3	0.21	2 093 417	112	30.8	0.79
1956—1957	2 900 000	126	42.7	570 265	130	8.4	0.20	2 329 735	125	34.3	0.80
1957—1958	2 298 000	100	33.9	475 737	108	7.0	0.21	1 822 263	98	26.9	0.79
1958—1959	2 206 000	96	32.5	368 430	84	5.4	0.17	1 837 570	99	27.1	0.83
1959 — 1960											
5 YEARS AVERAGE											
MAXIMUM	3 242 000	141	47.8	794 000	181	11.7	0.24	2 448 000	131	36.1	0.76
MINIMUM	1 664 000	72	24.5	237 000	54	3.5	0.14	1 427 000	76	21.0	0.86

TABLE XI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION.

RAINFALL, RUN-OFF AND LOSS OF WATER

OBSERVED AND SYNTHETIC YEARLY VALUES

RIVER Little Ruaha STATION Ihimbu No. 1KA21 CATCHMENT AREA 957 SQ. MILES

HYDROLOGICAL YEAR 1/11 -31/10	RAINFALL			RUN-OFF				LOSS OF WATER			
	ACRE FEET	%OF MEAN	INCHES	ACRE FEET	%OF MEAN	INCHES	RUN OFF COEFFICIENT	ACRE FEET	%OF MEAN	INCHES	LOSS COEFFICIENT
1940—1941	1 900 000	102	37.2	398 000	101	7.8	0.21	1 502 000	102	29.4	0.79
1941—1942	2 200 000	118	43.1	520 000	132	10.2	0.24	1 680 000	115	32.9	0.76
1942—1943	1 861 000	100	36.5	383 000	97	7.5	0.21	1 478 000	101	29.0	0.79
1943—1944	1 607 000	86	31.5	296 000	75	5.8	0.18	1 311 000	89	25.7	0.82
1944—1945	2 691 000	145	52.8	750 000	190	14.7	0.28	1 941 000	132	38.1	0.72
5 YEARS AVERAGE	2 052 000	110	40.2	469 000	119	9.2	0.23	1 583 000	108	31.0	0.77
1945—1946	1 581 000	85	31.0	286 000	73	5.6	0.18	1 295 000	88	25.4	0.82
1946—1947	2 217 000	119	43.5	530 000	135	10.4	0.24	1 687 000	115	33.1	0.76
1947—1948	2 033 000	109	39.9	454 000	115	8.9	0.22	1 579 000	108	31.0	0.78
1948—1949	1 346 000	72	26.4	214 000	54	4.2	0.16	1 132 000	77	22.2	0.84
1949—1950	1 500 000	81	29.4	265 000	67	5.2	0.18	1 235 000	84	24.2	0.82
5 YEARS AVERAGE	1 735 000	93	34.0	350 000	89	6.9	0.20	1 385 000	94	27.1	0.80
1950—1951	1 775 000	95	34.8	357 000	91	7.0	0.20	1 418 000	97	27.8	0.80
1651—1952	2 038 000	110	40.0	454 000	115	8.9	0.22	1 584 000	108	31.1	0.78
1952—1953	1 575 000	85	30.9	286 000	73	5.6	0.18	1 289 000	88	25.3	0.82
1953—1954	1 708 000	92	33.5	332 000	84	6.5	0.19	1 376 000	94	27.0	0.81
1954—1955	1 867 000	100	36.6	388 000	98	7.6	0.21	1 479 000	101	29.0	0.79
5 YEARS AVERAGE	1 793 000	96	35.1	363 000	92	7.1	0.20	1 430 000	98	28.0	0.80
15 YEARS AVERAGE	1 860 000	100	36.5	394 000	100	7.6	0.21	1 466 000	100	28.9	0.79
1955—1956	2 091 000	112	41.0	474 000	120	9.3	0.23	1 617 000	110	31.7	0.77
1956—1957	2 385 000	128	46.8	478 192	121	9.4	0.20	1 906 808	130	37.4	0.80
1957—1958	1 866 000	100	36.6	439 649	112	8.6	0.23	1 426 351	97	28.0	0.77
1958—1959	1 753 000	94	34.4	334 589	85	6.6	0.19	1 418 411	97	27.8	0.81
1959 —1960											
5 YEARS AVERAGE											
MAXIMUM	2 691 000	145	52.8	750 000	190	14.7	0.28	1 941 000	132	38.1	0.72
MINIMUM	1 346 000	72	26.4	214 000	54	4.2	0.16	1 132 000	77	22.2	0.84

TABLE XI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION.

RAINFALL, RUN-OFF AND LOSS OF WATER

OBSERVED AND SYNTHETIC YEARLY VALUES

RIVER Mtitu STATION Mtitu No. 1KA22 CATCHMENT AREA 172 SQ. MILES

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL			RUN-OFF				LOSS OF WATER			
	ACRE FEET	%OF MEAN	INCHES	ACRE FEET	%OF MEAN	INCHES	RUN OFF COEFFICIENT	ACRE FEET	%OF MEAN	INCHES	LOSS COEFFICIENT
1940—1941	361 000	99	39.4	79 000	96	8.6	0.22	282 000	100	30.8	0.78
1941—1942	459 000	126	50.1	123 000	150	13.4	0.27	336 000	119	36.7	0.73
1942—1943	390 000	107	42.5	91 000	111	9.9	0.23	299 000	106	32.6	0.77
1943—1944	307 000	84	33.5	59 000	72	6.4	0.19	248 000	88	27.1	0.81
1944—1945	504 000	138	55.0	143 000	174	15.6	0.28	361 000	128	39.4	0.72
5 YEARS AVERAGE	404 000	111	44.1	99 000	121	10.8	0.24	305 000	108	33.3	0.76
1945—1946	341 000	93	37.2	72 000	88	7.8	0.21	269 000	95	29.4	0.79
1946—1947	409 000	112	44.6	100 000	122	10.9	0.24	309 000	109	33.7	0.76
1947—1948	422 000	116	46.0	105 000	128	11.5	0.25	317 000	112	34.5	0.75
1948—1949	307 000	84	33.5	59 000	72	6.4	0.19	248 000	88	27.1	0.81
1949—1950	290 000	79	31.6	53 000	65	5.8	0.18	237 000	84	25.8	0.82
5 YEARS AVERAGE	354 000	97	38.6	78 000	95	8.5	0.22	276 000	98	30.1	0.78
1950—1951	350 000	96	38.2	75 000	91	8.2	0.21	275 000	97	30.0	0.79
1651—1952	399 000	109	43.5	95 000	116	10.4	0.24	304 000	107	33.1	0.76
1952—1953	308 000	84	33.6	59.000	72	6.4	0.19	249 000	88	27.2	0.81
1953—1954	290 000	79	31.6	53 000	65	5.8	0.18	237 000	84	25.8	0.82
1954—1955	337 000	92	36.8	70 000	85	7.6	0.21	267 000	94	29.2	0.79
5 YEARS AVERAGE	337 000	92	36.8	70 000	85	7.6	0.21	267 000	94	29.2	0.79
15 YEARS AVERAGE	365 000	100	39.8	82 000	100	8.9	0.22	283 000	100	30.9	0.78
1955—1956	419 000	115	45.7	105 000	128	11.4	0.25	314 000	111	34.3	0.75
1956—1957	333 000	91	36.3	69 000	84	7.5	0.21	264 000	93	28.8	0.79
1957—1958	308 000	84	33.6	95 244	116	10.4	0.31	212 756	75	23.2	0.69
1958—1959	321 000	88	35.0	73 767	90	8.0	0.23	247 233	87	27.0	0.77
1959 - 1960											
5 YEARS AVERAGE											
NOTE: These computations are done by analogy with runoff at Ihimbu and Iwawa as well as with rainfall.											
MAXIMUM	504 000	138	55.0	143 000	174	15.6	0.28	361 000	128	39.4	0.72
MINIMUM	290 000	79	31.6	53 000	65	5.8	0.18	237 000	84	25.8	0.82

TABLE XI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION.

RAINFALL, RUN-OFF AND LOSS OF WATER

OBSERVED AND SYNTHETIC YEARLY VALUES.

RIVER Hukuni STATION Iyayi No. 1KA23 CATCHMENT AREA 118 SQ. MILES

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL			RUN-OFF				LOSS OF WATER			
	ACRE FEET	%OF MEAN	INCHES	ACRE FEET	%OF MEAN	INCHES	RUN OFF COEFFICIENT	ACRE FEET	%OF MEAN	INCHES	LOSS COEFFICIENT
1940—1941	215 000	114	34.2	35 000	121	5.5	0.16	180 000	113	28.7	0.84
1941—1942	250 000	132	39.7	47 000	162	7.4	0.19	203 000	127	32.3	0.81
1942—1943	167 000	88	26.6	23 000	79	3.6	0.14	144 000	90	23.0	0.86
1943—1944	155 000	82	24.6	20 000	69	3.2	0.13	135 000	84	21.4	0.87
1944—1945	272 000	144	43.2	54 000	186	8.6	0.20	218 000	136	34.6	0.80
5 YEARS AVERAGE	212 000	112	33.7	36 000	124	5.7	0.17	176 000	110	28.0	0.83
1945—1946	182 000	96	28.9	26 000	90	4.1	0.14	156 000	97	24.8	0.86
1946—1947	145 000	77	23.0	16 000	55	2.6	0.11	129 000	81	20.4	0.89
1947—1948	183 000	97	29.1	26 000	90	4.1	0.14	157 000	98	25.0	0.86
1948—1949	132 000	70	21.0	14 000	48	2.2	0.10	118 000	74	18.8	0.90
1949—1950	220 000	116	35.0	36 000	124	5.7	0.16	184 000	115	29.3	0.84
5 YEARS AVERAGE	172 000	91	27.3	24 000	83	3.8	0.14	148 000	93	23.5	0.86
1950—1951	205 000	108	32.6	38 000	131	5.0	0.15	167 000	104	27.6	0.85
1651—1952	225 000	119	35.8	31 000	107	6.0	0.17	194 000	121	29.8	0.83
1952—1953	107 000	57	17.0	11 000	38	1.8	0.11	96 000	23	15.2	0.89
1953—1954	188 000	99	29.9	28 000	97	4.4	0.15	160 000	100	25.5	0.85
1954—1955	192 000	102	30.5	28 000	96	4.5	0.15	164 000	102	26.0	0.85
5 YEARS AVERAGE	183 000	97	29.1	27 000	93	4.3	0.15	156 000	97	24.8	0.85
15 YEARS AVERAGE	189 000	100	30.1	29 000	100	4.6	0.15	160 000	100	25.5	0.85
1955—1956	236 000	125	37.5	40 000	138	6.4	0.17	196 000	123	31.1	0.83
1956—1957	217 000	115	34.5	12 730	44	2.0	0.06	204 270	128	32.5	0.94
1957—1958	194 000	103	30.8	35 115	121	5.6	0.18	158 885	99	25.2	0.82
1958—1959	180 000	95	28.6	18 339	63	2.9	0.10	161 661	101	25.7	0.90
1959 - 1960											
5 YEARS AVERAGE											

NOTE: The same rainfall runoff relation curve as for Iyayi D/S is applied in these calculations.

MAXIMUM	272 000	144	43.2	54 000	186	8.6	0.20	218 000	136	34.6	0.80
MINIMUM	107 000	57	17.0	11 000	38	1.8	0.11	96 000	23	15.2	0.89

TABLE XI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION.

RAINFALL, RUN-OFF AND LOSS OF WATER

OBSERVED AND SYNTHETIC YEARLY VALUES.

RIVER Great Ruaha STATION Kisilwa-Mganzipile No. 1KA26 CATCHMENT AREA 13844 SQ. MILES

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL			RUN-OFF				LOSS OF WATER			
	ACRE FEET	%OF MEAN	INCHES	ACRE FEET	%OF MEAN	INCHES	RUN OFF COEFFICIENT	ACRE FEET	%OF MEAN	INCHES	LOSS COEFFICIENT
1940—1941	19 933 000	112	27.0	1 771 000	118	2.40	0.089	18 162 000	112	24.60	0.911
1941—1942	22 834 000	129	30.9	1 919 000	128	2.60	0.084	20 915 000	129	28.30	0.916
1942—1943	15 358 000	87	20.8	1 254 000	84	1.70	0.082	14 104 000	87	19.10	0.918
1943—1944	16 777 000	95	22.7	1 328 000	89	1.80	0.079	15 449 000	95	20.90	0.921
1944—1945	20 092 000	113	27.2	1 623 000	108	2.20	0.081	18 469 000	114	25.00	0.919
5 YEARS AVERAGE	18 999 000	107	25.7	1 579 000	105	2.10	0.082	17 420 000	107	23.60	0.918
1945—1946	17 277 000	97	23.4	1 476 000	98	2.00	0.085	15 801 000	97	21.40	0.915
1946—1947	22 741 000	128	30.8	1 919 000	128	2.60	0.084	20 822 000	128	28.20	0.916
1947—1948	18 902 000	107	25.6	1 623 000	108	2.20	0.086	17 279 000	106	23.40	0.914
1948—1949	11 592 000	65	15.7	959 000	64	1.30	0.083	10 633 000	65	14.40	0.917
1949—1950	17 876 000	101	24.2	1 476 000	98	2.00	0.083	16 400 000	101	22.20	0.917
5 YEARS AVERAGE	17 678 000	100	24.0	1 491 000	99	2.00	0.083	16 187 000	100	22.00	0.917
1950—1951	19 566 000	110	26.5	1 771 000	118	2.40	0.091	17 795 000	110	24.10	0.909
1651—1952	20 231 000	114	27.4	2 066 000	138	2.80	0.102	18 165 000	112	24.60	0.898
1952—1953	11 518 000	65	15.6	959 000	64	1.30	0.083	10 559 000	65	14.30	0.917
1953—1954	14 545 000	82	19.7	1 107 000	74	1.50	0.076	13 438 000	83	18.20	0.924
1954—1955	16 890 000	95	22.9	1 254 000	84	1.70	0.074	15 636 000	96	21.20	0.926
5 YEARS AVERAGE	16 550 000	93	22.4	1 431 000	95	1.90	0.085	15 119 000	93	20.50	0.915
15 YEARS AVERAGE	17 742 000	100	24.0	1 500 000	100	2.00	0.083	16 242 000	100	22.00	0.917
1955—1956	22 003 000	124	29.8	2 361 000	157	3.20	0.107	19 642 000	121	26.60	0.893
1956 1957	24 292 000	137	32.9	2 159 000	144	2.91	0.088	22 133 000	136	29.99	0.912
1957—1958	18 568 000	105	25.2	1 770 000	118	2.39	0.095	16 798 000	103	22.81	0.905
1958—1959	14 830 000	84	20.1	1 528 000	102	2.06	0.102	13 302 000	82	18.04	0.898
1959 —1960											
5 YEARS AVERAGE											
MAXIMUM	24 292 000	137	32.9	2 159 000	144	2.91	0.088	22 133 000	136	29.99	0.912
MINIMUM	11 518 000	65	15.6	959 000	64	1.30	0.083	10 559 000	65	14.30	0.917

TABLE XI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION.

RAINFALL, RUN-OFF AND LOSS OF WATER

OBSERVED AND SYNTHETIC YEARLY VALUES.

RIVER Great Ruaha STATION Mkopule (Hausmann's Bridge) No. 1KA27 CATCHMENT AREA 7700 SQ. MILES

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL			RUN-OFF				LOSS OF WATER			
	ACRE FEET	% OF MEAN	INCHES	ACRE FEET	% OF MEAN	INCHES	RUN OFF COEFFICIENT	ACRE FEET	% OF MEAN	INCHES	LOSS COEFFICIENT
1940—1941	12 813 000	113	31.2	1 477 000	110	3.6	0.115	11 336 000	113	27.6	0.885
1941—1942	13 100 000	115	31.9	1 519 000	113	3.7	0.116	11 581 000	115	28.2	0.884
1942—1943	9 733 000	85	23.7	1 190 000	88	2.9	0.122	8 543 000	85	20.8	0.873
1943—1944	10 760 000	95	26.2	1 272 000	95	3.1	0.118	9 488 000	95	23.1	0.882
1944—1945	13 141 000	115	32.0	1 519 000	113	3.7	0.116	11 622 000	116	28.3	0.884
5 YEARS AVERAGE	11 909 000	105	29.0	1 395 000	104	3.4	0.117	10 514 000	105	25.6	0.883
1945—1946	11 336 000	100	27.6	1 354 000	101	3.3	0.120	9 982 000	99	24.3	0.880
1946—1947	13 880 000	122	33.8	1 560 000	116	3.8	0.112	12 320 000	123	30.0	0.888
1947—1948	11 170 000	98	27.2	1 313 000	98	3.2	0.118	9 857 000	98	24.0	0.882
1948—1949	7 680 000	67	18.7	985 000	73	2.4	0.128	6 695 000	67	16.3	0.872
1949—1950	11 170 000	98	27.2	1 313 000	98	3.2	0.118	9 857 000	98	24.0	0.882
5 YEARS AVERAGE	11 047 000	97	26.9	1 305 000	97	3.2	0.119	9 742 000	97	23.7	0.881
1950—1951	13 225 000	116	32.2	1 519 000	113	3.7	0.115	11 706 000	117	28.5	0.885
1651—1952	13 059 000	115	31.8	1 519 000	113	3.7	0.116	11 540 000	115	28.1	0.884
1952- 1953	7 967 000	70	19.4	1 026 000	73	2.5	0.129	6 941 000	69	16.9	0.871
1953—1954	10 020 000	88	24.4	1 231 000	91	3.0	0.123	8 789 000	88	21.4	0.877
1954—1955	11 716 000	105	28.5	1 395 000	104	3.4	0.119	10 321 000	103	25.1	0.881
5 YEARS AVERAGE	11 197 000	98	27.3	1 338 000	99	3.3	0.121	9 859 000	98	24.0	0.879
15 YEARS AVERAGE	11 385 000	100	27.7	1 346 000	100	3.3	0.119	10 039 000	100	24.4	0.881
1955—1956	14 045 000	123	34.2	1 601 000	119	3.9	0.114	12 444 000	124	30.3	0.886
1956—1957	15 280 000	134	37.2	1 727 000	128	4.2	0.113	13 553 000	135	33.0	0.887
1957—1958	10 390 000	91	25.3	1 275 000	95	3.1	0.123	9 115 000	91	22.2	0.877
1958—1959	9 570 000	84	23.3	1 141 000	85	2.8	0.120	8 429 000	84	20.5	0.880
1959 - 1960											
5 YEARS AVERAGE											
MAXIMUM	15 280 000	134	37.2	1 727 000	128	4.2	0.113	13 553 000	135	33.0	0.887
MINIMUM	7 680 000	67	18.7	985 000	73	2.4	0.128	6 695 000	67	16.3	0.872

TABLE XI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION.

RAINFALL, RUN-OFF AND LOSS OF WATER

OBSERVED AND SYNTHETIC YEARLY VALUES.

RIVER Little Ruaha STATION Mawande No. 1KA31 CATCHMENT AREA 2005 SQ. MILES

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL			RUN-OFF				LOSS OF WATER			
	ACRE FEET	%OF MEAN	INCHES	ACRE FEET	%OF MEAN	INCHES	RUN OFF COEFFICIENT	ACRE FEET	%OF MEAN	INCHES	LOSS COEFFICIENT
1940—1941	3 340 000	101	31.3	449 000	97	4.2	0.13	2 891 000	101	27.1	0.87
1941—1942	4 160 000	125	38.9	663 000	143	6.2	0.16	3 497 000	122	32.7	0.84
1942 —1943	3 500 000	105	32.8	502 000	108	4.7	0.14	2 998 000	105	28.1	0.86
1943—1944	3 000 000	90	28.1	385 000	83	3.6	0.13	2 615 000	91	24.5	0.87
1944—1945	4 590 000	138	42.9	802 000	172	7.5	0.17	3 788 000	133	35.4	0.83
5 YEARS AVERAGE	3 718 000	112	34.8	560 000	120	5.2	0.15	3 158 000	110	29.6	0.85
1945—1946	2 989 000	90	28.0	385 000	83	3.6	0.13	2 604 000	91	24.4	0.87
1946—1947	3 850 000	116	36.0	588 000	126	5.5	0.15	3 262 000	114	30.5	0.85
1947—1948	3 660 000	110	34.2	534 000	115	5.0	0.15	3 126 000	109	29.2	0.85
1948—1949	2 190 000	66	20.5	214 000	46	2.0	0.10	1 976 000	69	18.5	0.90
1949—1950	2 580 000	78	24.1	289 000	62	2.7	0.11	2 291 000	80	21.4	0.89
5 YEARS AVERAGE	3 054 000	92	28.6	402 000	86	3.8	0.13	2 652 000	93	24.8	0.87
1950—1951	3 290 000	99	30.8	449 000	97	4.2	0.14	2 841 000	99	26.6	0.86
1651—1952	3 900 000	117	36.5	598 000	129	5.6	0.15	3 302 000	116	30.9	0.85
1952—1953	2 620 000	79	24.5	299 000	64	2.8	0.11	2 321 000	81	21.7	0.89
1953—1954	3 090 000	93	28.9	406 000	87	3.8	0.13	2 684 000	94	25.1	0.87
1954—1955	3 090 000	93	28.9	406 000	87	3.8	0.13	2 684 000	94	25.1	0.87
5 YEARS AVERAGE	3 198 000	96	28.9	432 000	93	4.0	0.13	2 766 000	97	25.9	0.87
15 YEARS AVERAGE	3 323 000	100	31.1	465 000	100	4.4	0.14	2 858 000	100	26.7	0.86
1955—1956	3 760 000	113	35.2	577 000	124	5.4	0.15	3 183 000	111	29.8	0.85
1956—1957	4 160 000	125	38.9	590 424	127	5.5	0.14	3 739 576	132	33.4	0.86
1957—1958	3 112 000	94	29.1	487 743	105	4.6	0.16	2 624 257	92	24.5	0.84
1958—1959	2 802 000	84	26.2	341 507	73	3.2	0.12	2 460 493	86	23.0	0.88
1959 - 1960											
5 YEARS AVERAGE											
MAXIMUM	4 590 000	138	42.9	802 000	172	7.5	0.17	3 788 000	133	35.4	0.83
MINIMUM	2 190 000	66	20.5	214 000	46	2.0	0.10	1 976 000	69	18.5	0.90

TABLE XI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION.

RAINFALL, RUN-OFF AND LOSS OF WATER

OBSERVED AND SYNTHETIC YEARLY VALUES.

RIVER Little Ruaha STATION Southern High. Club No. 1KA 32 CATCHMENT AREA 293 SQ. MILES

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL			RUN-OFF				LOSS OF WATER			
	ACRE FEET	%OF MEAN	INCHES	ACRE FEET	%OF MEAN	INCHES	RUN OFF COEFFICIENT	ACRE FEET	%OF MEAN	INCHES	LOSS COEFFICIENT
1940--1941	538 000	91	34.4	95 000	82	6.1	0.18	443 000	93	28.3	0.82
1941—1942	767 000	129	49.1	167 000	144	10.7	0.22	600 000	126	38.4	0.78
1942—1943	577 000	97	36.9	106 000	91	6.8	0.18	471 000	99	30.1	0.82
1943—1944	536 000	90	34.3	95 000	82	6.1	0.18	441 000	92	28.2	0.82
1944—1945	885 000	149	56.7	209 000	180	15.4	0.24	676 000	142	43.3	0.76
5 YEARS AVERAGE	661 000	111	42.3	134 000	116	8.6	0.20	527 000	110	33.7	0.80
1945—1946	520 000	88	33.3	91 000	78	5.8	0.17	429 000	90	27.5	0.83
1946—1947	698 000	118	44.7	144 000	124	9.2	0.21	554 000	116	35.5	0.79
1947—1948	623 000	105	39.9	120 000	103	7.7	0.19	503 000	105	32.2	0.81
1948—1949	336 000	57	21.5	52 000	45	3.3	0.15	284 000	60	18.2	0.85
1949—1950	475 000	80	30.4	80 000	69	5.1	0.17	395 000	83	25.3	0.83
5 YEARS AVERAGE	530 000	89	33.9	97 000	84	6.2	0.18	433 000	91	27.7	0.82
1950—1951	618 000	104	39.6	119 000	103	7.6	0.19	499 000	105	32.0	0.81
1651—1952	789 000	133	50.5	191 000	165	12.2	0.24	598 000	125	38.3	0.76
1952—1953	432 000	73	27.7	70 000	60	4.5	0.16	362 000	76	23.2	0.84
1953—1954	517 000	87	33.1	91 000	78	5.8	0.18	426 000	89	27.3	0.82
1954—1955	587 000	99	37.6	109 000	94	7.0	0.19	478 000	100	30.6	0.81
5 YEARS AVERAGE	589 000	99	37.7	116 000	100	7.4	0.20	473 000	99	30.3	0.80
15 YEARS AVERAGE	593 000	100	38.0	116 000	100	7.4	0.19	477 000	100	30.6	0.81
1955—1956	765 000	129	49.0	166 000	143	10.6	0.22	599 000	126	38.4	0.78
1956—1957	740 000	125	47.4	158 000	136	10.1	0.21	582 000	122	37.3	0.79
1957—1958	603 000	102	38.6	136 020	117	8.7	0.23	466 980	98	29.9	0.77
1958—1959	580 000	98	37.1	87 222	75	5.6	0.15	492 778	103	31.5	0.85
1959 - 1960											
5 YEARS AVERAGE											
MAXIMUM	885 000	149	56.7	209 000	180	13.4	0.24	676 000	142	43.3	0.76
MINIMUM	336 000	57	21.5	52 000	45	3.3	0.15	284 000	60	18.2	0.85

TABLE XI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION.

RAINFALL, RUN-OFF AND LOSS OF WATER

OBSERVED AND SYNTHETIC YEARLY VALUES.

RIVER Ndembera STATION Madibira No. 1KA35 CATCHMENT AREA 707 SQ. MILES

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL			RUN-OFF				LOSS OF WATER			
	ACRE FEET	%OF MEAN	INCHES	ACRE FEET	%OF MEAN	INCHES	RUN OFF COEFFICIENT	ACRE FEET	%OF MEAN	INCHES	LOSS COEFFICIENT
1940—1941	992 000	87	26.7	117 000	80	3.1	0.12	875 000	88	23.6	0.88
1941—1942	1 263 000	111	33.5	170 000	116	4.5	0.13	1 093 000	110	29.0	0.87
1942—1943	1 184 000	104	31.4	151 000	103	4.0	0.13	1 033 000	104	27.4	0.87
1943—1944	1 060 000	93	28.1	124 000	84	3.3	0.12	936 000	94	24.8	0.88
1944—1945	1 531 000	134	40.6	237 000	161	6.3	0.16	1 294 000	130	34.3	0.84
5 YEARS AVERAGE	1 206 000	106	32.0	160 000	109	4.2	0.13	1 046 000	105	27.8	0.87
1945—1946	1 063 000	93	28.2	128 000	87	3.4	0.12	935 000	94	24.8	0.88
1946—1947	1 350 000	118	35.8	188 000	128	5.0	0.14	1 162 000	117	30.8	0.86
1947—1948	1 184 000	104	31.4	151 000	103	4.0	0.13	1 033 000	104	27.4	0.87
1948—1949	705 000	62	18.7	72 000	49	1.9	0.10	633 000	64	16.8	0.90
1949—1950	1 146 000	100	30.4	143 000	97	3.8	0.15	1 003 000	101	26.6	0.87
5 YEARS AVERAGE	1 090 000	95	28.9	136 000	93	3.6	0.12	954 000	96	25.3	0.88
1950—1951	1 323 000	116	35.1	185 000	126	4.9	0.14	1 138 000	114	30.2	0.86
1651—1952	1 218 000	107	32.3	158 000	107	4.2	0.13	1 060 000	107	28.1	0.87
1952—1953	667 000	58	17.7	64 000	44	1.7	0.10	603 000	61	16.0	0.90
1953—1954	1 094 000	96	29.0	132 000	90	3.5	0.12	962 000	97	25.5	0.88
1954—1955	1 350 000	118	35.8	188 000	128	5.0	0.14	1 162 000	117	30.8	0.86
5 YEARS AVERAGE	1 130 000	99	30.0	145 000	99	3.9	0.13	985 000	99	26.1	0.87
15 YEARS AVERAGE	1 142 000	100	30.3	147 000	100	3.9	0.13	995 000	100	26.4	0.87
1955—1956	1 602 000	140	42.5	260 000	179	6.9	0.16	1 342 000	135	35.6	0.84
1956—1957	1 501 000	131	39.8	165 446	112	4.4	0.11	1 335 554	134	35.4	0.89
1957—1958	1 225 000	107	32.5	189 198	129	5.0	0.15	1 035 802	104	27.5	0.85
1958—1959	1 320 000	116	35.0	181 750	124	4.8	0.14	1 138 250	114	30.2	0.86
1959—1960											
5 YEARS AVERAGE											
MAXIMUM	1 602 000	140	42.5	260 000	179	6.9	0.16	1 342 000	135	35.6	0.84
MINIMUM	667 000	58	17.7	64 000	44	1.7	0.10	603 000	61	16.0	0.90

TABLE XI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION.

RAINFALL, RUN-OFF AND LOSS OF WATER

OBSERVED AND SYNTHETIC YEARLY VALUES

RIVER Halali STATION Majojolo No. 1KA36 CATCHMENT AREA 1014 SQ. MILES

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL			RUN-OFF				LOSS OF WATER			
	ACRE FEET	%OF MEAN	INCHES	ACRE FEET	%OF MEAN	INCHES	RUN OFF COEFFICIENT	ACRE FEET	%OF MEAN	INCHES	LOSS COEFFICIENT
1940—1941	1 687 000	109	31.2	238 000	116	4.4	0.14	1 449 000	108	26.8	0.86
1941—1942	1 983 000	128	36.7	324 000	158	6.0	0.16	1 659 000	124	30.7	0.84
1942—1943	1 428 000	92	26.4	178 000	87	3.3	0.13	1 250 000	93	23.1	0.87
1943—1944	1 254 000	81	23.2	135 000	66	2.5	0.11	1 119 000	83	20.7	0.89
1944—1945	1 973 000	127	36.5	270 000	132	5.0	0.14	1 703 000	127	31.5	0.86
5 YEARS AVERAGE	1 665 000	107	30.8	229 000	112	4.2	0.14	1 436 000	107	26.6	0.86
1945—1946	1 415 000	91	26.2	173 000	84	3.2	0.12	1 242 000	93	23.0	0.88
1946—1947	1 451 000	94	26.8	184 000	90	3.4	0.13	1 267 000	94	23.4	0.87
1947—1948	1 657 000	107	30.7	232 000	113	4.3	0.14	1 425 000	107	26.4	0.86
1948—1949	1 095 000	71	20.3	103 000	50	1.9	0.09	992 000	74	18.4	0.91
1949—1950	1 478 000	95	27.3	184 000	90	3.4	0.12	1 294 000	96	23.9	0.88
5 YEARS AVERAGE	1 419 000	92	26.2	175 000	85	3.2	0.12	1 244 000	93	23.0	0.88
1950 1951	1 811 000	117	33.5	276 000	135	5.1	0.15	1 535 000	114	28.4	0.85
1651—1952	1 911 000	124	35.4	303 000	148	5.6	0.16	1 608 000	120	29.8	0.84
1952—1953	976 000	63	18.1	81 000	40	1.5	0.08	895 000	67	16.6	0.92
1953—1954	1 511 000	98	28.0	195 000	95	3.6	0.13	1 316 000	98	24.4	0.87
1954 1955	1 559 000	101	28.8	205 000	100	3.8	0.13	1 354 000	101	25.0	0.87
5 YEARS AVERAGE	1 554 000	101	28.7	212 000	103	3.9	0.14	1 342 000	100	24.8	0.86
15 YEARS AVERAGE	1 546 000	100	28.6	205 000	100	3.8	0.13	1 341 000	100	24.8	0.87
1955—1956	2 072 000	134	38.3	357 000	174	6.6	0.17	1 715 000	128	31.7	0.83
1956—1957	1 850 000	120	34.2	286 000	140	5.3	0.15	1 564 000	117	28.9	0.85
1957—1958	1 653 000	107	30.6	232 000	113	4.3	0.14	1 421 000	106	26.3	0.86
1958—1959	1 499 000	97	27.7	185 439	90	3.4	0.12	1 313 561	98	24.3	0.88
1959 - 1960											
5 YEARS AVERAGE											
MAXIMUM	2 072 000	134	38.3	357 000	174	6.6	0.17	1 715 000	128	31.7	0.83
MINIMUM	976 000	63	18.1	81 000	40	1.5	0.08	895 000	67	16.6	0.92

TABLE XI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION.

RAINFALL, RUN-OFF AND LOSS OF WATER

OBSERVED AND SYNTHETIC YEARLY VALUES.

RIVER Little Ruaha STATION Iwawa No. 1KA39 CATCHMENT AREA 645 SQ. MILES

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL			RUN-OFF				LOSS OF WATER			
	ACRE FEET	%OF MEAN	INCHES	ACRE FEET	%OF MEAN	INCHES	RUN OFF COEFFICIENT	ACRE FEET	%OF MEAN	INCHES	LOSS COEFFICIENT
1940—1941	1 342 000	98	39.0	244 000	92	7.1	0.18	1 098 000	99	31.9	0.82
1941—1942	1 770 000	129	51.5	399 000	151	11.6	0.23	1 371 000	123	39.9	0.77
1942—1943	1 395 000	101	40.6	261 000	98	7.6	0.19	1 134 000	102	33.0	0.81
1943—1944	1 222 000	89	35.5	213 000	80	6.2	0.17	1 009 000	91	29.3	0.83
1944—1945	1 980 000	144	57.6	495 000	187	14.4	0.25	1 485 000	134	43.2	0.75
5 YEARS AVERAGE	1 542 000	112	44.9	322 000	122	9.4	0.21	1 220 000	110	35.5	0.79
1945—1946	1 122 000	82	32.6	189 000	71	5.5	0.17	933 000	84	27.1	0.83
1946—1947	1 575 000	114	45.8	320 000	121	9.3	0.20	1 255 000	113	36.5	0.80
1947—1948	1 422 000	103	41.4	265 000	100	7.7	0.19	1 157 000	104	33.7	0.81
1948—1949	1 022 000	74	29.7	162 000	61	4.7	0.16	860 000	77	25.0	0.84
1949—1950	1 061 000	77	30.9	172 000	65	5.0	0.16	889 000	80	25.9	0.84
5 YEARS AVERAGE	1 240 000	90	36.1	222 000	84	6.5	0.18	1 018 000	92	29.6	0.82
1950—1951	1 400 000	102	40.7	261 000	98	7.6	0.19	1 139 000	103	33.1	0.81
1651—1952	1 658 000	120	48.2	347 000	131	10.1	0.21	1 311 000	118	38.1	0.79
1952—1953	1 120 000	81	32.6	189 000	71	5.5	0.17	931 000	84	27.1	0.83
1953—1954	1 220 000	89	35.5	213 000	80	6.2	0.17	1 007 000	91	29.3	0.83
1954—1955	1 328 000	97	38.6	241 000	91	7.0	0.18	1 087 000	98	31.6	0.82
5 YEARS AVERAGE	1 345 000	98	39.1	250 000	94	7.3	0.19	1 095 000	99	31.8	0.81
15 YEARS AVERAGE	1 376 000	100	40.0	265 000	100	7.7	0.19	1 111 000	100	32.3	0.81
1955—1956	1 540 000	112	44.8	306 000	115	8.9	0.20	1 234 000	111	35.9	0.80
1956—1957	1 690 000	123	49.2	361 000	136	10.5	0.21	1 329 000	120	38.7	0.79
1957—1958	1 251 000	91	36.4	308 094	116	9.0	0.25	942 906	85	27.4	0.75
1958—1959	1 203 000	87	35.0	227 325	86	6.6	0.19	975 675	88	28.4	0.81
1959 - 1960											
5 YEARS AVERAGE											

NOTE: These computations are done by analogy with runoff at Mtitu and Ihimbu as well as with rainfall.

MAXIMUM	1 980 000	144	57.6	495 000	187	14.4	0.25	1 485 000	134	43	0.75
MINIMUM	1 022 000	74	29.7	162 000	61	4.7	0.16	860 000	77	25.0	0.84

TABLE XI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION.

RAINFALL, RUN-OFF AND LOSS OF WATER

OBSERVED AND SYNTHETIC YEARLY VALUES

RIVER Halali STATION Iyayi U/S No. 1KA46 CATCHMENT AREA 184 SQ. MILES

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL			RUN-OFF				LOSS OF WATER			
	ACRE FEET	%OF MEAN	INCHES	ACRE FEET	%OF MEAN	INCHES	RUN OFF COEFFICIENT	ACRE FEET	%OF MEAN	INCHES	LOSS COEFFICIENT
1940—1941	370 000	121	37.7	65 000	138	6.6	0.18	305 000	118	31.1	0.82
1941—1942	394 000	129	40.2	75 000	160	7.6	0.19	319 000	123	32.6	0.81
1942—1943	268 000	88	27.3	36 000	77	3.7	0.14	232 000	90	23.6	0.86
1943—1944	261 000	85	26.6	34 000	72	3.5	0.13	227 000	88	23.1	0.87
1944—1945	421 000	138	42.9	81 000	172	8.3	0.19	340 000	131	34.6	0.81
5 YEARS AVERAGE	343 000	112	35.0	58 000	123	5.9	0.17	285 000	110	29.1	0.83
1945—1946	313 000	102	31.9	47 000	100	4.8	0.15	266 000	103	27.1	0.85
1946—1947	319 000	104	32.5	49 000	104	5.0	0.15	270 000	104	27.5	0.85
1947—1948	284 000	93	30.0	40 000	85	4.1	0.14	244 000	94	25.9	0.86
1948—1949	204 000	67	20.8	22 000	47	2.2	0.11	182 000	70	18.6	0.89
1949—1950	341 000	111	34.8	56 000	119	5.7	0.16	285 000	110	29.1	0.84
5 YEARS AVERAGE	292 000	95	29.8	43 000	91	4.4	0.15	249 000	96	25.4	0.85
1950—1951	333 000	109	34.0	53 000	113	5.4	0.16	280 000	108	28.6	0.84
1651—1952	338 000	110	34.5	55 000	117	5.6	0.16	283 000	109	28.9	0.84
1952—1953	170 000	56	17.3	18 000	38	1.8	0.10	152 000	59	15.5	0.90
1953—1954	296 000	97	30.2	43 000	91	4.4	0.15	253 000	98	25.8	0.85
1954—1955	274 000	90	27.9	37 000	79	3.8	0.14	237 000	92	24.1	0.86
5 YEARS AVERAGE	282 000	92	28.8	41 000	87	4.2	0.15	241 000	93	24.6	0.85
15 YEARS AVERAGE	306 000	100	31.2	47 000	100	4.8	0.15	259 000	100	26.4	0.85
1955—1956	378 000	124	38.5	69 000	147	7.0	0.18	309 000	119	31.5	0.82
1956—1957	370 000	121	37.7	66 000	140	6.7	0.18	304 000	117	31.0	0.82
1957—1958	328 000	107	33.4	53 000	113	5.4	0.16	275 000	106	28.0	0.84
1958—1959	305 000	100	31.1	41 628	89	4.2	0.14	263 372	102	26.9	0.86
1959 - 1960											
5 YEARS AVERAGE											

NOTE: The same rainfall-runoff relation curve as for Iyayi D/S is applied in these calculations.

MAXIMUM	421 000	138	42.9	81 000	172	8.3	0.19	340 000	131	34.6	0.81
MINIMUM	170 000	56	17.3	18 000	38	1.8	0.10	152 000	59	15.5	0.90

TABLE XI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION.

RAINFALL, RUN-OFF AND LOSS OF WATER

OBSERVED AND SYNTHETIC YEARLY VALUES.

RIVER Kilombero STATION Ifakara No. 1KB2 CATCHMENT AREA 12063 SQ. MILES

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL			RUN-OFF				LOSS OF WATER			
	ACRE FEET	%OF MEAN	INCHES	ACRE FEET	%OF MEAN	INCHES	RUN OFF COEFFICIENT	ACRE FEET	%OF MEAN	INCHES	LOSS COEFFICIENT
1940—1941	32 683 000	93	50.8	9 390 000	89	14.6	0.29	23 293 000	95	36.2	0.71
1941—1942	36 414 000	104	56.6	11 320 000	107	17.6	0.31	25 094 000	103	39.0	0.69
1942—1943	32 875 000	94	51.1	9 520 000	90	14.8	0.29	23 355 000	96	36.3	0.71
1943—1944	31 720 000	91	49.3	8 940 000	85	13.9	0.28	22 780 000	93	35.4	0.72
1944—1945	47 106 000	135	73.3	16 780 000	159	26.1	0.36	30 326 000	124	47.2	0.64
5 YEARS AVERAGE	36 160 000	103	56.2	11 190 000	106	17.4	0.31	24 970 000	102	38.8	0.69
1945—1946	33 000 000	94	51.3	9 580 000	91	14.9	0.29	23 420 000	96	36.4	0.71
1946—1947	40 950 000	117	63.7	13.500 000	128	21.0	0.33	27 450 000	112	42.7	0.67
1947—1948	36 414 000	104	56.6	11 250 000	107	17.5	0.31	25 164 000	103	39.1	0.69
1948—1949	25 225 000	72	39.2	6 040 000	57	9.4	0.24	19 185 000	78	29.8	0.76
1949—1950	38 344 000	110	59.6	12 220 000	116	19.0	0.32	26 124 000	107	40.6	0.68
5 YEARS AVERAGE	34 787 000	99	54.1	10 520 000	100	16.4	0.30	24 267 000	99	37.7	0.70
1950 1951	30 092 000	103	56.1	10 990 000	104	17.1	0.30	25 102 000	103	39.0	0.70
1651—1952	42 140 000	120	65.5	14 150 000	134	22.0	0.34	27 990 000	114	43.5	0.66
1952—1953	27 640 000	79	43.0	7 070 000	67	11.0	0.26	20.570 000	84	32.0	0.74
1953—1954	30 082 000	86	46.8	8 170 000	77	12.7	0.27	21 912 000	90	34.1	0.73
1954—1955	34 420 000	98	53.5	9 480 000	90	14.7	0.27	24 940 000	102	38.8	0.73
5 YEARS AVERAGE	34 035 000	97	52.9	9 970 000	94	15.5	0.29	24 065 000	99	37.4	0.71
15 YEARS AVERAGE	35 007 000	100	54.4	10 560 000	100	16.4	0.30	24 447 000	100	38.0	0.70
1955—1956	45 240 000	129	70.4	16 610 000	157	25.8	0.37	28 630 000	117	44.6	0.63
1956—1957	37 058 000	106	57.6	12 930 000	122	20.1	0.35	24 128 000	99	37.5	0.65
1957—1958	35 385 000	101	55.0	12 060 000	114	18.8	0.34	23 325 000	95	36.2	0.66
1958—1959	26 506 000	76	41.2	6 820 000	65	10.6	0.26	19 686 000	81	30.6	0.74
1959—1960											
5 YEARS AVERAGE											
MAXIMUM	47 106 000	135	73.3	16 780 000	159	26.1	0.36	30 326 000	124	47.2	0.64
MINIMUM	25 225 000	72	39.2	6 040 000	57	9.4	0.24	19 185 000	78	29.8	0.76

TABLE XI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION.

RAINFALL, RUN-OFF AND LOSS OF WATER

OBSERVED AND SYNTHETIC YEARLY VALUES.

RIVER Kilombero STATION Ifwema No. 1KB4 CATCHMENT AREA 7048 SQ. MILES

HYDROLOGICAL YEAR 1/11- 31/10	RAINFALL			RUN-OFF				LOSS OF WATER			
	ACRE FEET	%OF MEAN	INCHES	ACRE FEET	%OF MEAN	INCHES	RUN OFF COEFFICIENT	ACRE FEET	%OF MEAN	INCHES	LOSS COEFFICIENT
1940 – 1941	18 006 000	93	47.9	5 034 000	96	13.4	0.28	12 972 000	92	34.5	0.72
1941—1942	21 235 000	110	56.5	5 823 000	111	15.5	0.27	15 412 000	110	41.0	0.73
1942—1943	19 266 000	100	51.3	5 372 000	103	14.3	0.28	13 894 000	99	37.0	0.72
1943—1944	17 655 000	92	47.0	4 959 000	95	13.2	0.28	12 696 000	91	33.8	0.72
1944—1945	27 927 000	145	74.3	7 025 000	134	18.7	0.25	20 902 000	149	55.6	0.75
5 YEARS AVERAGE	20 818 000	108	55.4	5 643 000	108	15.0	0.27	15 175 000	108	40.4	0.73
1945—1946	18 113 000	94	48.2	5 071 000	97	13.5	0.28	13 042 000	93	34.7	0.72
1946—1947	20 360 000	106	54.2	5 635 000	108	15.0	0.28	14 725 000	105	39.2	0.72
1947—1948	18 404 000	96	49.0	5 147 000	98	13.7	0.28	13 257 000	95	35.3	0.72
1948—1949	14 635 000	76	39.0	4 095 000	78	10.9	0.28	10 540 000	75	28.1	0.72
1949—1950	20 290 000	105	54.0	5 635 000	108	15.0	0.28	14 657 000	105	39.0	0.72
5 YEARS AVERAGE	18 361 000	95	48.9	5 117 000	98	13.6	0.28	13 244 000	94	35.3	0.72
1950 -1951	17 594 000	91	46.8	4 921 000	94	13.1	0.28	12 673 000	90	33.7	0.72
1651—1952	24 457 000	127	65.1	6 461 000	123	17.2	0.26	17 996 000	128	47.9	0.74
1952—1953	15 848 000	82	42.2	4 433 000	85	11.8	0.28	11 415 000	81	30.4	0.72
1953—1954	16 113 000	84	42.9	4 320 000	83	11.5	0.27	11 793 000	84	31.4	0.73
1954- 1955	18 986 000	99	50.5	4 594 989	88	12.2	0.24	14 391 011	103	38.3	0.76
5 YEARS AVERAGE	18 600 000	97	49.5	4 946 000	94	13.2	0.27	13 654 000	97	36.3	0.73
15 YEARS AVERAGE	19 259 000	100	51.3	5 235 000	100	13.9	0.27	14 024 000	100	37.4	0.73
1955—1956	27 291 000	142	72.6	6 920 000	132	18.4	0.25	20 370 354	145	54.2	0.75
1956—1957	22 457 000	117	59.8	6 029 648	115	16.1	0.27	16 427 352	117	43.7	0.73
1957 1958	19 620 000	102	52.2	5 477 801	105	14.6	0.28	14 142 199	101	37.6	0.72
1958—1959	15 853 000	82	42.2	4 439 927	85	11.8	0.28	11 413 073	81	30.4	0.72
1959 - 1960											
5 YEARS AVERAGE											
MAXIMUM	27 927 000	145	74.3	7 025 000	134	18.7	0.25	20 902 000	149	55.6	0.75
MINIMUM	14 635 000	76	39.0	4 095 000	78	10.9	0.28	10 540 000	75	28.1	0.72

TABLE XI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION.

RAINFALL, RUN-OFF AND LOSS OF WATER

OBSERVED AND SYNTHETIC YEARLY VALUES.

RIVER Luhombero STATION Ilonga No. 1KB5 CATCHMENT AREA 395 SQ. MILES

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL			RUN-OFF				LOSS OF WATER			
	ACRE FEET	%OF MEAN	INCHES	ACRE FEET	%OF MEAN	INCHES	RUN OFF COEFFICIENT	ACRE FEET	%OF MEAN	INCHES	LOSS COEFFICIENT
1940—1941	1 102 000	104	52.3	183 000	101	8.7	0.17	919 000	104	43.6	0.83
1941—1942	1 120 000	105	53.2	190 000	104	9.0	0.17	930 000	105	44.2	0.83
1942—1943	1 045 000	98	49.6	168 000	92	8.0	0.16	877 000	99	41.6	0.84
1943—1944	1 116 000	105	53.0	187 000	103	8.9	0.17	929 000	105	44.1	0.83
1944—1945	1 300 000	122	61.7	251 000	138	11.8	0.19	1 049 000	119	49.9	0.81
5 YEARS AVERAGE	1 137 000	107	54.0	196 000	108	9.3	0.17	941 000	107	44.7	0.83
1945—1946	1 066 000	100	50.6	175 000	96	8.3	0.16	891 000	101	42.3	0.84
1946—1947	1 082 000	102	51.4	179 000	98	8.5	0.17	903 000	102	42.9	0.83
1947—1948	1 050 000	97	49.0	164 000	90	7.8	0.16	866 000	98	41.2	0.84
1948—1949	837 000	79	39.8	120 000	66	5.7	0.14	717 000	81	34.1	0.86
1949—1950	1 203 000	113	57.1	215 000	118	10.2	0.18	988 000	112	46.9	0.82
5 YEARS AVERAGE	1 044 000	98	49.6	171 000	94	8.1	0.16	873 000	99	41.5	0.84
1950—1951	864 000	81	41.0	124 000	68	5.9	0.14	740 000	84	35.1	0.86
1651—1952	1 350 000	127	64.1	267 000	147	12.7	0.20	1 083 000	123	51.4	0.80
1952—1953	870 000	82	41.3	126 000	69	6.0	0.15	744 000	84	35.3	0.85
1953—1954	916 000	86	43.5	157 000	75	6.5	0.15	779 000	88	37.0	0.85
1954—1955	1 047 000	98	49.7	240 609	132	11.4	0.23	806 691	91	38.3	0.77
5 YEARS AVERAGE	1 009 000	95	47.9	179 000	98	8.5	0.18	830 000	94	39.4	0.82
15 YEARS AVERAGE	1 064 000	100	50.5	182 000	100	8.6	0.17	882 000	100	41.9	0.83
1955—1956	1 630 000	153	77.4	377 703	208	17.9	0.23	1 252 297	142	59.5	0.77
1956—1957	1 264 000	119	60.0	218 864	120	10.4	0.17	1 045 136	118	49.6	0.83
1957—1958	1 243 000	117	59.1	228 434	126	10.9	0.18	1 014 566	115	48.2	0.82
1958—1959	760 000	71	36.1	103 762	57	4.9	0.14	656 238	74	31.2	0.86
1959—1960											
5 YEARS AVERAGE											
MAXIMUM	1 630 000	153	77.4	377 703	208	17.9	0.23	1 252 297	142	59.5	0.77
MINIMUM	760 000	71	36.1	103 762	57	4.9	0.14	656 238	74	31.2	0.86

TABLE XI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION.

RAINFALL, RUN-OFF AND LOSS OF WATER

OBSERVED AND SYNTHETIC YEARLY VALUES.

RIVER Kigogo-Ruaha STATION Frick's Bridge No. 1KB6 CATCHMENT AREA 511 SQ. MILES

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL			RUN-OFF				LOSS OF WATER			
	ACRE FEET	%OF MEAN	INCHES	ACRE FEET	%OF MEAN	INCHES	RUN OFF COEFFICIENT	ACRE FEET	%OF MEAN	INCHES	LOSS COEFFICIENT
1940—1941	1 063 000	82	39.0	232 000	82	8.5	0.22	831 000	82	30.5	0.78
1941—1942	1 700 000	131	62.4	373 000	131	13.7	0.22	1 327 000	130	48.7	0.78
1942—1943	1 300 000	100	47.7	283 000	100	10.4	0.22	1 017 000	100	37.3	0.78
1943—1944	1 333 000	102	48.9	291 000	102	10.7	0.22	1 042 000	102	38.2	0.78
1944—1945	1 920 000	148	70.5	417 000	147	15.3	0.22	1 503 000	148	55.2	0.78
5 YEARS AVERAGE	1 463 000	112	53.7	319 000	112	11.7	0.22	1 144 000	112	42.0	0.78
1945—1946	1 300 000	100	47.7	283 000	100	10.4	0.22	1 017 000	100	37.3	0.78
1946—1947	1 220 000	94	44.8	267 000	94	9.8	0.22	953 000	94	35.0	0.78
1947—1948	1 250 000	96	45.9	272 000	96	10.0	0.22	978 000	96	35.9	0.78
1948—1949	1 040 000	80	38.2	229 000	81	8.4	0.22	811 000	80	29.8	0.78
1949—1950	1 290 000	99	47.4	280 000	99	10.3	0.22	1 010 000	99	37.1	0.78
5 YEARS AVERAGE	1 220 000	94	47.8	266 000	94	9.8	0.22	954 000	94	35.0	0.78
1950—1951	1 140 000	88	41.9	251 000	88	9.2	0.22	889 000	87	32.7	0.78
1651—1952	1 670 000	128	61.3	362 000	127	13.3	0.22	1 308 000	129	48.0	0.78
1952—1953	872 000	67	32.0	191 000	67	7.0	0.22	681 000	67	25.0	0.78
1953—1954	1 083 000	83	39.8	237 000	83	8.7	0.22	846 000	83	31.1	0.78
1951—1955	1 334 000	103	49.0	291 000	102	10.7	0.22	1 043 000	103	38.3	0.78
5 YEARS AVERAGE	1 220 000	94	44.8	266 000	94	9.8	0.22	954 000	94	35.0	0.78
15 YEARS AVERAGE	1 301 000	100	47.8	284 000	100	10.4	0.22	1 017 000	100	37.4	0.78
1955—1956	1 608 000	124	59.0	351 000	124	12.9	0.22	1 257 000	124	46.1	0.78
1956—1957	1 553 000	119	57.0	311 086	110	11.4	0.20	1 241 914	122	45.6	0.80
1957—1958	1 677 000	129	61.6	365 481	129	13.4	0.22	1 311 519	129	48.2	0.78
1958—1959	987 000	76	36.2	246 281	87	9.0	0.25	740 719	73	27.2	0.75
1959 - 1960											
5 YEARS AVERAGE											
MAXIMUM	1 920 000	148	70.5	417 000	147	15.3	0.22	1 503 000	148	55.2	0.78
MINIMUM	872 000	67	32.0	191 000	67	7.0	0.22	681 000	67	25.0	0.78

TABLE XI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION.

RAINFALL, RUN-OFF AND LOSS OF WATER

OBSERVED AND SYNTHETIC YEARLY VALUES.

RIVER Mpanga STATION Mpanga Mission No. 1KB8 CATCHMENT AREA 937 SQ. MILES

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL			RUN-OFF				LOSS OF WATER			
	ACRE FEET	%OF MEAN	INCHES	ACRE FEET	%OF MEAN	INCHES	RUN OFF COEFFICIENT	ACRE FEET	%OF MEAN	INCHES	LOSS COEFFICIENT
1940—1941	2 044 000	73	40.9	629 000	72	12.6	0.31	1 415 000	73	28.3	0.69
1941—1942	3 668 000	130	73.4	1 139 000	131	22.8	0.31	2 529 000	130	50.6	0.69
1942—1943	2 564 000	91	51.3	789 000	91	15.8	0.31	1 775 000	91	35.5	0.69
1943—1944	2 544 000	90	50.9	784 000	90	15.7	0.31	1 760 000	90	35.2	0.69
1944—1945	3 933 000	140	78.8	1 219 000	140	24.4	0.31	2 714 000	139	54.4	0.69
5 YEARS AVERAGE	2 951 000	105	59.1	912 000	105	18.3	0.31	2 039 000	105	40.8	0.69
1945—1946	2 754 000	98	55.1	849 000	98	17.0	0.31	1 905 000	98	38.1	0.69
1946—1947	2 838 000	101	56.8	874 000	101	17.5	0.31	1 964 000	101	39.3	0.69
1947—1948	2 740 000	97	54.9	814 000	94	16.3	0.30	1 926 000	99	38.6	0.70
1948—1949	2 309 000	82	46.2	714 000	82	14.3	0.31	1 595 000	82	31.9	0.69
1949—1950	2 872 000	102	57.5	889 000	102	17.8	0.31	1 983 000	102	39.7	0.69
5 YEARS AVERAGE	2 703 000	96	54.1	828 000	95	16.6	0.31	1 875 000	96	37.5	0.69
1950—1951	2 374 000	84	47.5	734 000	84	14.7	0.31	1 640 000	84	32.8	0.69
1651—1952	3 788 000	134	75.8	1 179 000	136	23.6	0.31	2 609 000	134	52.2	0.69
1952—1953	2 314 000	82	46.3	714 000	82	14.3	0.31	1 600 000	82	32.0	0.69
1953—1954	2 529 000	90	50.6	779 000	90	15.6	0.31	1 750 000	90	35.0	0.69
1954—1955	3 003 000	107	60.1	929 000	107	18.6	0.31	2 074 000	106	41.5	0.69
5 YEARS AVERAGE	2 802 000	99	56.1	867 000	100	17.4	0.31	1 935 000	99	38.7	0.69
15 YEARS AVERAGE	2 818 000	100	56.4	869 000	100	17.4	0.31	1 949 000	100	39.0	0.69
1955—1956	3 603 000	128	72.1	1 119 000	129	22.4	0.31	2 484 000	127	49.7	0.69
1956—1957	3 053 000	108	61.1	898 657	103	18.0	0.29	2 154 343	111	43.1	0.71
1957—1958	2 661 000	94	53.3	860 266	99	17.2	0.32	1 800 734	92	36.1	0.68
1958—1959	2 359 000	84	47.2	706 678	81	14.2	0.30	1 652 322	85	33.0	0.70
1959 - 1960											
5 YEARS AVERAGE											
MAXIMUM	3 933 000	140	78.8	1 219 000	140	24.4	0.31	2 714 000	139	54.4	0.69
MINIMUM	2 044 000	73	40.9	629,000	72	12.6	0.31	1 415 000	73	28.3	0.69

TABLE XI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION.

RAINFALL, RUN-OFF AND LOSS OF WATER

OBSERVED AND SYNTHETIC YEARLY VALUES.

RIVER Mnyera STATION Taveta No. 1KB9 CATCHMENT AREA 1950 SQ. MILES

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL			RUN-OFF				LOSS OF WATER			
	ACRE FEET	%OF MEAN	INCHES	ACRE FEET	%OF MEAN	INCHES	RUN OFF COEFFICIENT	ACRE FEET	%OF MEAN	INCHES	LOSS COEFFICIENT
1940—1941	5 283 000	95	50.8	1 621 000	96	15.6	0.31	3 662 000	94	35.2	0.69
1941--1942	6 545 000	117	63.0	2 027 000	120	19.5	0.31	4 518 000	116	43.5	0.69
1942—1943	5 431 000	97	52.3	1 674 000	99	16.1	0.31	3 757 000	97	36.2	0.69
1943—1944	5 511 000	99	53.0	1 694 000	100	16.3	0.31	3 817 000	98	36.7	0.69
1944—1945	8 163 000	146	78.5	2 526 000	149	24.3	0.31	5 637 000	145	54.2	0.69
5 YEARS AVERAGE	6 187 000	111	59.5	1 908 000	113	18.4	0.31	4 279 000	110	41.1	0.69
1945—1946	5 307 000	95	51.0	1 652 000	96	15.7	0.31	3 675 000	95	35.3	0.69
1946—1947	5 598 000	100	53.9	1 725 000	102	16.6	0.31	3 873 000	100	37.3	0.69
1947—1948	5 390 000	97	51.9	1 663 000	98	16.0	0.31	3 727 000	96	35.9	0.69
1948—1949	4 023 000	72	38.7	1 154 000	68	11.1	0.29	2 869 000	74	27.6	0.71
1949—1950	5 923 000	106	57.0	1 829 000	108	17.6	0.31	4 094 000	105	39.4	0.69
5 YEARS AVERAGE	5 248 000	94	50.5	1 601 000	94	15.4	0.30	3 647 000	94	35.1	0.70
1950 1951	5 071 000	91	48.8	1 559 000	92	15.0	0.31	3 512 000	90	33.8	0.69
1651—1952	6 656 000	119	64.0	1 736 000	102	16.7	0.26	4 920 000	127	47.3	0.74
1952—1953	4 557 000	82	43.8	1 403 000	83	13.5	0.31	3 154 000	81	30.3	0.69
1953—1954	4 772 000	86	45.9	1 476 000	87	14.2	0.31	3 296 000	85	31.7	0.69
1954—1955	5 483 000	98	52.8	1 694 000	100	16.3	0.31	3 789 000	97	36.5	0.69
5 YEARS AVERAGE	5 308 000	95	51.1	1 574 000	93	15.1	0.30	3 734 000	96	36.0	0.70
15 YEARS AVERAGE	5 581 000	100	53.7	1 694 000	100	16.3	0.30	3 887 000	100	37.4	0.70
1955—1956	7 988 000	143	76.9	2 494 000	147	24.0	0.31	5 494 000	141	52.9	0.69
1956—1957	5 417 000	97	52.1	1 588 492	94	15.3	0.29	3 828 508	98	36.8	0.71
1957—1958	5 150 000	92	49.6	1 654 342	98	15.9	0.32	3 495 658	90	33.7	0.68
1958—1959	4 220 000	76	40.6	1 356 161	80	13.0	0.32	2 863 839	74	27.6	0.68
1959 – 1960											
5 YEARS AVERAGE											
MAXIMUM	8 163 000	146	78.5	2 526 000	149	24.3	0.31	5 637 000	145	54.2	0.69
MINIMUM	4 023 000	72	38.7	1 154 000	68	11.1	0.29	2 869 000	74	27.6	0.71

TABLE XI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION.

RAINFALL, RUN-OFF AND LOSS OF WATER

OBSERVED AND SYNTHETIC YEARLY VALUES.

RIVER Ruhuji STATION Mwayamalungu No. 1KB10 CATCHMENT AREA 3294 SQ. MILES

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL			RUN-OFF				LOSS OF WATER			
	ACRE FEET	%OF MEAN	INCHES	ACRE FEET	%OF MEAN	INCHES	RUN OFF COEFFICIENT	ACRE FEET	%OF MEAN	INCHES	LOSS COEFFICIENT
1940—1941	8 172 000	96	46.5	2 142 000	95	12.2	0.26	6 030 000	96	34.3	0.74
1941—1942	8 865 000	104	50.5	2 423 000	107	13.8	0.27	6 442 000	102	36.7	0.73
1942—1943	8 411 000	98	47.9	2 212 000	98	12.6	0.26	6 199 000	98	35.3	0.74
1943—1944	7 633 000	89	43.5	2 002 000	89	11.4	0.26	5 631 000	89	32.1	0.74
1944—1945	12 345 000	144	70.3	3 283 000	145	18.7	0.27	9 062 000	144	51.6	0.73
5 YEARS AVERAGE	9 085 000	106	51.7	2 412 000	107	13.7	0.26	6 673 000	106	38.0	0.74
1945—1946	7 827 000	92	44.6	2 054 000	91	11.7	0.26	5 773 000	92	32.9	0.74
1946—1947	9 282 000	109	52.9	2 458 000	109	14.0	0.26	6 824 000	108	38.9	0.74
1947—1948	8 075 000	94	46.0	2 124 000	94	12.1	0.26	5 951 000	95	33.9	0.74
1948—1949	6 561 000	77	37.4	1 721 000	76	9.8	0.26	4 840 000	77	27.6	0.74
1949—1950	8 481 000	99	48.3	2 230 000	99	12.7	0.26	6 251 000	99	35.6	0.74
5 YEARS AVERAGE	8 045 000	94	45.8	2 117 000	94	12.1	0.26	5 928 000	94	33.7	0.74
1950—1951	7 758 000	91	44.2	2 037 000	90	11.6	0.26	5 721 000	91	32.6	0.74
1651—1952	11 257 000	132	64.1	2 985 000	132	17.0	0.27	8 272 000	131	47.1	0.73
1952—1953	7 097 000	83	40.4	1 843 000	82	10.5	0.26	5 254 000	83	29.9	0.74
1953—1954	7 721 000	90	44.0	2 019 000	89	11.5	0.26	5 702 000	91	32.5	0.74
1954—1955	8 820 000	103	50.2	2 318 000	103	13.2	0.26	6 502 000	103	37.0	0.74
5 YEARS AVERAGE	8 531 000	100	48.6	2 240 000	99	12.8	0.26	6 291 000	100	35.8	0.74
15 YEARS AVERAGE	8 554 000	100	48.7	2 257 000	100	12.9	0.26	6 297 000	100	35.8	0.74
1955—1956	12 031 000	141	68.5	3 195 000	142	18.2	0.27	8 836 000	140	50.3	0.73
1956—1957	11 243 000	131	64.0	2 992 567	133	17.0	0.27	8 250 433	131	47.0	0.73
1957—1958	8 059 000	94	45.9	2 657 270	118	15.1	0.33	5 401 730	86	30.8	0.67
1958—1959	7 431 000	87	42.3	1 945 715	86	11.1	0.26	5 485 285	87	31.2	0.74
1959 - 1960											
5 YEARS AVERAGE											
MAXIMUM	12 345 000	144	70.3	3 283 000	145	18.7	0.27	9 062 000	144	51.6	0.73
MINIMUM	6 561 000	77	37.4	1 721 000	76	9.8	0.26	4 840 000	77	27.6	0.74

TABLE XI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION.

RAINFALL, RUN-OFF AND LOSS OF WATER

OBSERVED AND SYNTHETIC YEARLY VALUES.

RIVER Furua STATION Malinyi No. 1KB16 CATCHMENT AREA 507 SQ. MILES

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL			RUN-OFF				LOSS OF WATER			
	ACRE FEET	%OF MEAN	INCHES	ACRE FEET	%OF MEAN	INCHES	RUN OFF COEFFICIENT	ACRE FEET	%OF MEAN	INCHES	LOSS COEFFICIENT
1940—1941	1 317 000	102	48.7	627 000	104	23.2	0.48	690 000	101	25.5	0.52
1941—1942	1 514 000	118	56.0	767 000	127	28.4	0.51	747 000	110	27.6	0.49
1942—1943	1 430 000	111	52.9	705 000	117	26.1	0.49	725 000	106	26.8	0.51
1943—1944	1 030 000	80	38.1	422 000	70	15.6	0.41	608 000	89	22.5	0.59
1944—1945	1 411 000	110	52.2	692 000	115	25.6	0.49	719 000	105	26.6	0.51
5 YEARS AVERAGE	1 340 000	104	49.6	643 000	106	23.8	0.48	697 000	102	25.8	0.52
1945—1946	1 220 000	95	45.1	559 000	93	20.7	0.46	661 000	97	24.4	0.54
1946—1947	1 301 000	101	48.1	616 000	102	22.8	0.47	685 000	100	25.3	0.53
1947—1948	1 246 000	97	46.1	576 000	95	21.3	0.46	670 000	98	24.8	0.54
1948—1949	1 163 000	90	43.0	516 000	85	19.1	0.44	647 000	95	23.9	0.56
1949—1950	1 574 000	122	58.2	808 000	134	29.9	0.51	766 000	112	28.3	0.49
5 YEARS AVERAGE	1 301 000	101	48.1	615 000	102	22.8	0.47	686 000	101	25.3	0.53
1950—1951	1 200 000	93	44.4	543 000	90	20.1	0.45	657 000	96	24.3	0.55
1651—1952	1 625 000	126	60.1	819 000	136	31.3	0.52	806 000	118	28.8	0.48
1952—1953	952 000	74	35.2	392 000	65	14.5	0.41	560 000	82	20.7	0.59
1953—1954	1 028 000	80	38.0	422 000	70	15.6	0.41	606 000	89	22.4	0.59
1954 - 1955	1 279 000	99	47.3	597 000	99	22.1	0.47	682 000	100	25.2	0.53
5 YEARS AVERAGE	1 217 000	95	45.0	555 000	92	20.5	0.46	662 000	97	24.5	0.54
15 YEARS AVERAGE	1 286 000	100	47.6	604 000	100	22.4	0.47	682 000	100	25.2	0.53
1955—1956	1 844 000	143	68.2	1 000 000	166	37.0	0.54	844 000	124	31.2	0.46
1956—1957	1 495 000	116	55.3	751 000	124	27.8	0.50	744 000	109	27.5	0.50
1957—1958	1 217 000	95	45.0	557 439	92	20.6	0.46	659 561	97	24.4	0.54
1958—1959	1 006 000	78	37.2	405 745	67	15.0	0.40	600 255	88	22.2	0.60
1959 - 1960											
5 YEARS AVERAGE											
MAXIMUM	1 844 000	143	68.2	1 000 000	166	37.0	0.54	844 000	124	31.2	0.46
MINIMUM	952 000	74	35.2	392 000	65	14.5	0.41	560 000	82	20.7	0.59

TABLE XI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION.

RAINFALL, RUN-OFF AND LOSS OF WATER

OBSERVED AND SYNTHETIC YEARLY VALUES.

RIVER Kilombero STATION Swero No. 1KB17 CATCHMENT AREA 12 915 SQ. MILES

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL			RUN-OFF				LOSS OF WATER			
	ACRE FEET	%OF MEAN	INCHES	ACRE FEET	%OF MEAN	INCHES	RUN OFF COEFFICIENT	ACRE FEET	%OF MEAN	INCHES	LOSS COEFFICIENT
1940—1941	34 637 000	93	50.3	9 775 000	88	14.2	0.28	24 862 000	0.96	36.1	0.72
1941—1942	38 914 000	105	56.5	11 909 000	107	17.3	0.31	27 005 000	104	39.2	0.69
1942—1943	34 556 000	93	50.2	9 775 000	88	14.2	0.28	24 781 000	95	36.0	0.72
1943—1944	33 630 000	91	48.9	9 393 000	84	13.5	0.28	24 337 000	94	35.4	0.72
1944—1945	50 060 000	135	72.7	17 485 000	158	25.4	0.35	32 575 000	125	47.3	0.65
5 YEARS AVERAGE	38 359 000	103	55.7	11 647 000	105	16.9	0.30	26 712 000	103	38.8	0.70
1945—1946	34 910 000	94	50.7	9 981 000	90	14.5	0.29	24 929 000	96	36.2	0.71
1946—1947	43 222 000	117	62.8	14 043 000	127	20.4	0.32	29 179 000	112	42.4	0.68
1947—1948	38 686 000	104	56.2	11 840 000	107	17.2	0.31	26 846 000	103	39.0	0.69
1948—1949	27 025 000	75	39.3	6 333 000	57	9.2	0.23	20 692 000	80	30.1	0.77
1949—1950	40 616 000	109	59.0	12 735 000	115	18.5	0.31	27 881 000	107	40.5	0.69
5 YEARS AVERAGE	36 892 000	99	53.6	10 986 000	99	16.0	0.30	25 906 000	100	37.6	0.70
1950—1951	37 912 000	102	55.0	12 046 000	109	17.5	0.32	25 866 000	99	37.5	0.68
1651—1952	44 866 000	121	65.2	14 869 000	134	21.6	0.33	29 997 000	115	43.6	0.67
1952—1953	29 370 000	79	42.3	7 228 000	65	10.5	0.25	22 142 000	85	31.8	0.75
1953—1954	31 847 000	86	46.3	8 398 000	76	12.2	0.26	23 449 000	90	34.1	0.74
1954—1955	36 240 000	98	52.6	10 670 000	96	15.5	0.29	25 570 000	98	37.1	0.71
5 YEARS AVERAGE	36 047 000	97	52.3	10 642 000	96	15.5	0.30	25 405 000	97	36.8	0.70
15 YEARS AVERAGE	37 099 000	100	53.9	11 092 000	100	16.1	0.30	26 007 000	100	37.8	0.70
1955—1956	47 966 000	129	69.7	16 314 000	147	23.7	0.34	31 652 000	122	46.0	0.66
1956—1957	39 105 000	105	56.8	12 046 000	109	17.5	0.31	27 057 000	104	39.3	0.69
1957—1958	37 430 000	101	54.4	11 221 000	101	16.3	0.30	26 209 000	101	38.1	0.70
1958—1959	28 256 000	76	41.1	6 789 000	61	9.9	0.24	21 537 000	83	31.2	0.76
1959—1960											
5 YEARS AVERAGE											
MAXIMUM	50 060 000	135	72.7	17 485 000	158	25.4	0.35	35 575 000	125	47.3	0.65
MINIMUM	27 025 000	75	39.3	6 333 000	57	9.2	0.23	20 692 000	80	30.1	0.77

TABLE VII

ANNUAL RAINFALL

Rufiji *River to* Indian Ocean (Entire Basin).

Catchment area 68500 *Sq. miles*

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL		
	ACRE FEET	%OF MEAN	INCHES
1940—1941	119 293 000	97	32.7
1941—1942	140 615 000	114	38.5
1942—1943	114 226 000	93	31.3
1943—1944	113 838 000	93	31.2
1944—1945	149 376 000	122	40.9
5 YEARS AVERAGE	127 470 000	104	34.9
1945—1946	108 187 000	88	29.6
1946—1947	155 072 000	126	42.5
1947—1948	129 409 000	105	35.4
1948—1949	89 277 000	73	24.5
1949—1950	133 698 000	109	36.6
5 YEARS AVERAGE	123 129 000	101	33.7
1950—1951	129 765 000	106	35.5
1951—1952	141 152 000	115	38.7
1952—1953	90 097 000	73	24.7
1953—1954	100 939 000	82	27.6
1954—1955	124 983 000	102	34.2
5 YEARS AVERAGE	117 387 000	96	32.2
15 YEARS AVERAGE	122 662 000	100	33.6
1955—1956	168 941 000	138	46.3
1956—1957	135 485 000	110	37.1
1957—1958	123 394 000	101	33.8
1958—1959	106 532 000	87	29.2
1959—1960			
5 YEARS AVERAGE			
MAXIMUM	168 941 000	138	46.3
MINIMUM	89 277 000	73	24.5

TABLE VII

ANNUAL RAINFALL

Rufiji River to Indian Ocean from Confl. Luwegu, Kilombero and Gt. Ruaha.

Catchment area 10478 Sq. miles

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL		
	ACRE FEET	%OF MEAN	INCHES
1940—1941	16 419 000	88	29.4
1941—1942	24 182 000	129	43.3
1942—1943	19 044 000	102	34.1
1943—1944	19 100 000	102	34.2
1944—1945	24 015 000	128	43.0
5 YEARS AVERAGE	20 552 000	110	36.8
1945—1946	13 962 000	75	25.0
1946—1947	24 461 000	131	43.8
1947—1948	18 877 000	101	33.8
1948—1949	13 627 000	73	24.4
1949—1950	17 089 000	91	30.6
5 YEARS AVERAGE	17 603 000	94	31.5
1950—1951	21 055 000	113	37.7
1951—1952	19 044 000	102	34.1
1952—1953	12 901 000	69	23.1
1953—1954	16 196 000	87	29.0
1954—1955	21 446 000	115	38.4
5 YEARS AVERAGE	18 128 000	97	32.4
15 YEARS AVERAGE	18 761 000	100	33.5
1955—1956	20 329 000	109	36.4
1956—1957	17 871 000	96	32.0
1957—1958	15 861 000	85	28.4
1958—1959	16 978 000	91	30.4
1959—1960			
5 YEARS AVERAGE			
MAXIMUM	24 461 000	131	43.8
MINIMUM	12 901 000	69	23.1

TABLE VII

ANNUAL RAINFALL

Great Ruaha River to Rufiji Confluence

Catchment area 32424 Sq. miles

HYDROLOGICAL YEAR 1/11--31/10	RAINFALL		
	ACRE FEET	%OF MEAN	INCHES
1940—1941	42 132 000	106	24.4
1941—1942	48 813 000	123	28.2
1942—1943	35 757 000	90	20.7
1943—1944	34 964 000	88	20.2
1944—1945	42 396 000	107	24.5
5 YEARS AVERAGE	40 812 000	103	23.6
1945—1946	37 250 000	94	21.6
1946—1947	53 620 000	135	31.0
1947—1948	44 548 000	112	25.8
1948—1949	27 220 000	68	15.8
1949—1950	43 287 000	109	25.0
5 YEARS AVERAGE	41 185 000	104	23.8
1950—1951	42 652 000	107	24.7
1951—1952	46 566 000	117	26.9
1952—1953	27 944 000	70	16.2
1953—1954	29 923 000	75	17.3
1954—1955	39 417 000	99	22.8
5 YEARS AVERAGE	37 300 000	94	21.6
15 YEARS AVERAGE	39 766 000	100	23.0
1955—1956	56 559 000	142	32.7
1956—1957	49 798 000	125	28.8
1957—1958	44 977 000	112	25.7
1958—1959	39 083 000	98	22.6
1959—1960			
5 YEARS AVERAGE			
MAXIMUM	56 559 000	142	32.7
MINIMUM	27 220 000	68	15.8

TABLE VII

ANNUAL RAINFALL

Little Ruaha *River to* Great Ruaha Confluence

Catchment area 2141 *Sq. miles*

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL		
	ACRE FEET	%OF MEAN	INCHES
1940—1941	3 410 000	99	29.9
1941—1942	4 430 000	129	38.8
1942—1943	3 620 000	105	31.7
1943—1944	3 160 000	92	27.7
1944—1945	4 810 000	140	42.1
5 YEARS AVERAGE	3 886 000	113	34.1
1945—1946	3 040 000	89	26.6
1946—1947	4 020 000	117	35.2
1947—1948	3 740 000	109	32.8
1948—1949	2 260 000	66	19.8
1949—1950	2 645 000	77	23.2
5 YEARS AVERAGE	3 141 000	92	27.5
1950—1951	3 340 000	97	29.3
1951—1952	4 035 000	118	35.4
1952—1953	2 720 000	79	23.8
1953—1954	3 150 000	92	27.6
1954—1955	3 100 000	90	27.2
5 YEARS AVERAGE	3 269 000	95	28.6
15 YEARS AVERAGE	3 432 000	100	30.1
1955—1956	3 872 000	113	33.9
1956—1957	4 618 000	135	40.5
1957—1958	3 225 000	94	28.3
1958—1959	2 946 000	86	25.8
1959—1960			
5 YEARS AVERAGE			
MAXIMUM	4 810 000	140	42.1
MINIMUM	2 260 000	66	19.8

TABLE VII

ANNUAL RAINFALL

Ipwani River to Tunduma

Catchment area 637 Sq. miles

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL		
	ACRE FEET	%OF MEAN	INCHES
1940—1941	1 020 000	107	30.0
1941—1942	1 223 000	129	36.0
1942—1943	920 000	97	27.1
1943—1944	781 000	82	23.0
1944—1945	1 172 000	123	34.5
5 YEARS AVERAGE	1 023 000	108	30.1
1945—1946	832 000	88	24.5
1946—1947	883 000	93	26.0
1947—1948	1 019 000	107	30.0
1948—1949	680 000	72	20.0
1949—1950	885 000	93	26.1
5 YEARS AVERAGE	860 000	91	25.3
1950—1951	1 093 000	115	32.2
1951—1952	1 165 000	123	34.3
1952—1953	640 000	67	18.8
1953—1954	951 000	100	28.0
1954—1955	970 000	102	28.6
5 YEARS AVERAGE	964 000	101	28.4
15 YEARS AVERAGE	949 000	100	28.0
1955—1956	1 308 000	138	38.5
1956—1957	1 170 000	123	34.5
1957—1958	1 070 000	113	31.5
1958—1959	934 000	98	27.5
1959—1960			
5 YEARS AVERAGE			
MAXIMUM	1 308 000	138	38.5
MINIMUM	640 000	67	18.8

TABLE VII

ANNUAL RAINFALL

Ipwani *River to* Proposed Damsite

Catchment area 455 *Sq. miles*

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL		
	ACRE FEET	%OF MEAN	INCHES
1940—1941	818 000	111	33.7
1941—1942	922 000	126	38.0
1942—1943	717 000	98	29.6
1943—1944	558 000	76	23.0
1944—1945	898 000	122	37.0
5 YEARS AVERAGE	783 000	107	32.3
1945—1946	655 000	89	27.0
1946—1947	645 000	88	26.6
1947—1948	860 000	117	35.5
1948—1949	607 000	83	25.0
1949—1950	655 000	89	27.0
5 YEARS AVERAGE	684 000	93	28.2
1950—1951	850 000	116	35.0
1951—1952	898 000	122	37.0
1952—1953	500 000	68	20.6
1953—1954	709 000	97	29.2
1954—1955	720 000	98	29.7
5 YEARS AVERAGE	735 000	100	30.3
15 YEARS AVERAGE	734 000	100	30.3
1955—1956	857 000	117	35.3
1956—1957	966 000	132	39.8
1957—1958	787 000	107	32.4
1958—1959	747 000	102	30.8
1959—1960			
5 YEARS AVERAGE			
MAXIMUM	966 000	132	39.8
MINIMUM	500 000	68	20.6

TABLE VII

ANNUAL RAINFALL

Halali River to Tunduma

Catchment area 377 Sq. miles

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL		
	ACRE FEET	%OF MEAN	INCHES
1940—1941	667 000	112	33.2
1941—1942	760 000	127	37.8
1942—1943	508 000	85	25.3
1943—1944	473 000	79	23.5
1944—1945	801 000	134	39.9
5 YEARS AVERAGE	642 000	107	31.9
1945—1946	583 000	98	29.0
1946—1947	568 000	95	28.3
1947—1948	638 000	107	31.7
1948—1949	415 000	70	20.7
1949—1950	593 000	99	29.5
5 YEARS AVERAGE	559 000	94	27.8
1950—1951	718 000	120	35.7
1951—1952	746 000	125	37.1
1952—1953	336 000	56	16.7
1953—1954	560 000	94	27.9
1954—1955	589 000	99	29.3
5 YEARS AVERAGE	599 000	99	29.4
15 YEARS AVERAGE	597 000	100	29.7
1955—1956	764 000	128	38.0
1956—1957	680 000	114	33.8
1957—1958	583 000	98	29.0
1958—1959	565 000	95	28.1
1959—1960			
5 YEARS AVERAGE			
MAXIMUM	801 000	134	39.9
MINIMUM	336 000	56	16.7

TABLE VII

ANNUAL RAINFALL

Mbarali River to Proposed Damsite

Catchment area 574 *Sq. miles*

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL		
	ACRE FEET	%OF MEAN	INCHES
1940—1941	1 135 000	113	37.1
1941—1942	1 034 000	103	33.8
1942—1943	987 000	98	32.2
1943—1944	926 000	92	30.3
1944—1945	1 435 000	143	46.9
5 YEARS AVERAGE	1 103 000	110	36.0
1945—1946	1 136 000	113	37.1
1946—1947	1 031 000	103	33.7
1947—1948	1 019 000	101	33.3
1948—1949	683 000	68	22.3
1949—1950	1 022 000	102	33.4
5 YEARS AVERAGE	978 000	97	32.0
1950—1951	1 022 000	102	33.4
1951—1952	1 132 000	113	37.0
1952—1953	622 000	62	20.3
1953—1954	917 000	91	30.0
1954—1955	976 000	97	31.9
5 YEARS AVERAGE	934 000	93	30.5
15 YEARS AVERAGE	1 005 000	100	32.8
1955—1956	1 294 000	129	42.3
1956—1957	1 195 000	119	39.1
1957—1958	948 000	94	31.0
1958—1959			
1959—1960			
5 YEARS AVERAGE			
MAXIMUM	1 435 000	143	46.9
MINIMUM	622 000	62	20.3

TABLE VII

ANNUAL RAINFALL

Chimala River to Chimala

Catchment area 85 Sq. miles

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL		
	ACRE FEET	%OF MEAN	INCHES
1940—1941	215 000	105	47.4
1941—1942	262 000	128	57.8
1942—1943	166 000	81	36.6
1943—1944	143 000	70	31.6
1944—1945	233 000	114	51.4
5 YEARS AVERAGE	204 000	100	45.0
1945—1946	251 000	122	55.4
1946—1947	243 000	119	53.6
1947—1948	203 000	99	44.8
1948—1949	136 000	66	30.0
1949—1950	218 000	106	48.1
5 YEARS AVERAGE	210 000	102	46.4
1950—1951	240 000	117	53.0
1951—1952	246 000	120	54.3
1952—1953	181 000	88	39.9
1953—1954	178 000	87	39.3
1954—1955	164 000	80	36.2
5 YEARS AVERAGE	202 000	98	44.5
15 YEARS AVERAGE	205 000	100	45.2
1955—1956	285 000	139	62.9
1956—1957	239 000	117	52.8
1957—1958	198 000	97	43.7
1958—1959	193 000	94	42.6
1959—1960			
5 YEARS AVERAGE			
MAXIMUM	285 000	139	62.9
MINIMUM	136 000	66	30.0

TABLE VII

ANNUAL RAINFALL

Liosi River to Old Gt.North Road

Catchment area 30 *Sq. miles*

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL		
	ACRE FEET	%OF MEAN	INCHES
1940—1941	82 000	106	51.3
1941—1942	102 000	132	63.8
1942—1943	59 000	77	36.9
1943—1944	49 000	64	30.6
1944—1945	108 000	140	67.5
5 YEARS AVERAGE	80 000	104	50.0
1945—1946	95 000	123	59.4
1946—1947	92 000	119	57.5
1947—1948	74 000	96	46.3
1948—1949	50 000	65	31.3
1949—1950	80 000	104	50.0
5 YEARS AVERAGE	78 000	101	48.9
1950—1951	90 000	117	56.3
1951—1952	92 000	119	57.5
1952—1953	52 000	68	32.5
1953—1954	63 000	82	39.4
1954—1955	70 000	91	43.8
5 YEARS AVERAGE	73 000	95	45.9
15 YEARS AVERAGE	77 000	100	48.2
1955—1956	105 000	136	65.7
1956—1957	94 000	122	58.8
1957—1958			
1958—1959			
1959—1960			
5 YEARS AVERAGE			
MAXIMUM	108 000	140	67.5
MINIMUM	49 000	64	30.6

TABLE VII

ANNUAL RAINFALL

Mambi *River to* Old Gt. North Road

Catchment area 32 *Sq. miles*

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL		
	ACRE FEET	%OF MEAN	INCHES
1940—1941	91 000	106	53.4
1941—1942	103 000	120	60.4
1942—1943	64 000	74	37.5
1943—1944	59 000	69	34.6
1944—1945	122 000	142	71.5
5 YEARS AVERAGE	88 000	102	51.5
1945—1946	101 000	117	59.2
1946—1947	107 000	124	62.7
1947—1948	85 000	99	49.8
1948—1949	57 000	66	33.4
1949—1950	90 000	105	52.8
5 YEARS AVERAGE	88 000	102	51.6
1950—1951	94 000	109	55.1
1951—1952	105 000	122	61.6
1952—1953	62 000	72	36.4
1953—1954	69 000	80	40.4
1954—1955	83 000	97	48.7
5 YEARS AVERAGE	83 000	96	48.4
15 YEARS AVERAGE	86 000	100	50.4
1955—1956	111 000	129	65.1
1956—1957	96 000	112	56.3
1957—1958			
1958—1959			
1959—1960			
5 YEARS AVERAGE			
MAXIMUM	122 000	142	71.5
MINIMUM	57 000	66	33.4

TABLE VII

ANNUAL RAINFALL

Mswiswi River to Old Gt. North Road

Catchment area 36 Sq. miles

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL		
	ACRE FEET	%OF MEAN	INCHES
1940—1941	106 000	106	55.2
1941—1942	108 000	108	56.3
1942—1943	80 000	80	41.7
1943—1944	79 000	79	41.2
1944—1945	145 000	145	75.6
5 YEARS AVERAGE	104 000	104	54.0
1945—1946	114 000	114	59.4
1946—1947	126 000	126	65.7
1947—1948	99 000	99	51.6
1948—1949	69 000	69	36.0
1949—1950	102 000	102	53.2
5 YEARS AVERAGE	102 000	102	53.2
1950—1951	108 000	108	56.3
1951—1952	122 000	122	63.6
1952—1953	72 000	72	37.5
1953—1954	86 000	86	44.8
1954—1955	91 000	91	47.4
5 YEARS AVERAGE	96 000	96	49.9
15 YEARS AVERAGE	100 000	100	52.1
1955—1956	129 000	129	67.2
1956—1957	144 000	144	75.0
1957—1958			
1958—1959			
1959—1960			
5 YEARS AVERAGE			
MAXIMUM	145 000	145	75.6
MINIMUM	69 000	69	36.0

TABLE VII

ANNUAL RAINFALL

Kilombero *River to* Luwegu Confluence

Catchment area 15442 *Sq. miles*

HYDROLOGICAL YEAR 1/11 – 31/10	RAINFALL		
	ACRE FEET	%OF MEAN	INCHES
1940—1941	40 602 000	94	49.3
1941—1942	44 180 000	102	53.7
1942—1943	41 755 000	97	50.7
1943—1944	40 274 000	93	48.9
1944—1945	58 385 000	155	70.9
5 YEARS AVERAGE	45 039 000	104	54.7
1945—1946	38 775 000	90	47.1
1946—1947	49 661 000	115	60.3
1947—1948	43 240 000	100	52.5
1948—1949	31 800 000	73	38.6
1949—1950	48 772 000	113	59.3
5 YEARS AVERAGE	42 450 000	98	51.6
1950—1951	45 800 000	106	55.6
1951—1952	53 532 000	124	65.0
1952—1953	33 172 000	77	40.3
1953—1954	35 650 000	82	43.3
1954—1955	43 320 000	100	52.6
5 YEARS AVERAGE	42 295 000	98	51.4
15 YEARS AVERAGE	43 261 000	100	52.6
1955—1956	60 533 000	140	73.5
1956—1957	46 040 000	106	55.9
1957—1958	44 802 000	104	54.4
1958—1959	32 813 000	76	32.9
1959—1960			
5 YEARS AVERAGE			
MAXIMUM	60 533 000	140	73.5
MINIMUM	31 800 000	73	38.6

TABLE VII

ANNUAL RAINFALL

Lumemo River to Kibaoni & Ifakara

Catchment area 165 Sq. miles

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL		
	ACRE FEET	%OF MEAN	INCHES
1940—1941	574 000	100	65.3
1941—1942	646 000	112	73.5
1942—1943	551 000	96	62.6
1943—1944	507 000	88	57.6
1944—1945	734 000	127	83.5
5 YEARS AVERAGE	602 000	105	68.5
1945—1946	512 000	89	58.2
1946—1947	616 000	107	70.1
1947—1948	607 000	105	69.0
1948—1949	435 000	76	49.5
1949—1950	600 000	104	68.2
5 YEARS AVERAGE	554 000	96	63.0
1950—1951	554 000	96	63.0
1951—1952	718 000	125	81.6
1952—1953	636 000	110	72.3
1953—1954	474 000	82	53.9
1954—1955	484 000	84	55.0
5 YEARS AVERAGE	573 000	99	65.2
15 YEARS AVERAGE	576 000	100	65.5
1955—1956	660 000	115	75.1
1956—1957	532 000	92	60.5
1957—1958	539 000	94	61.3
1958—1959	501 000	87	57.0
1959—1960			
5 YEARS AVERAGE			
MAXIMUM	734 000	127	83.5
MINIMUM	435 000	76	49.5

TABLE VII

ANNUAL RAINFALL

Ruipa *River to* Kilombero Confluence

Catchment area 683 *Sq. miles*

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL		
	ACRE FEET	%OF MEAN	INCHES
1940—1941	2 180 000	107	59.9
1941—1942	2 412 000	118	66.2
1942—1943	2 257 000	111	62.0
1943—1944	1 829 000	90	50.2
1944—1945	3 035 000	149	83.4
5 YEARS AVERAGE	2 343 000	115	64.3
1945—1946	1 910 000	94	52.5
1946—1947	2 260 000	111	62.1
1947—1948	2 202 000	108	60.5
1948—1949	1 229 000	60	33.7
1949—1950	2 046 000	100	56.2
5 YEARS AVERAGE	1 929 000	95	53.0
1950—1951	1 774 000	87	48.7
1951—1952	2 708 000	133	74.4
1952—1953	1 658 000	81	45.5
1953—1954	1 602 000	79	44.0
1954—1955	1 500 000	74	41.2
5 YEARS AVERAGE	1 848 000	90	50.7
15 YEARS AVERAGE	2 040 000	100	56.0
1955—1956	2 447 000	120	67.2
1956—1957	1 946 000	95	53.4
1957—1958	2 262 000	111	62.1
1958—1959	1 763 000	86	48.4
1959—1960			
5 YEARS AVERAGE			
MAXIMUM	3 035 000	149	83.4
MINIMUM	1 229 000	60	33.7

TABLE VII

ANNUAL RAINFALL

Ruipa River to Proposed Damsite

Catchment area 535 Sq. miles

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL		
	ACRE FEET	%OF MEAN	INCHES
1940—1941	1 597 000	113	56.0
1941—1942	1 650 000	117	57.8
1942—1943	1 500 000	106	52.6
1943—1944	1 278 000	90	44.8
1944—1945	2 056 000	145	72.1
5 YEARS AVERAGE	1 616 000	114	56.7
1945—1946	1 358 000	96	47.6
1946—1947	1 612 000	114	56.5
1947—1948	1 592 000	121	55.8
1948—1949	850 000	60	29.8
1949—1950	1 401 000	99	49.1
5 YEARS AVERAGE	1 363 000	96	47.8
1950—1951	1 200 000	85	42.1
1951—1952	1 766 000	125	61.9
1952—1953	1 164 000	82	40.8
1953—1954	1 141 000	81	40.0
1954—1955	1 070 000	76	37.5
5 YEARS AVERAGE	1 268 000	90	44.5
15 YEARS AVERAGE	1 416 000	100	49.7
1955—1956	1 586 000	112	55.6
1956—1957	1 347 000	95	47.2
1957—1958	1 555 000	110	54.5
1958—1959	1 147 000	81	40.2
1959—1960			
5 YEARS AVERAGE			
MAXIMUM	2 056 000	145	72.1
MINIMUM	850 000	60	29.8

TABLE VII

ANNUAL RAINFALL

Kihansi River to Proposed Damsite

Catchment area 475 *Sq. miles*

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL		
	ACRE FEET	%OF MEAN	INCHES
1940—1941	1 520 000	95	60.0
1941—1942	1 723 000	108	68.1
1942—1943	1 590 000	100	62.8
1943—1944	1 520 000	95	60.0
1944—1945	2 055 000	129	81.2
5 YEARS AVERAGE	1 682 000	106	66.4
1945—1946	1 523 000	96	60.2
1946—1947	1 574 000	99	62.2
1947—1948	1 512 000	95	59.7
1948—1949	1 328 000	83	52.5
1949—1950	1 784 000	112	70.5
5 YEARS AVERAGE	1 544 000	97	61.0
1950—1951	1 505 000	94	59.4
1951—1952	1 911 000	120	75.5
1952—1953	1 380 000	87	54.5
1953—1954	1 430 000	90	56.5
1954—1955	1 556 000	98	61.4
5 YEARS AVERAGE	1 556 000	98	61.5
15 YEARS AVERAGE	1 594 000	100	63.0
1955—1956	1 985 000	125	78.4
1956—1957	1 581 000	99	62.4
1957—1958	1 460 000	92	57.7
1958—1959	1 300 000	82	51.3
1959—1960			
5 YEARS AVERAGE			
MAXIMUM	2 055 000	129	81.2
MINIMUM	1 300 000	82	51.3

TABLE VII

ANNUAL RAINFALL

Mpanga River to Mnyera Confluence

Catchment area 1010 Sq. miles

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL		
	ACRE FEET	%OF MEAN	INCHES
1940—1941	2 160 000	73	40.1
1941—1942	3 528 000	120	65.5
1942—1943	2 704 000	92	50.2
1943—1944	2 677 000	91	49.7
1944—1945	4 072 000	138	75.6
5 YEARS AVERAGE	3 028 000	103	56.2
1945—1946	2 941 000	100	54.6
1946—1947	2 963 000	100	55.0
1947—1948	2 876 000	97	53.4
1948—1949	2 489 000	84	46.2
1949—1950	3 005 000	102	55.8
5 YEARS AVERAGE	2 855 000	97	53.0
1950—1951	2 532 000	86	47.0
1951—1952	3 975 000	135	73.8
1952—1953	2 424 000	82	45.0
1953—1954	2 726 000	92	50.6
1954—1955	3 176 000	108	59.0
5 YEARS AVERAGE	2 967 000	100	55.1
15 YEARS AVERAGE	2 950 000	100	54.8
1955—1956	3 819 000	129	70.9
1956—1957	3 243 000	110	60.2
1957—1958	2 790 000	95	51.8
1958—1959	2 487 000	84	46.2
1959—1960			
5 YEARS AVERAGE			
MAXIMUM	4 072 000	138	75.6
MINIMUM	2 160 000	73	40.1

TABLE VII

ANNUAL RAINFALL

Mpanga River to Proposed Damsite

Catchment area 910 *Sq. miles*

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL		
	ACRE FEET	%OF MEAN	INCHES
1940—1941	1 985 000	73	40.9
1941—1942	3 596 000	131	79.1
1942—1943	2 500 000	91	51.5
1943—1944	2 475 000	90	51.0
1944—1945	3 848 000	141	79.3
5 YEARS AVERAGE	2 881 000	105	59.4
1945—1946	2 682 000	98	55.3
1946—1947	2 771 000	101	57.1
1947—1948	2 660 000	97	54.8
1948—1949	2 247 000	82	46.3
1949—1950	2 830 000	103	58.3
5 YEARS AVERAGE	2 638 000	96	54.4
1950—1951	2 315 000	85	47.7
1951—1952	3 512 000	128	72.4
1952—1953	2 261 000	83	46.6
1953—1954	2 460 000	90	50.7
1954—1955	2 917 000	107	60.1
5 YEARS AVERAGE	2 693 000	98	55.5
15 YEARS AVERAGE	2 737 000	100	56.4
1955—1956	3 427 000	125	70.7
1956—1957	2 961 000	108	61.0
1957—1958	2 596 000	95	53.5
1958—1959	2 305 000	84	47.5
1959—1960			
5 YEARS AVERAGE			
MAXIMUM	3 848 000	141	79.3
MINIMUM	1 985 000	73	40.9

TABLE VII

ANNUAL RAINFALL

Mnyeara River to Ruhuji Confluence

Catchment area 2652 Sq. miles

HYDROLOGICAL YEAR 1/11– 31/10	RAINFALL		
	ACRE FEET	%OF MEAN	INCHES
1940—1941	7 463 000	97	52.8
1941—1942	8 640 000	112	61.1
1942—1943	7 981 000	104	56.5
1943—1944	7 155 000	93	50.6
1944—1945	11 263 000	147	79.7
5 YEARS AVERAGE	8 500 000	111	60.1
1945—1946	7 177 000	93	50.8
1946—1947	7 918 000	103	56.0
1947—1948	7 267 000	95	51.4
1948—1949	5 428 000	71	38.4
1949—1950	8 593 000	112	60.8
5 YEARS AVERAGE	7 277 000	95	51.5
1950—1951	7 217 000	94	51.0
1951—1952	8 986 000	117	63.6
1952—1953	6 168 000	80	43.6
1953—1954	6 503 000	85	46.0
1954—1955	7 509 000	98	53.1
5 YEARS AVERAGE	7 277 000	95	51.5
15 YEARS AVERAGE	7 685 000	100	54.4
1955—1956	10 163 000	132	71.9
1956—1957	7 781 000	101	55.0
1957—1958	7 490 000	97	53.0
1958—1959	5 742 000	75	40.6
1959—1960			
5 YEARS AVERAGE			
MAXIMUM	11 263 000	147	79.7
MINIMUM	5 428 000	71	38.4

TABLE VII

ANNUAL RAINFALL

Mnyera *River to* Proposed Damsite

Catchment area 2264 *Sq. miles*

HYDROLOGICAL YEAR 1/11–31/10	RAINFALL		
	ACRE FEET	%OF MEAN	INCHES
1940—1941	6 323 000	96	52.4
1941—1942	7 580 000	115	62.8
1942—1943	6 631 000	101	55.0
1943—1944	6 265 000	95	51.9
1944—1945	9 663 000	147	80.1
5 YEARS AVERAGE	7 292 000	111	60.4
1945—1946	6 227 000	95	51.6
1946—1947	6 718 000	102	55.7
1947—1948	6 294 000	96	52.2
1948—1949	4 663 000	71	38.6
1949—1950	7 143 000	109	59.2
5 YEARS AVERAGE	6 209 000	94	51.4
1950—1951	6 077 000	92	50.3
1951—1952	7 746 000	118	64.2
1952—1953	5 361 000	81	44.4
1953—1954	5 572 000	85	46.2
1954—1955	6 454 000	98	53.5
5 YEARS AVERAGE	6 242 000	95	51.7
15 YEARS AVERAGE	6 581 000	100	54.5
1955—1956	9 261 000	141	76.7
1956—1957	6 539 000	99	54.2
1957—1958	6 290 000	96	52.1
1958—1959	5 024 000	76	41.6
1959—1960			
5 YEARS AVERAGE			
MAXIMUM	9 663 000	147	80.1
MINIMUM	4 663 000	71	38.6

TABLE VII

ANNUAL RAINFALL

Kigogo-Ruaha River to Lidete Confluence

Catchment area 684 Sq. miles

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL		
	ACRE FEET	%OF MEAN	INCHES
1940—1941	1 730 000	90	47.4
1941—1942	2 317 000	120	63.6
1942—1943	1 973 000	102	54.1
1943—1944	1 924 000	100	52.8
1944—1945	2 825 000	146	77.5
5 YEARS AVERAGE	2 154 000	112	59.1
1945—1946	1 866 000	97	51.2
1946—1947	1 912 000	99	52.4
1947—1948	1 902 000	98	52.2
1948—1949	1 461 000	76	40.1
1949—1950	1 980 000	103	54.3
5 YEARS AVERAGE	1 824 000	94	50.0
1950—1951	1 714 000	89	47.0
1951—1952	2 382 000	123	65.3
1952—1953	1 371 000	71	37.6
1953—1954	1 607 000	83	44.0
1954—1955	2 000 000	104	54.8
5 YEARS AVERAGE	1 815 000	94	49.7
15 YEARS AVERAGE	1 931 000	100	52.9
1955—1956	2 373 000	123	65.1
1956—1957	2 168 000	112	59.5
1957—1958	2 375 000	123	65.1
1958—1959	1 375 000	71	37.7
1959—1960			
5 YEARS AVERAGE			
MAXIMUM	2 825 000	146	77.5
MINIMUM	1 371 000	71	37.6

TABLE VII

ANNUAL RAINFALL

Lidete-Ruaha River to Kigogo-Ruaha Confluence

Catchment area 1002 Sq. miles

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL		
	ACRE FEET	%OF MEAN	INCHES
1940—1941	2 567 000	92	48.0
1941—1942	3 313 000	119	62.0
1942—1943	2 500 000	90	46.8
1943—1944	2 830 000	102	52.9
1944—1945	4 008 000	144	75.0
5 YEARS AVERAGE	3 044 000	110	56.9
1945—1946	2 667 000	96	49.9
1946—1947	2 672 000	96	50.0
1947—1948	2 739 000	98	51.1
1948—1949	2 140 000	77	40.1
1949—1950	2 887 000	104	54.0
5 YEARS AVERAGE	2 619 000	94	49.0
1950—1951	2 600 000	94	48.7
1951—1952	3 260 000	117	61.0
1952—1953	2 441 000	88	45.7
1953—1954	2 405 000	87	45.0
1954—1955	2 667 000	96	49.9
5 YEARS AVERAGE	2 675 000	96	50.1
15 YEARS AVERAGE	2 779 000	100	52.0
1955—1956	3 474 000	125	65.0
1956—1957	2 334 000	84	43.7
1957—1958	2 832 000	102	53.0
1958—1959	1 951 000	70	36.5
1959—1960			
5 YEARS AVERAGE			
MAXIMUM	4 008 000	144	75.0
MINIMUM	1 951 000	70	36.5

TABLE VII

ANNUAL RAINFALL

Kigogo-Ruaha *River to* Proposed Damsite

Catchment area 529 *Sq. miles*

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL		
	ACRE FEET	%OF MEAN	INCHES
1940—1941	1 116 000	82	39.6
1941—1942	1 770 000	129	62.8
1942—1943	1 369 000	100	48.5
1943—1944	1 398 000	102	49.6
1944—1945	2 012 000	147	71.4
5 YEARS AVERAGE	1 533 000	112	54.4
1945—1946	1 362 000	100	48.3
1946—1947	1 292 000	94	45.8
1947—1948	1 322 000	97	46.9
1948—1949	1 089 000	80	38.6
1949—1950	1 362 000	100	48.3
5 YEARS AVERAGE	1 285 000	94	45.6
1950—1951	1 201 000	88	42.6
1951—1952	1 752 000	128	62.1
1952—1953	925 000	68	32.8
1953—1954	1 142 000	83	40.5
1954—1955	1 406 000	103	49.9
5 YEARS AVERAGE	1 285 000	94	45.6
15 YEARS AVERAGE	1 368 000	100	48.5
1955—1956	1 687 000	123	59.8
1956—1957	1 622 000	119	57.5
1957—1958	1 755 000	128	62.2
1958—1959	1 044 000	76	37.0
1959—1960			
5 YEARS AVERAGE			
MAXIMUM	2 012 000	147	71.4
MINIMUM	925 000	68	32.8

TABLE VII

ANNUAL RAINFALL

Fuagi River to Ruaha Confluence

Catchment area 39 *Sq. miles*

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL		
	ACRE FEET	%OF MEAN	INCHES
1940—1941	88 000	76	42.3
1941—1942	142 000	122	68.3
1942—1943	107 000	92	51.5
1943—1944	127 000	109	61.1
1944—1945	155 000	134	74.6
5 YEARS AVERAGE	124 000	107	59.6
1945—1946	112 000	97	53.9
1946—1947	116 000	100	55.8
1947—1948	105 000	91	50.5
1948—1949	91 000	78	43.8
1949—1950	120 000	103	57.7
5 YEARS AVERAGE	109 000	94	52.4
1950—1951	108 000	93	51.9
1951—1952	144 000	124	69.3
1952—1953	96 000	83	46.2
1953—1954	93 000	80	44.7
1954—1955	132 000	114	63.5
5 YEARS AVERAGE	115 000	99	55.1
15 YEARS AVERAGE	116 000	100	55.8
1955—1956	128 000	110	61.5
1956—1957	130 000	112	62.5
1957—1958	142 000	122	68.3
1958—1959	79 000	68	38.0
1959—1960			
5 YEARS AVERAGE			
MAXIMUM	155 000	134	74.6
MINIMUM	79 000	68	38.0

TABLE VII

ANNUAL RAINFALL

Fuagi River to Livalonga Bridge

Catchment area 24 *Sq. miles*

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL		
	ACRE FEET	%OF MEAN	INCHES
1940—1941	51 000	77	39.9
1941—1942	85 000	129	66.4
1942—1943	62 000	94	48.5
1943—1944	67 000	102	52.4
1944—1945	95 000	144	74.3
5 YEARS AVERAGE	72 000	109	56.3
1945—1946	63 000	95	49.2
1946—1947	61 000	92	47.7
1947—1948	57 000	86	44.6
1948—1949	54 000	82	42.2
1949—1950	66 000	100	51.6
5 YEARS AVERAGE	60 000	91	47.0
1950—1951	60 000	91	46.9
1951—1952	90 000	136	70.4
1952—1953	51 000	77	39.9
1953—1954	56 000	85	43.8
1954—1955	77 000	117	60.2
5 YEARS AVERAGE	67 000	101	52.3
15 YEARS AVERAGE	66 000	100	51.6
1955—1956	75 600	115	58.9
1956—1957	77 300	117	60.5
1957—1958	85 700	130	67.0
1958—1959	46 300	70	36.2
1959—1960			
5 YEARS AVERAGE			
MAXIMUM	95 000	144	74.3
MINIMUM	46 000	70	36.2

TABLE VII

ANNUAL RAINFALL

Fuagi River to Proposed Damsite

Catchment area 21 Sq. miles

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL		
	ACRE FEET	%OF MEAN	INCHES
1940—1941	44 000	76	39.3
1941—1942	74 000	128	66.1
1942—1943	54 000	93	48.2
1943—1944	56 000	97	50.0
1944—1945	84 000	145	75.0
5 YEARS AVERAGE	62 000	107	55.4
1945—1946	54 000	93	48.2
1946—1947	53 000	91	47.4
1947—1948	49 000	84	43.8
1948—1949	47 000	81	42.0
1949—1950	58 000	100	51.8
5 YEARS AVERAGE	52 000	90	46.5
1950—1951	52 000	90	46.5
1951—1952	77 000	133	68.8
1952—1953	47 000	81	42.0
1953—1954	50 000	86	44.7
1954—1955	66 000	114	59.0
5 YEARS AVERAGE	58 000	101	51.8
15 YEARS AVERAGE	58 000	100	51.8
1955—1956	65 000	112	58.1
1956—1957	67 000	116	59.9
1957—1958	74 000	128	66.1
1958—1959	41 000	71	36.6
1959—1960			
5 YEARS AVERAGE			
MAXIMUM	84 000	145	75.0
MINIMUM	41 000	71	36.6

TABLE VII

ANNUAL RAINFALL

Ruhuji River to Mnyera Confluence

Catchment area 3312 Sq. miles

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL		
	ACRE FEET	%OF MEAN	INCHES
1940—1941	8 209 000	96	46.5
1941—1942	8 901 000	104	50.4
1942—1943	8 439 000	98	47.8
1943—1944	7 665 000	89	43.4
1944—1945	12 391 000	144	70.2
5 YEARS AVERAGE	9 121 000	106	51.7
1945—1946	7 857 000	91	44.5
1946—1947	9 317 000	109	52.8
1947—1948	8 107 000	94	45.9
1948—1949	6 588 000	77	37.3
1949—1950	8 517 000	99	48.2
5 YEARS AVERAGE	8 077 000	94	45.8
1950—1951	7 789 000	91	44.0
1951—1952	11 299 000	132	64.0
1952—1953	7 126 000	83	40.4
1953—1954	7 750 000	90	43.9
1954—1955	8 852 000	103	50.1
5 YEARS AVERAGE	8 563 000	100	48.5
15 YEARS AVERAGE	8 587 000	100	48.6
1955—1956	12 080 000	141	68.4
1956—1957	11 271 000	131	63.8
1957—1958	8 982 000	105	50.9
1958—1959	7 490 000	87	42.4
1959—1960			
5 YEARS AVERAGE			
MAXIMUM	12 391 000	144	70.2
MINIMUM	6 588 000	77	37.3

TABLE VII

ANNUAL RAINFALL

Ruhuji *River to* Proposed Damsite

Catchment area 3277 *Sq. miles*

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL		
	ACRE FEET	%OF MEAN	INCHES
1940—1941	8 161 000	96	46.7
1941—1942	8 827 000	104	50.5
1942—1943	8 381 000	98	48.0
1943—1944	7 600 000	89	43.5
1944—1945	12 297 000	144	70.4
5 YEARS AVERAGE	9 053 000	106	51.8
1945—1946	7 794 000	91	44.6
1946—1947	9 253 000	109	53.0
1947—1948	8 040 000	94	46.0
1948—1949	6 533 000	77	37.4
1949—1950	8 441 000	99	48.3
5 YEARS AVERAGE	8 012 000	94	45.9
1950—1951	7 726 000	91	44.2
1951—1952	11 211 000	132	64.2
1952—1953	7 067 000	83	40.5
1953—1954	7 690 000	90	44.0
1954—1955	8 786 000	103	50.3
5 YEARS AVERAGE	8 496 000	100	48.6
15 YEARS AVERAGE	8 520 000	100	48.7
1955—1956	11 998 000	141	68.7
1956—1957	11 153 000	131	63.8
1957—1958	8 025 000	94	45.9
1958—1959	7 393 000	87	42.3
1959—1960			
5 YEARS AVERAGE			
MAXIMUM	12 297 000	144	70.4
MINIMUM	6 533 000	77	37.4

TABLE VII

ANNUAL RAINFALL

Ruhuji River to Pitu Confluence

Catchment area 1847 *Sq. miles*

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL		
	ACRE FEET	%OF MEAN	INCHES
1940—1941	5 113 000	96	51.9
1941—1942	5 526 000	103	56.1
1942—1943	5 615 000	105	57.0
1943—1944	4 581 000	86	46.5
1944—1945	7 386 000	138	75.0
5 YEARS AVERAGE	5 644 000	106	57.3
1945—1946	4 630 000	87	47.0
1946—1947	6 107 000	114	62.0
1947—1948	5 122 000	96	52.0
1948—1949	4 147 000	78	42.1
1949—1950	5 221 000	98	53.0
5 YEARS AVERAGE	5 045 000	94	51.2
1950—1951	4 900 000	92	49.8
1951—1952	7 093 000	133	72.0
1952—1953	4 334 000	81	44.0
1953—1954	4 920 000	92	50.0
1954—1955	5 517 000	103	56.0
5 YEARS AVERAGE	5 353 000	100	54.4
15 YEARS AVERAGE	5 347 000	100	54.3
1955—1956	7 486 000	140	76.0
1956—1957	6 226 000	116	63.2
1957—1958	5 024 000	94	51.0
1958—1959	4 906 000	92	49.8
1959—1960			
5 YEARS AVERAGE			
MAXIMUM	7 486 000	140	76.0
MINIMUM	4 334 000	81	44.0

TABLE VII

ANNUAL RAINFALL

Pitu *River to* Ruhuji Confluence

Catchment area 937 *Sq. miles*

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL		
	ACRE FEET	%OF MEAN	INCHES
1940—1941	2 290 000	95	45.9
1941—1942	2 380 000	99	47.6
1942—1943	1 990 000	83	39.8
1943—1944	2 340 000	97	46.8
1944—1945	3 500 000	145	70.0
5 YEARS AVERAGE	2 500 000	104	50.0
1945—1946	2 340 000	97	46.9
1946—1947	2 890 000	120	57.9
1947—1948	2 340 000	97	46.9
1948—1949	1 900 000	79	38.0
1949—1950	2 530 000	105	50.7
5 YEARS AVERAGE	2 400 000	100	48.1
1950—1951	2 440 000	101	48.8
1951—1952	2 980 000	124	59.7
1952—1953	1 720 000	71	34.4
1953—1954	1 900 000	79	38.0
1954—1955	2 600 000	108	52.1
5 YEARS AVERAGE	2 328 000	97	46.6
15 YEARS AVERAGE	2 409 000	100	48.2
1955—1956	3 050 000	127	61.1
1956—1957	2 910 000	121	58.3
1957—1958	2 750 000	114	55.1
1958—1959	1 800 000	75	36.0
1959—1960			
5 YEARS AVERAGE			
MAXIMUM	3 500 000	145	70.0
MINIMUM	1 800 000	75	36.0

TABLE VII

ANNUAL RAINFALL

Luwegu River to Kilombero Confluence

Catchment area 10156 Sq. miles

HYDROLOGICAL YEAR 1/11—31/10	RAINFALL		
	ACRE FEET	%OF MEAN	INCHES
1940—1941	20 140 000	96	37.2
1941—1942	23 440 000	112	43.3
1942—1943	17 670 000	85	32.6
1943—1944	19 500 000	93	36.0
1944—1945	24 580 000	118	45.4
5 YEARS AVERAGE	21 066 000	101	38.9
1945—1946	18 200 000	87	33.6
1946—1947	27 330 000	131	50.5
1947—1948	22 744 000	109	42.0
1948—1949	16 630 000	80	30.7
1949—1950	24 550 000	118	45.4
5 YEARS AVERAGE	21 891 000	105	40.4
1950—1951	20 258 000	97	37.4
1951—1952	22 010 000	105	40.7
1952—1953	16 080 000	77	29.7
1953—1954	19 170 000	92	35.4
1954—1955	20 800 000	100	38.4
5 YEARS AVERAGE	19 664 000	94	36.3
15 YEARS AVERAGE	20 873 000	100	38.6
1955—1956	31 520 000	151	58.2
1956—1957	21 776 000	104	40.2
1957—1958	18 254 000	87	33.7
1958—1959	17 658 000	85	32.6
1959—1960			
5 YEARS AVERAGE			
MAXIMUM	31 520 000	151	58.2
MINIMUM	16 080 000	77	29.7

TABLE VIII

ANNUAL AVERAGE and SPECIFIC RUNOFF
at
THE RUFIJI BASIN SURVEY GAUGING STATIONS.

The Table also contains Runoff Contribution from Partial Sub-Catchments between Established Stations.

A : Catchment Area, Sq. Miles.

Q_m : Average Annual Runoff for the 15-Year Period 1940/41 to 1954/55, Acre Feet.

$\frac{Q_m}{A}$: Specific Runoff, Acre Feet per Sq.Mile per Year.

GREAT RUAHA RIVER (1KA - STATIONS).

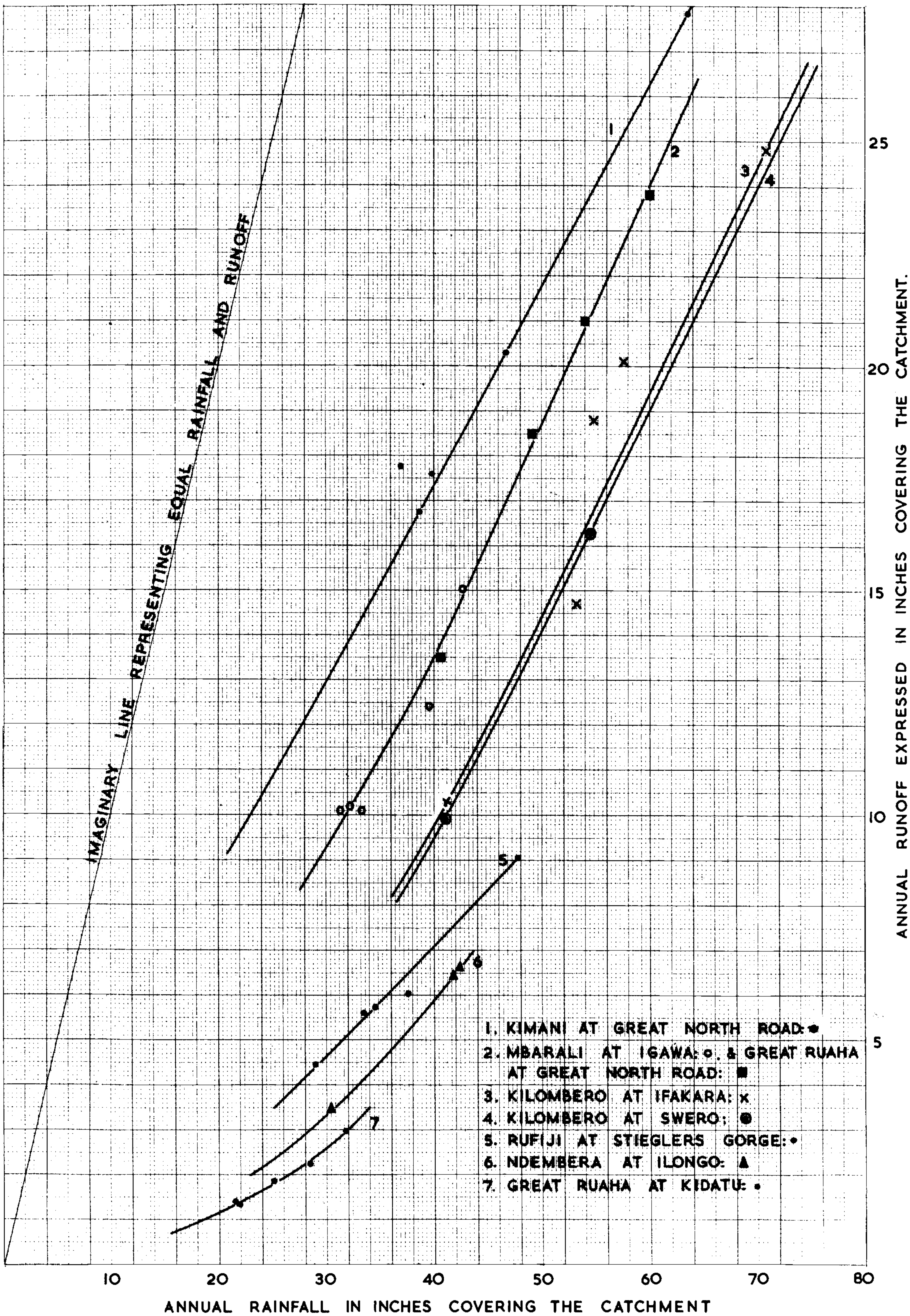
Sub-Catchment	A	Q_m	$\frac{Q_m}{A}$
Mswiswi to Old Great North Road	36	37 600	1044
Mambi to Old Great North Road	32	35 500	1100
Liosi to Old Great North Road	30	32 800	1093
Chimala to Chimala	85	76 000	894
Great Ruaha to Great North Road	328	238 000	726
Kimani to Great North Road	173	134 000	775
Mlombosi to Igawa	95	35 000	368
Mbarali to Igawa	619	357 000	577
Mbarali to Rujewa Farm	762	402 000	528
Difference Rujewa - Igawa, Mlombosi	48	10 000	208
Halali to Iyayi U/S	184	47 000	255
Rukuni to Iyayi	118	29 000	246
Halali to Iyayi D/S	302	76 000	252
Halali to Tunduma	377	91 000	241
Difference Tunduma - Iyayi	75	15 000	200
Halali to Majojolo	1014	205 000	202
Difference Majojolo - Tunduma (Ipwani)	637	114 000	179
Difference Majojolo - Iyayi	712	129 000	181
Ndembera to Ilongo	404	95 000	235
Ndembera to Madibira	707	147 000	208
Difference Madibira - Ilongo	303	52 000	172

TABLE VIII

Sub-Catchment	A	Q_m	$\frac{Q_m}{A}$
Great Ruaha to Mkopule	7 700	1 346 000	175
Difference Mkopule and above rivers to lowest gauging point	4 533	38 000	8
Little Ruaha to Southern Highlands Club	293	116 000	396
Little Ruaha to Iwawa	645	265 000	411
Difference Iwawa - S.H. Club	352	149 000	423
Mtitu to Mtitu Bridge	172	82 000	477
Little Ruaha to Ihimbu	957	394 000	412
Difference Ihimbu - Iwawa, Mtitu	140	47 000	336
Little Ruaha to Iringa	1 127	444 000	394
Difference Iringa - Ihimbu	170	50 000	294
Little Ruaha to Tosamaganga	1 273	439 000	345
Difference Tosamaganga - Iringa	146	- 5 000	Minus
Little Ruaha to Mawande	2 005	465 000	232
Difference Mawande - Tosamaganga	722	26 000	36
Great Ruaha to Kisilwa	13 844	1 500 000	108
Difference Kisilwa - Mkopule, Mawande	4 139	- 311 000	Minus
Njombe to Isanga	1 457	44 000	30
Njombe to Ifumba	5 438	197 000	36
Difference Ifumba - Isanga	3 981	153 000	45
Kisigo to Ilangali	3 413	94 000	28
Kisigo to Kinunguru	9 476	276 000	29
Great Ruaha to Mtera	26 254	1 655 000	63
Difference Mtera - Mkopule	18 554	309 000	17
Difference Mtera - Kinunguru, Mawande, Mkopule	7 073	-432 000	Minus
Great Ruaha to Mbuyuni	28 774	1 712 000	60
Difference Mbuyuni - Mtera	2 520	57 000	23
Lukosi to Mtandika	1 117	410 000	367
Yovi to Madizini Estate	25	24 000	960
Yovi to Great Ruaha Confluence	243	74 000	305
Difference G.R.Confl. - Madizini	218	50 000	229
Great Ruaha to Kidatu	30 905	2 386 000	77

TABLE VIII

Sub-Catchments	A	Q_m	$\frac{Q_m}{A}$
Difference Kidatu - Mbuyuni	2 131	674 000	316
Difference Kidatu - Mbuyuni, Mtandika, Yovi	771	190 000	246
KILOMBERO RIVER (1KB - STATIONS).			
Fuagi to Idege (Livalonga Bridge)	24	21 000	875
Kigogo-Ruaha to Frick's Bridge	511	284 000	556
Difference Fricks Bridge - Idege	487	263 000	540
Mnyera to Taveta	1 950	1 694 000	869
Difference Taveta - Frick's Bridge	1 439	1 410 000	980
Ruhuji to Mwayamalungu	3 294	2 257 000	685
Mpanga to Mpanga Mission	937	869 000	927
Kilombero to Ifwema	7 048	5 235 000	743
Difference Ifwema - Mpanga M, Taveta, and Mwayamalungu	867	415 000	479
Furua to Malinyi	507	604 000	1 191
Sofi to Sofi Mission	62	44 000	710
Mchilipa to Idete	114	36 000	316
Mgeta to Mchombe Mission	124	284 000	2 290
Lumemo to Kibaoni	165	312 000	1 891
Kilombero to Ifakara	12 063	10 560 000	875
Kilombero to Swero	12 915	11 092 000	859
Difference Swero - Ifwema	5 867	5 857 000	998
Difference Swero - Ifwema, Furua Sofi, Mchilipa, Mgeta, Lumemo	4 895	4 577 000	935
Luhombero at Ilonga	395	182 000	461
RUFIJI RIVER (1K - STATIONS).			
Rufiji to Stiegler's Gorge	61 106	18 050 000	295
Difference Stiegler's Gorge - Kidatu, Swero	17 286	4 572 000	265



COMPARISON BETWEEN ANNUAL RAINFALL AND RUNOFF
FOR SELECTED AREAS OF THE RUFIJI BASIN.

9. FLOODS

a. INTRODUCTION

To all concerned with construction work on, or living on a river, information on floods is of great and often vital importance. The type and shape of flood spates depends on the intensities and duration of rainfall, the area effected by rain and besides this on the characteristics of the catchment, size, shape, slope and water-retaining factors such as swamps, lakes, flooded areas, vegetation and type of soil cover. There are, therefore, a great many factors operating together which determine flood conditions on a river, and if the detailed effects of all these are known, typical flood hydrographs can be established. For understandable reasons the preliminary reconnaissance survey of the Rufiji Basin could not go into flood studies in such detail, and this chapter, therefore, summarizes only what is known about floods in the Basin up to the present date. It is hoped that compilation of flood data will continue and that reliable hydrographs will be established for floods in the future, which then will show the combined effects of the above mentioned factors.

b. FLOOD RECORDS

The highest floods observed each year during the period of survey are listed, with dates of observation, on the Discharge and Runoff Summary Sheets, Tables V in the previous chapter. The maximum water levels observed are given in part 2 of this report. These records cover only a very few years and they are not comprehensive enough for detailed flood studies. On some of the rivers the highest recorded flood is thought to be comparatively high and close to what can be considered as a "design flood", but it can generally be said that higher floods than were observed during these few years can and will occur in the future. High floods were observed on rivers from the Kipengere Mountain Range in 1959, and the Mbarali was especially high.

On the Great Ruaha there was a high flood in 1936. At Mtera the maximum peak was reported to be 6 feet above the roadway level. (Recorded by Mr. F.M.Coster, Engineering Geologist. WD and ID). This corresponds to approximately 39 feet on the present river gauge and a discharge of about 160 000 cusecs.

On the Lower Rufiji some early flood information has been extracted from old Agricultural Department Reports, and there is evidence that floods sufficiently great to endanger human life occurred during the last century. One high flood is said to have caused great changes in the river course about 1875 in the region north of Utete. Another such flood, which caused a second change of course in the same region is said to have occurred just after the German occupation of this area, about 1890. Floods which have occurred during the present century are well remembered, and are given special names, although the names may differ in different parts of the valley.

1. The 1905 flood is known as "Faya". This is the local name for a machine gun, and the flood is remembered by that name because natives saw such a gun for the first time in that year, in use during the "Maji-Maji" rebellion.

2. The 1917 flood is remembered as "Ndege" because natives saw airoplanes for the first time that year. In parts of the delta it is called "Konombo" after a steamer which entered far into the delta waters at height of the flood.

3. The 1930 flood is called "Lilale" meaning famine, in memory of the famine conditions which resulted from the floods.

4. The 1936 flood is known as "Ifakara" because a large canoe was swept away from Ifakara and retrieved at Utete.

5. The 1937 flood is called "Kgoli Mwali". The native name of a District Officer at that time.

On the Rufiji water level readings were taken at Mpanganya Experimental Farm west of Utete, 1926 to 1938. Gauge zero is stated to be 15' below bank level, and when this station was closed down a new gauge was set up at Zombe Experimental Station, 12 miles east of Mpanganya. This station has records since 1939 but unfortunately there is no overlap in the readings so they are not comparable.

The maximum recorded water level every year reached the following heights above an average minimum water level:-

Mpanganya

1926 - 10'9"
1927 - 10'2"
1928 - 9' 7"
1929 - 12'1"
1930 - 15'7"
1931 - 11'4"
1932 - 12'4"
1933 - 11'7"
1934 - 11'7"
1935 - 16'1"
1936 - 16'2"
1937 - 15'6"
1938 - 11'11"

Zombe

1939 - 11'4"
1940 - 13'10"
1941 - 11'7"
1942 - 13'4"
1943 - 11'2"
1944 - 13'7"
1945 - 14'0"
1946 - 11'3"
1947 - 13'6"
1948 - 10'10"
1949 - 7' 4"
1950 - 12'7"
1951 - 10'11"
1952 - 14'3"
1953 - 6' 0"
1954 - 10'1"
1955 - 12'8"
1956 - 15'3"

Average minimum water level at Mpanganga is - 2'7" on the gauge and at Zombe the gauge zero is stated to be at average minimum water level.

The District Agricultural Officer made the following observations on flooding of the plains at different readings of the Mpanganya gauge.

a/ Gauge Reading 6 ft. (8'7" in above tabulation)

No flooding takes place on any large area of land, although small depressions are flooded and form backwaters of the river.

b/ Gauge Reading 7 ft. (9'7" in above tabulation)

Large areas of the lowlands are flooded, but not sufficient to harm standing crops.

c/ Gauge Reading 8 ft. (10'7" in above tabulation)

May be regarded as a normal maximum for the year; if it comes late in the season, then some damage will be done to the low-lying rice-fields, especially near Ndundu.

d,' Gauge Reading 9 ft. (11'7" in above tabulation)

Considerable and extensive damage to crops will occur at this and higher levels.

The gauge reading of the maximum 1917 flood would have been 17 ft. on the Mpanganya gauge, 19'7" in above tabulation, and the whole alluvial plain would be under water.

At Mkalinzo village on the main Rufiji above the Pangani Rapids there is a baobab tree on which are marked high water levels for five years between 1929 and 1956 inclusive. A flood level gauge was established near to this tree in order to get corresponding readings with Stiegler's Gorge for a discharge calibration of the heights. A benchmark was established near the baobab tree 20.85 ft. above gauge zero and the water level at time of establishment, 24th November 1956, was 14.27 feet below gauge zero.

The heights of the various high water marks on the baobab tree with corresponding approximate discharges (after Stiegler's Gorge) are as follows:-

1954 - 22.40 ft. - 193 000 cusecs
1953 - 24.15 ft. - 209 000 "
1929 - 25.74 ft. - 222 000 "
1936 - 27.30 ft. - 236 000 "
1956 - 29.00 ft. - 252 000 "

Compared with other flood records the timing of these marks coincide only for the 1956, 1936 and possible also the 1954 floods. The mark given for 1929 would compare with the Mpanganya records for 1930. The 1953 flood was very low on the Zombe gauge. The falls in water level from maximum to minimum at observed places on the Rufiji in 1956 were:-

Mkalinzo	43.27 ft.
Stiegler's Gorge	35.80 ft.
Mtanza	15.00 ft. approximately.
Utete	16.00 ft.
Ndundu	16.60 ft. approximately.

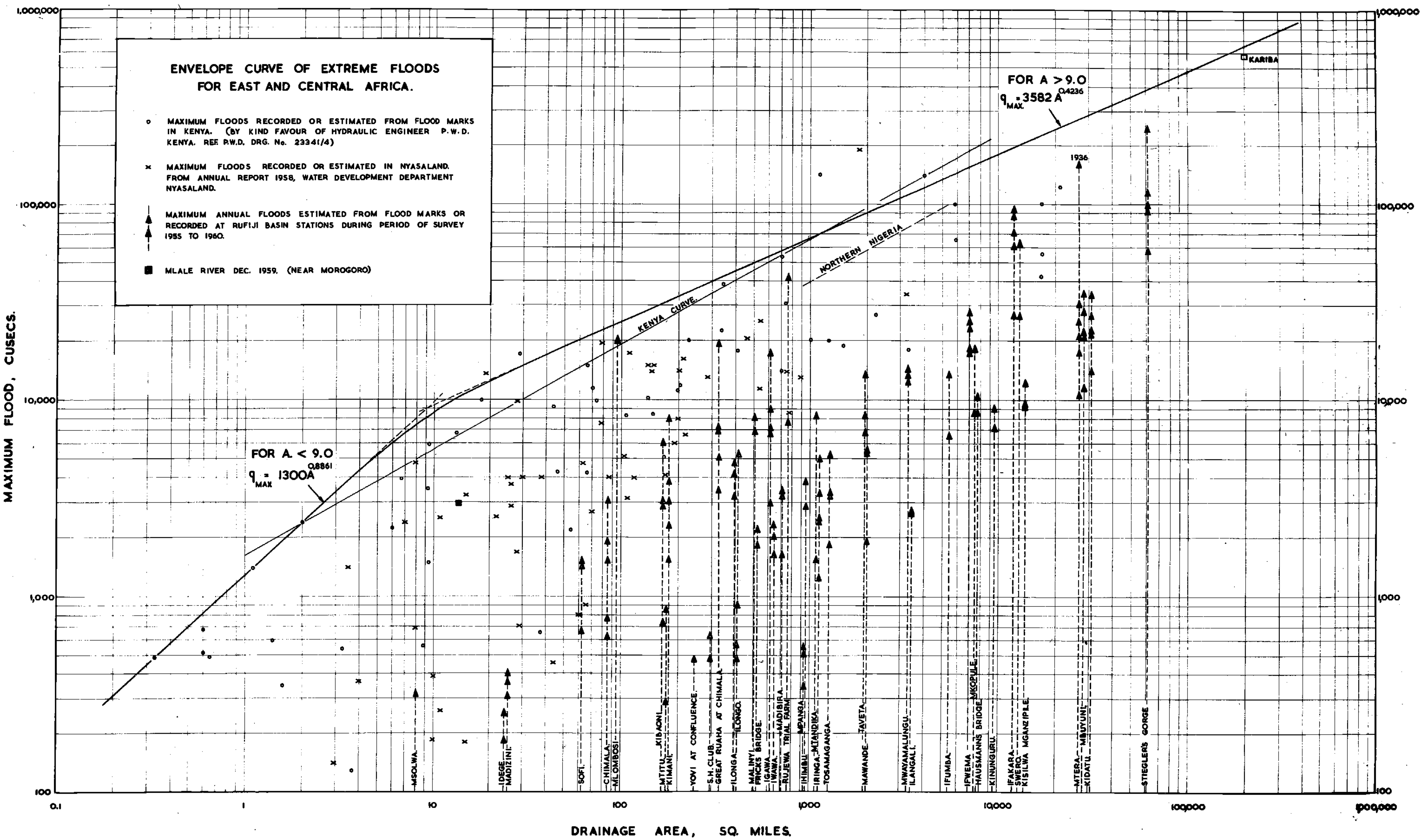
At the head of the Pangani Rapids the 1917 flood reached a height corresponding to 47 feet above the low level. The physical signs of probably the 1940 flood were found on an elevation corresponding to 43 feet above low flow level (Figures obtained from E. Marks. Dip. Eng. Danzig).

According to this information it seems that in the present century there were high floods in 1905, 1917, 1930, 1935, 1936, 1937 and 1956. Of these the 1917 flood appears to have been the highest and thereafter came the 1956 flood. The latter was observed at Stiegler's Gorge and the maximum discharge was 252 000 cusecs. The Kilombero was comparatively high in 1956 at Ifakara, but the Great Ruaha was not very high, and therefore a greater proportion of the spate must derive from the Luwegu. This is a flashy river causing high floods which pass through the Rufiji Gorge down to the delta. If high flood spates on the tributaries coincide better, higher floods than in 1956 will occur on the Rufiji in the future. A flood of 400,000 cusecs is not an impossibility.

c. ENVELOPING FLOOD GRAPH.

In order to get some knowledge on maximum floods which are likely to occur records were compiled from neighbouring countries in East and Central Africa. The Chief Hydraulic Engineer, Ministry of Public Works, Kenya, kindly gave the information available on high floods in Kenya where hydrological investigations have been carried out for a longer period. The information was presented in graph form and found extremely valuable. In the Annual Reports of Water Development Department, Nyasaland, observed maximum floods are given and all this information together with the famous Kariba flood in 1957 are plotted against catchment area on illustration at the end of this chapter. For comparison the flood peaks observed at the Rufiji Basin Survey stations are also plotted. An enveloping curve is drawn indicating the upper limit of observed floods.

It must be stressed again that floods do not entirely depend upon the size of the catchment and the enveloping curve must therefore be used with the utmost care. Rivers like the Little Ruaha, Ruhuji, Mnyera and Mpanga have a high degree of natural regulation of the flows. The runoff during the dry season is comparatively high and floods correspondingly low, and rivers of this type cannot directly be compared with more flashy rivers. However, before better studies can be made on flood conditions, the graph provides interim information that certainly is of value.


ENVELOPE CURVE OF EXTREME FLOODS FOR EAST AND CENTRAL AFRICA.
o MAXIMUM FLOODS RECORDED OR ESTIMATED FROM FLOOD MARKS IN KENYA. (BY KIND FAVOUR OF HYDRAULIC ENGINEER P.W.D. KENYA. REF. P.W.D. DRG. No. 23341/4)
× MAXIMUM FLOODS RECORDED OR ESTIMATED IN NYASALAND. FROM ANNUAL REPORT 1958, WATER DEVELOPMENT DEPARTMENT NYASALAND.
MAXIMUM ANNUAL FLOODS ESTIMATED FROM FLOOD MARKS OR RECORDED AT RUFIJI BASIN STATIONS DURING PERIOD OF SURVEY 1955 TO 1960.
■ MLALE RIVER DEC. 1959. (NEAR MOROGORO)
FOR A > 9.0
$q_{MAX.} = 3582\,A^{0.4236}$
FOR A < 9.0
$q_{MAX} = 1300A^{0.8861}$
KENYA CURVE.
NORTHERN NIGERIA
KARIBA
1936
MAXIMUM FLOOD, CUSECS.
1,000,000
100,000
10,000
1,000
100
0.1
1
10
100
1000
10,000
100,000
1,000,000
DRAINAGE AREA, SQ. MILES.
MSOLWA
IDEGE
MADIZINI
SOFI
CHIMALA
MLOMBOSI
MTITU
KIBAONI
KIMANI
YOVI AT CONFLUENCE
S.H. CLUB
GREAT RUAHA AT CHIMALA
ILONGA
ILONGO
MALINYI
FRICKS BRIDGE
IGAWA
IWAWA
MADIBIRA
RUJEWA TRIAL FARM
IHIMBU
MPANGA
IRINGA
MTANDIKA
TOSAMAGANGA
MAWANDE
TAVETA
MWAYAMALUNGU
ILANGALI
IFUMBA
IFWEMA
MKOPULE
HAUSMANNS BRIDGE
KINUNGURU
IFAKARA
SWERO
KISILWA MGANZIPLE
MTERA
MBUYUNI
KIDATU
STIEGLERS GORGE

10. GROUND WATER DEPLETION

BY L. HORST.

a. INTRODUCTION

For a number of hydrological studies the Ground Water Depletion Curve is an important criterion and an attempt was made to construct such curves for hydrometric stations of the Rufiji Basin.

A ground water depletion curve can be defined as follows: "If the ground water level were at its maximum height at the end of surface runoff and no further precipitation should occur until streamflow ceased entirely, the resulting hydrograph during this period would represent a ground water depletion curve". (9, p.24).

The magnitude and shape of this resulting hydrograph depends upon the retaining capacity of the catchment as well as the loss of water by evapotranspiration during the dry season. Observations have shown that the shape of the ground water depletion curve is in general characteristic for a river basin.

The ground water depletion curve can be of use:

1. To get a general insight into the physical qualities of the catchment area such as: ground water supply and evaporation between two observed stations, influence of various types of vegetation, swamps, springs, etc.
2. To estimate the maximum storage capacity required for river regulation.

b. GENERAL CONSIDERATIONS

Ground water depletion curves as defined here have not been observed in the Rufiji Basin because of rainfall occurances during the dry season, but it was possible to establish theoretical curves from segments of the May to November hydrographs. Fig. 1a gives a sketch of such a hydrograph with the corresponding theoretical ground water depletion curve I - II. It is only possible to construct part A-B of curve I - II because of:

1. The rainfall never stops abruptly but ends gradually in smaller and more localised rains influencing the high part of the curves, thus part I - A does not occur without surface runoff superimposed on it.
2. Short periods of local rainfall enable us to construct only part A - B. In Fig. 1b the various short period rainfall's influence on the hydrograph are explained. Extension of theoretical ground water depletion curve with, for instance, the Horton Formula (9, p.315) for lower discharges than observed appears to be dangerous.

Another influence can be scattered rainfall over a longer period resulting in a general flattening of the curve without clearly definable momentary disturbances. This can be traced from the available rainfall records inside the catchment area.

c. THEORETICAL GROUNDWATER DEPLETION

1. Construction of Groundwater Depletion Curves

With the above mentioned hydrograph disturbances in mind the depletion curve for each station and each year can be achieved by plotting those parts of the q-time curve which are representative for the theoretical depletion curve. The representative parts of the curves, plotted on tracing paper, have to be shifted parallel to the time axis until they correspond. See Fig. 1c. To find for each station the mean ground water depletion curve, the curves, as found above for the available years, are compared with each other.

The curve found, represents the groundwater discharge minus the losses upstream for a minimum dry year. For most of the Rufiji stations daily discharge records are available only for 1957, 1958 and 1959, but for some stations also for 1955 and 1956. In a great number of sub-catchments rainfall data are also available to assess periods of rainfall influence on observed hydrographs.

In general the depletion curves for the years 1957, 1958 and 1959 agree with each other fairly well. The depletion curve for 1956 is in most instances less steep, possibly due to lower evaporation during that year. The year 1955 was dry and the rainfall stopped earlier than usual. Thus the observed depletion commenced at a comparatively low stage. For the majority of the stations the mean of the 1955, 1957, 1958 and 1959 constructed curves have been applied.

2. Reliability

The ground water depletion curves are constructed from an average of 3 to 5 years observation data. The construction of the ground water depletion curve is carried out in a rather conservative manner. Due to this, the constructed theoretical curves will differ from the average observed dry season hydrograph, and the preparation of the curve in this way is thought justifiable for the following reasons:-

1. The available discharge records do not include an extremely dry year. The influence of the maximum evaporation expected is unknown.

2. The greater the dryness the heavier the local water requirements are from the river. This is a progressive phenomenon and difficult to predict.

3. The accuracy of the rating tables for the stations are normally within 8% deviation. For smaller discharges, the error becomes relatively larger.

4. The available number of observation years is too small for a probability computation concerning most conservative groundwater depletion.

5. The individual approach in the construction of the curves is inevitable.

When more records are available it will be possible to establish more reliable curves. Detailed studies on rainfall, evaporation, vegetation and groundwater hydraulics should, if possible, be incorporated in future analyses.

3. Presentation of Results

a. Logarithmic Presentation

Time co-ordination. To get a general idea of the ground water depletion in a catchment area, the established curve for each station is plotted in a graph with log q as vertical and the time as horizontal axis.

The time scales for the stations are made to coincide by selecting data from the available observation years 1957, 1958 and 1959 on which the theoretical groundwater depletion curve follows the observed hydrograph. The observed discharges on these dates are plotted on the ground water depletion curves and the curves shifted horizontally until the points concerned correspond vertically with each other.

This generally gave satisfactory results. Only for the Western Mountain tributaries of the Great Ruaha a coincidence was difficult to find, which is probably due to the different characteristics of the catchment areas. For some stations additional indications are found from correlation curves between various stations.

Interpretation. The shape of the ground water depletion curve can give indications regarding typical physical qualities of the catchment area concerned. Fig. 1d gives in principal the following possibilities:-

Curve a. A steep curve indicates a small retention capacity.

Curve b. The groundwater storage is larger and the retention greater than Curve "a".

Curve c. The lower part of the curve can be an indication of springs. The steep beginning of the curve can be surface runoff or groundwater depletion with small retention.

Curve d. The curve progressively going down at the end can be the result of swamp vegetation where evapotranspiration and/or an underground water leakage form a relatively increasing part.

b. Specific Accumulation. Fig. 1e and f.

Plotting. The relation between the specific accumulation (Q_s) and the corresponding specific discharge (q_s) is found by integration in the q-time graph between a certain q and q_{min}.

To find a relation between the stations a time is arbitrarily chosen as an average of t_{min} for each station in the log q-time presentation.

On the horizontal axis is plotted

$$q_s = \frac{q}{\text{catchment area}}$$

On the vertical axis the corresponding

$$Q_s = \frac{Q}{\text{catchment area}}$$

in which

$$Q = \int_{t_{min}}^{t} q \, dt$$

Interpretation. The specific accumulation curve gives an insight of the storage capacity per sq.mile of catchment. The initial situation can give an idea regarding specific storage after t_{min} and the slope is an indication of the exhaustion rate of the groundwater storage. A steep beginning of the curve (see rivers Mpanga and Lukosi) gives a relatively slow groundwater exhaustion.

c. Potential Accumulation. Fig. 1g and h.

Plotting. The potential accumulation for a certain station for depletion periods of 1, 2, 3 etc. months, following a certain initial discharge q_i is found by integration.

The initial discharge q_i corresponds with t_i, arbitrary chosen as the same, for all stations.

The areas of catchments are plotted as the abscissa. For each station the values of the accumulation for depletion periods of 1, 2, 3, etc. months are plotted as the ordinate and the corresponding points linearly joined.

A tributary joining between two stations can be included in the presentation, provided the depletion curve for this is known and the time scale can be shifted into the established time co-ordination. (e.g. Little Ruaha, Lukosi and Yovi coming in to the Great Ruaha and the Great Ruaha coming into the Rufiji).

Interpretation. The potential accumulation graph gives an idea of the ground water supply and water losses between two stations.

If the monthly accumulation curves are steep, the groundwater contribution is high. This is generally the case with the mountain tributaries. If the curves are flat there is not much groundwater contribution from the catchment. Between some stations the curves are even declining. Then the losses in the river stretch are greater than the contribution.

d. RESULTS

The groundwater depletion studies of the Rufiji Basin are sub-divided into three parts:-

1. Little Ruaha, fig. 2a, b and c.
2. Great Ruaha, fig. 3a, b and c.
3. Kilombero - Rufiji, fig. 4a, b and c.

Each drawing has a small key map. For further information reference is made to the Hydrological Key Map. (See Map Folder). The time scales in fig. 2, 3 and 4 do not correspond with each other.

1. Little Ruaha, Fig. 2a, b and c.

The groundwater depletion curves are constructed for the six stations on the Little Ruaha:-

Little Ruaha.

Curve Symbol	Station	Catch.Area sq.m.
1	S. Highlands Club.	293
2	Iwawa.	645
3	Ihimbu.	957
4	Iringa.	1,127
5	Tosamaganga.	1,273
6	Mawande.	2,005

Fig. 2a gives the logarithmic presentation of the groundwater depletion curves.

In the headwaters of the catchment there is a rich vegetation and a comparatively high annual rainfall with local showers occurring at all times of the year. The downstream part of the catchment is dry. This is shown in the difference of the curves (1) (2) (3) and (4), the coincidence of the curves (4) (5) and (6) at the beginning of the dry season, and the lower position of the curves (5) and (6) at the end of the dry season.

This can also be seen in Fig. 2b where curves (1) (2) (3) and (4) roughly coincide, while the curves (5) and (6) show a smaller specific accumulation. Between stations (4) and (5) the losses are relatively high (see Fig. 6) because of swamp vegetation and most probably underground losses as well. Fig. 2c also shows that the groundwater contribution comes from the upper part (to Station 4) while for the downstream part the contribution and evaporation about equal each other.

2. Great Ruaha Fig. 3a, b and c.

Mountain Tributaries. The gauged headwater tributaries of the Great Ruaha can be listed as follows:

Curve Symbol	River	Station	Catch.Area sq.miles
a	Mswiswi	Kalanzi	36
b	Mambi	Kalanzi	32

Curve Symbol	River	Station	Catch.Area. sq.miles
o	Chimala	Chimala	85
1	Great Ruaha	Gt. N.Road	328
d	Kimani	Gt. N.Road	173
e	Mbarali	Rujewa	762
f	Halali	Iyayi	302
g	Ndembera	Madibira	707
I	Sümmation		2425

Owing to the different characteristics of the catchment areas of these tributaries, it is difficult to find a time correspondence. In Fig. 3a the groundwater depletion curves are shown to give an idea of their shape and values. Although the time co-ordination between them is not reliable, a summation curve (I) is presented, to give a rough comparison with the station Mkopule (2), below their confluence. It appears that the summation data in the latter part of the dry season exceeds the discharges of Mkopule. The reason can be explained by the high water losses in the Usangu Plain.

Fig. 3b also gives an indication of the high groundwater depletion from the mountain tributaries, curve (I) being a typical mountain tributary. This can also be seen in Fig. 3c where the accumulation curves start off with steep gradients.

The groundwater depletion curve for Mkopule is irregular (Fig.3a). This can be a result of the influence of the swamp vegetation.

Stations on the Great Ruaha.

Curve Symbol	Station	Catch.Area, sq.m.
1	Gt. N. Road.	328
2	Mkopule.	7700
3	Kisilwa.	13884
4	Mtera.	26254
5	Mbuyuni.	28274
6	Kidatu.	30905
(II)	Lukosi River (trib.)	1117
(III)	Substraction (6) - (5)	2631

Between station (2) and (3) the area is semi-arid and the losses from the river exceed the groundwater contribution from the catchment: see Fig. 3c where the accumulation curves decline. The Little Ruaha, with a high specific accumulation, comes in just before Kisilwa (3). Because of this confluence, see Fig. 3b, curve (3) seems steeper than (2) in spite of the small potential accumulation for the Gt. Ruaha itself between (2) and (3).

Between (3) and (4) the Kisigo River comes in. This river dries out very rapidly after the rainy season. From (4) to (5) the Great Ruaha flows through a mountain valley with little groundwater supply and high evaporation.

The foregoing is illustrated by Fig. 3a, b and c. Between (5) and (6) typical mountain rivers come in. The Lukosi River being the most important, is presented in Fig. 3a, curve (II). It appears from curve (II) and (III), plotted as the difference between (6) and (5), that these mountain rivers show a very great specific storage capacity with a slow exhaustion. In Fig. 3b curve (6) is steeper than (4) and (5) because of the relatively higher specific accumulation of these mountain tributaries.

3. Kilombero and Rufiji, Fig. 4a, b and c.

Curve Symbol	River	Station	Catch.Area. sq.miles
1A	Mpanga	Mpanga	937
1B	Mnyera	Taveta	1950
1C	Ruhuji	Mwayamalungu	3294
1S	Summation 1 A-B-C		6181
1	Kilombero	Ifwema	7048
2	Kilombero	Ifakara	12063
3	Kilombero	Swero	12915
3s	Summation (3) + Gt.Ruaha (Kidatu)		43820
4	Rufiji	Stiegler's Gorge	61106

In the South Western mountainous part, three sub-catchments join up just before the station Ifwema (1): the Mpanga (1A), the Mnyera (1B) and the Ruhuji (1C). These three rivers and their summation (1S) and the stations (1) (2) and (3) of the Kilombero all show groundwater depletion curves less steep than the Great Ruaha (dotted curve), see Fig. 4a. This is in agreement with the character in this part of the Basin where the annual rainfall is high and the vegetation rich.

The difference between the summation 1S and Ifwema (1), see Fig. 4a, represents the groundwater inflow from the partial sub-catchments between the above stations and Ifwema. This difference is comparatively large. The river Mpanga (1A) shows a great specific accumulation, Fig. 4b. Fig. 4c shows a similar picture until station (3), so the groundwater depletion per sq.mile is roughly the same for the whole Kilombero sub-catchment. Between (3) and (4) the Luwegu and the Luhombero come in, together draining a large catchment area. There are not much data available for these rivers but it may be assumed that the groundwater contribution is comparatively small, see Fig. 4c. Because of the different character of the Luhombero and the Great Ruaha compared with the Kilombero, curve (4) has changed compared with (3), see Fig. 4b. Fig. 4a shows a loss between (3) and (4). Reliable groundwater depletion curves could not be established for stations downstream of Stiegler's Gorge.

e. ESTIMATION OF GROUNDWATER RESOURCES FOR VARIOUS DAMSITES.

In order to forecast the groundwater resources for an extremely dry year some special calculations were carried out.

The theoretical groundwater depletion curve has a maximum starting point above which groundwater depletion and surface runoff are always existing together.

Theoretically this point should occur under conditions given in the definition of the curve - see introduction. In practice, however, this point is hard to evaluate because the occurrence and magnitude of the last, mostly scattered, rains of the wet season cannot be fully determined from the small number of rainfall stations available.

In the following the highest discharge, which fits on to the theoretical groundwater depletion curve, is taken as the initial point of the groundwater depletion curve. In other words this discharge q_i is assumed as the highest possible discharge where no surface runoff occurs.

In order to find the date at which this q_i occurs in an average year, and in an extremely dry year, the following procedure has been used. The dates at which q_i occurs in the observation years are plotted against the annual runoff expressed as a percentage of the 15 years average. This gave for most stations a satisfying result, giving a linear correspondence. In Fig.5 an example is given for Great Ruaha at Mtera. For most stations the year 1956 does not follow the general linear correspondence, but the points lay higher due to the heavy rains at the beginning of the rainy season, thus shifting the initial time, t_i, to an earlier date.

In the table IX the minimum groundwater resources are given for river stations located near proposed damsites.

The minimum groundwater resources for depletion periods of 1,2,3 etc. months are found by integration of the depletion curve $q = f(t)$. The extension for periods longer than the constructed depletion is done by extrapolation (given in brackets) of the monthly reduction coefficient - see Fig.5. Information in table IX is arranged according to station numbers, see Schedule of Gauging Stations. It must be stressed that the figures given in table IX are rough approximations only.

f. GENERAL CONCLUSIONS.

The study of groundwater depletion curves at hydrometric stations in the Rufiji Basin showed that the main part of the dry season discharge results from groundwater runoff in the Middle Highlands (Mufindi Highlands, Uzungwa and Udekwa Mountains) and the Kilombero Valley. The groundwater resources available for river discharge in these areas from the end of May to November are of the order of 150-250 acrefeet per sq.mile (3-4.5 inches). The South-Western Mountain Ranges (Poroto and Kipengere Ranges) contribute about half as much: 50-130 acrefeet per sq.mile (1-2.5 inches). The North-Western part of the Rufiji Basin (Kisigo River and the middle reach of the Great Ruaha) and also the Southern part (Luwegu River) contribute very little to nil.

Consequently the Great Ruaha Catchment (32,424 sq.miles) covering about 50% of the total Rufiji Basin to Stiegler's Gorge (61106 sq.miles) is able to provide roughly only 15% of the total groundwater supply as gauged at Stiegler's Gorge. The remaining 85% is mainly coming from the Kilombero.

In Fig. 6 a summary is given for the whole Rufiji Basin concerning characteristic monthly groundwater storage capacity for the various parts of the catchments. The diagram is found by arbitrary choice of one month towards the end of the dry season. The difference of the accumulation of that month for two successive stations expresses the groundwater storage capacity for that partial area. This diagram gives an idea of the specific groundwater supply and losses for various parts of the catchment.

TABLE IX - MINIMUM GROUNDWATER RESOURCES.

RIVER: RUFIJI, STATION No. 1K.3
STATION: STIEGLER'S GORGE (61 106 sq.m)
DAMSITE: STIEGLER'S GORGE (61 106 sq.m)

$t_{o\ av}$ = 13th June.
$t_{o\ min}$ = 21st May.

Time in months	River discharge in cfs	Monthly reduction coeff %.	Minimum groundwater resources in 1000 acrefeet after						
			1 month	2 months	3 months	4 months	5 months	6 months	7 months
o = t_o	27500		1 280	2 020	2 485	2 761	2 920	(3 008)	(3 055)
1	15000	54.5	740	1 205	1 481	1 640	(1 728)	(1 775)	(1 799)
2	9700	65	465	741	900	(988)	(1 035)	(1 059)	
3	5800	60	276	435	(523)	(570)	(594)		
4	3400	58.5	159	(247)	(294)	(318)			
5	(1900)	(56)	(88)	(135)	(159)				
6	(1030)	(54)	(47)	(71)					
7	(540)	(52)	(24)						

RIVER: LITTLE RUAHA, STATION No. 1KA.2
STATION: IRINGA (1 127 sq.m)
DAMSITE: IRINGA (1 127 sq.m)

$t_{o\ av}$ = 24th April.
$t_{o\ min}$ = 22nd March.

Time in months	River discharge in cfs	Monthly reduction coeff %.	Minimum groundwater resources in 100 acrefeet after					
			1 month	2 months	3 months	4 months	5 months	6 months
o = t_o	1310		615	990	1 257	1 455	1 601	1 708
1	740	56.5	375	642	840	986	1 093	1 171
2	510	69	267	465	611	718	(796)	(853)
3	380	74.5	198	344	451	(529)	(586)	(628)
4	280	74	146	253	(331)	(388)	(430)	
5	205	73	107	(185)	(242)	(284)		
6	(150)	(73)	(78)	(135)	(177)			

TABLE IX - MINIMUM GROUNDWATER RESOURCES

RIVER: GT. RUAHA, STATION No. 1KA.3 — $t_{o\ av}$ = 27th May.
STATION: KIDATU (30 905 sq.m)
DAMSITE: KIDATU (30 905 sq.m) — $t_{o\ min}$ = 4th May.

Time in months	River discharge in cfs	Monthly reduction coeff %.	Minimum groundwater resources in 100 acrefeet after 1 month	2 months	3 months	4 months	5 months	6 months	7 months
o = t_o	4200		1 845	2 755	3 296	3 678	3 985	4 253	(4 493)
1	1950	46.5	910	145	183	214	240	(2 648)	(2 849)
2	1080	55.5	541	923	123	1 498	(1 738)	(1 939)	
3	725	67	382	689	957	(1 197)	(1 398)		
4	550	76	307	575	(815)	(1 016)			
5	475	86	268	(508)	(709)				
6	(420)	(90)	(240)	(441)					
7	(380)	(90)	(201)						

RIVER: GT. RUAHA, STATION No. 1KA.5 — $t_{o\ av}$ = 22nd May.
STATION: MTERA (26 254 sq.m)
DAMSITE: MTERA (26 254 sq.m) — $t_{o\ min}$ = 21st April.

Time in Months	River discharge in cfs	Monthly reduction coeff %.	Minimum groundwater resources in 100 acrefeet after 1 month	2 months	3 months	4 months	5 months	6 months	7 months
o = t_o	3000		1 290	1 857	2 121	2 253	2 335	2 366	2 377
1	1300	43.5	567	831	963	1 045	1 076	1 087	(1 089)
2	590	45.5	264	396	478	509	520	(522)	
3	290	49	132	214	245	256	(258)		
4	140	52	820	113	124	(126)			
5	75	50	31	42	(44)				
6	30	40	11	(13)					
7	(8)	(27)	(2)						

TABLE IX - MINIMUM GROUNDWATER RESOURCES

RIVER: CHIMALA, STATION No. 1KA.7 $t_{o\ av}$ = 6th July.
STATION: CHIMALA (85 sq.m)
DAMSITE: AILSA (76 sq.m) $t_{o\ min}$ = 22nd June.

Time in Months	River discharge in cfs	Monthly reduction coeff %.	Minimum groundwater resources in acrefeet after						
			1 month	2 months	3 months	4 months	5 months	6 months	7 months
o = t_o	45		2 100	3 460	4 620	5 570	6 240	(6 640)	(6 840)
1	25	56	1 360	2 520	3 470	4 140	(4 540)	(4 740)	(4 820)
2	20.5	82	1 160	2 110	2 780	(3 180)	(3 380)	(3 460)	
3	18	88	950	1 620	(2 020)	(2 220)	(2 300)		
4	13.7	76	670	(1 070)	(1 270)	(1 350)			
5	(8.1)	(64)	(400)	(600)	(680)				
6	(4.6)	(53)	(200)	(280)					
7	(2)	(43)	(80)						

RIVER: GT. RUAHA, STATION No. 1KA.8 $t_{o\ av}$ = 23rd May.
STATION: GT. N. ROAD (328 sq.m)
DAMSITE: S. of GT. N. ROAD (328 sq.m) $t_{o\ min}$ = 5th May.

Time in months	River discharge in cfs	Monthly reduction coeff %.	Minimum groundwater resources in 100 acrefeet after						
			1 month	2 months	3 months	4 months	5 months	6 months	7 months
o = t_o	280		135	222	285	334	373	404	(429)
1	170	61	87	150	199	238	269	(294)	(314)
2	120	71	63	112	151	182	(207)	(227)	
3	91	76	49	88	119	(144)	(164)		
4	72	79	39	70	(95)	(115)			
5	58	81	31	(56)	(76)				
6	(46)	(80)	(25)	(45)					
7	(37)	(80)	(20)						

TABLE IX - MINIMUM GROUNDWATER RESOURCES.

RIVER: KIMANI, STATION No. 1KA.9
STATION: GT. N. ROAD (173 sq.m)
DAMSITE: GT. N. ROAD (170 sq.m)

$t_{o\ av}$ = 28th May.
$t_{o\ min}$ = 15th May.

Time in months	River discharge in cfs	Monthly reduction coeff %.	Minimum groundwater resources in acrefeet after						
			1 month	2 months	3 months	4 months	5 months	6 months	7 months
o = t_o	100		4 500	6 970	8 470	9 510	10 260	10 800	(11 170)
1	50	50	2 470	3 970	5 010	5 760	6 300	(6 670)	(6 920)
2	30	60	1 500	2 540	3 290	3 830	(4 200)	(4 450)	
3	20	67	1 040	1 790	2 330	(2 700)	(2 950)		
4	14.5	72.5	750	1 290	(1 660)	(1 910)			
5	10.5	72.5	540	(910)	(1 160)				
6	(7.4)	(70)	(370)	(620)					
7	(5)	(68)	(250)						

RIVER: MBARALI, STATION No. 1KA.19
STATION: RUJEWA TRIAL FARM (762 sq.m)
DAMSITE: IGAWA (574 sq.m)

$t_{o\ av}$ = 9th June.
$t_{o\ min}$ = 2nd May.

Time in months	River discharge in cfs	Monthly reduction coeff %.	Minimum groundwater resources in 100 acrefeet after						
			1 month	2 months	3 months	4 months	5 months	6 months	7 months
o = t_o	350		168	280	371	445	499	535	(557)
1	210	60	112	203	277	331	367	(389)	(401)
2	165	79	91	165	219	255	(277)	(289)	
3	140	85	74	128	164	(186)	(198)		
4	107	76.5	54	90	(112)	(124)			
5	75	70	36	(58)	(70)				
6	(47)	(62)	(22)	(34)					
7	(26)	(55)	(12)						

TABLE IX - MINIMUM GROUNDWATER RESOURCES

RIVER: LITTLE RUAHA, STATION No. 1KA.32 — $t_{o\ av}$ = 5/25th April.
STATION: S.H.CLUB (293 sq.m)
DAMSITE: MAKALALA (293 sq.m) — $t_{o\ min}$ = 1/30th March.

Time in months	River discharge in cfs	Monthly reduction coeff %.	Minimum groundwater resources in 100 acrefeet after						
			month	months	months	months	months	months	months
o = t_o	520		252	387	481	543	581	602	613
1	265	51	135	229	291	329	350	361	(366)
2	185	70	94	156	194	215	226	(231)	
3	127	69	62	100	121	132	(137)		
4	80	63	38	59	70	(75)			
5	46	57.5	21	32	(37)				
6	25	54.5	11	(16)					
7	(12)	(50)	(5)						

RIVER: NDEMBERA, STATION No. 1KA.33 — $t_{o\ av}$ = 15/30th June.
STATION: MADIBIRA (707 sq.m)
DAMSITE: NGALENGE (404 sq.m) — $t_{o\ min}$ = 1/30th May.

Time in months	River discharge in cfs	Monthly reduction coeff %	Minimum groundwater resources in acrefeet after						
			1 month	2 months	3 months	4 months	5 months	6 months	7 months
o - t_o	60		2 550	3 850	4 890	5 790	6 570	(7 230)	(7 770)
1	25	42	1 300	2 340	3 240	4 020	(4 680)	(5 220)	(5 640)
2	18.5	74	1 040	1 940	2 720	(3 380)	(3 920)	(4 340)	
3	16	87	900	1 680	(2 340)	(2 880)	(3 300)		
4	14	87.5	780	(1 440)	(1 980)	(2 400)			
5	(12)	(86)	(660)	(1 200)	(1 620)				
6	(10)	(83)	(540)	(960)					
7	(8)	(80)	(420)						

TABLE IX - MINIMUM GROUNDWATER RESOURCES

RIVER: KIGOGO-RUAHA, STATION No. 1KB.6
STATION: FRICK'S BRIDGE (511 sq.m)
DAMSITE: FRICK'S BRIDGE (511 sq.m)

$t_{o\ av}$ = 16th May.
$t_{o\ min}$ = 22nd April.

Time in months	River discharge in cfs	Monthly reduction coeff %.	Minimum groundwater resources in 100 acrefeet after						
			1 month	2 months	3 months	4 months	5 months	6 months	7 months
o = t_o	538		256	414	518	591	645	687	(721)
1	320	60	158	262	335	389	431	(465)	(492)
2	205	64	104	177	231	273	(307)	(334)	
3	141	69	73	127	169	(203)	(230)		
4	103	73	54	96	(130)	(157)			
5	79	77	42	(76)	(103)				
6	(63)	(80)	(34)	(61)					
7	(50)	(80)	(27)						

RIVER: FUAGI, STATION No. 1KB.7
STATION: IDEGE (24 sq.m)
DAMSITE: IDEGE (21 sq.m)

$t_{o\ av}$ = 16th May.
$t_{o\ min}$ = 1st May.

Time in months	River discharge in cfs	Monthly reduction coeff %.	Minimum groundwater resources in acrefeet after						
			1 month	2 months	3 months	4 months	5 months	6 months	7 months
o = t_o	26		1 360	2 380	3 180	3 800	4 260	4 560	4 710
1	19.2	74	1 020	1 820	2 440	2 900	3 200	3 350	(3 400)
2	14.8	77	800	1 420	1 880	2 180	2 330	(2 380)	
3	11.8	80	620	1 080	1 380	1 530	(1 580)		
4	9	76	460	760	910	(960)			
5	6.4	71	300	450	(500)				
6	3.6	56	150	(200)					
7	1.4	(40)	(50)						

TABLE IX - MINIMUM GROUNDWATER RESOURCES

RIVER: MPANGA, STATION No. 1KB.8
STATION: MPANGA (937 sq.m)
DAMSITE: MDIKU (910 sq.m)

$t_{o\ av}$ = 19th June.
$t_{o\ min}$ - 4th May.

Time in months	River discharge in cfs	Monthly reduction coeff %.	Minimum groundwater resources in 100 acrefeet after						
			1 month	2 months	3 months	4 months	5 months	6 months	7 months
o = t_o	1050		560	1 014	1 401	1 743	2 049	(2 322)	(2 568)
1	820	78	454	841	1 183	1 489	(1 762)	(2 008)	(2 230)
2	690	84	387	729	1 035	(1 308)	(1 554)	(1 776)	
3	600	87	342	648	(921)	(1 167)	(1 389)		
4	540	90	306	(579)	(825)	(1 047)			
5	(480)	(90)	(273)	(519)	(741)				
6	(430)	(90)	(246)	(468)					
7	(390)	(90)	(222)						

RIVER: MNYERA, STATION No. 1KB.9
STATION: TAVETA (1950 sq.m)
DAMSITE: TAVETA (2264 sq.m)

$t_{o\ av}$ = 11th June.
$t_{o\ min}$ = 23rd April.

Time in months	River discharge in cfs.	Monthly reduction coeff %.	Minimum groundwater resources in 100 acrefeet after						
			1 month	2 months	3 months	4 months	5 months	6 months	7 months
o = t_o	2070		1 041	1 780	2 339	2 774	3 119	(3 392)	(3 608)
1	1410	68	739	1 298	1 733	2 078	(2 351)	(2 567)	(2 740)
2	1050	74.5	559	994	1 339	(1 612)	(1 828)	(2 001)	
3	810	77	435	780	(1 053)	(1 269)	(1 442)		
4	640	79	345	(618)	(834)	(1 007)			
5	(510)	(79)	(273)	(489)	(662)				
6	(400)	(79)	(216)	(389)					
7	(320)	(79)	(173)						

TABLE IX - MINIMUM GROUNDWATER RESOURCES.

RIVER: RUHUJI, STATION No. 1KB.10
STATION: MWAYAMALUNGU (3294 sq.m)
DAMSITE: MKASU (3277 sq.m)

$t_{o\ av}$ = 25th May.
$t_{o\ min}$ = 4th May.

Time in months	River discharge in cfs	Monthly reduction coeff %.	Minimum groundwater resources in 100 acrefeet after						
			1 month	2 months	3 months	4 months	5 months	6 months	7 months
o = t_o	3050		1 560	2 683	3 533	4 203	4 745	(5 185)	(5 542)
1	2150	70.5	1 123	1 973	2 643	3 185	(3 625)	(3 982)	(4 270)
2	1600	74.5	850	1 520	2 062	(2 502)	(2 859)	(3 147)	
3	1230	77	670	1 212	(1 652)	(2 009)	(2 297)		
4	1000	81	542	(982)	(1 339)	(1 627)			
5	(810)	(81)	(440)	(797)	(1 085)				
6	(660)	(81)	(357)	(645)					
7	(530)	(81)	(288)						

RIVER: KILOMBERO, STATION No. 1KB.17
STATION: SWERO (12915 sq.m)
DAMSITE: KINGENENAS (12915 sq.m)

$t_{o\ av}$ = 15th June.
$t_{o\ min}$ = 25th May.

Time in months	River discharge in cfs	Monthly reduction coeff %.	Minimum groundwater resources in 1000 acrefeet after						
			1 month	2 months	3 months	4 months	5 months	6 months	7 months
o = t_o	17000		800	1 280	1 620	1 887	2 094	(2 236)	(2 322)
1	9600	56.5	480	820	1 087	1 294	(1 436)	(1 522)	(1 567)
2	6400	66.5	340	607	814	(956)	(1 042)	(1 087)	
3	4900	77	267	474	(616)	(616)	(702)	(747)	
4	4000	82	207	(349)	(435)	(435)	(480)		
5	(2900)	(73)	(142)	(228)	(273)				
6	(1850)	(64)	(86)	(131)					
7	(1020)	(55)	(45)						

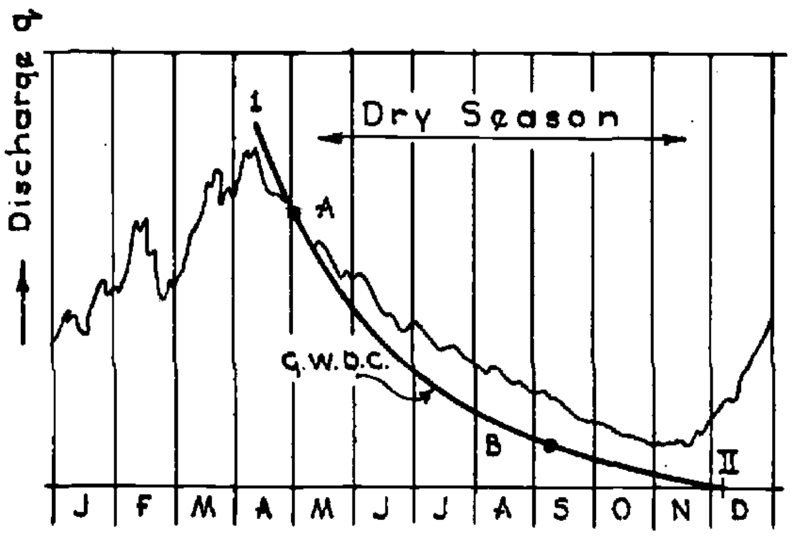


FIG-1a.
Theoretical G.W. Depletion Curve.

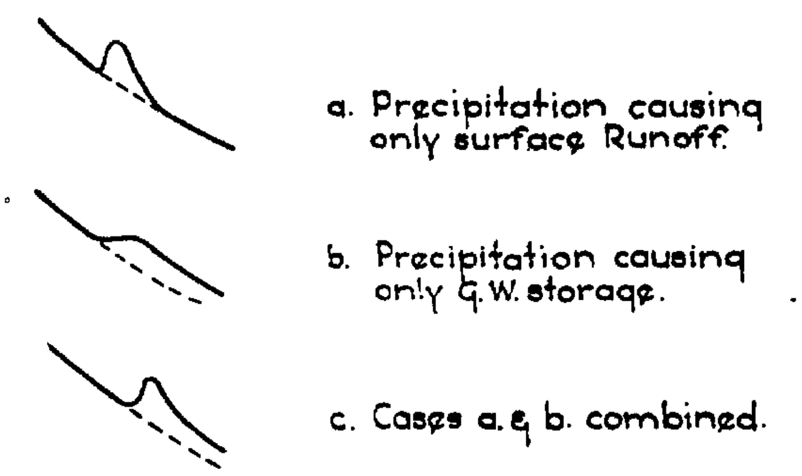


FIG-1b
Local Disturbances.

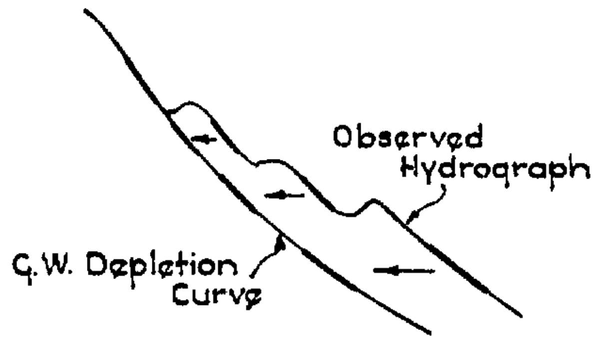


FIG-1c
Construction G.W.D. Curve.

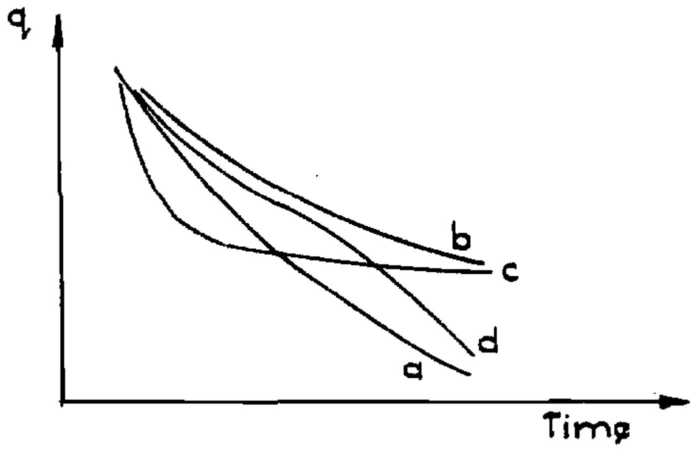


FIG-1d
Typical G.W.D. Curves.

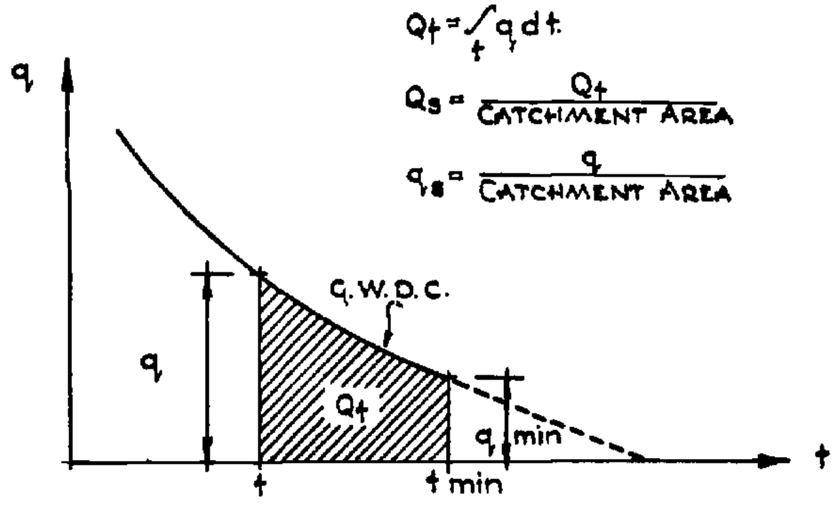


FIG-1e

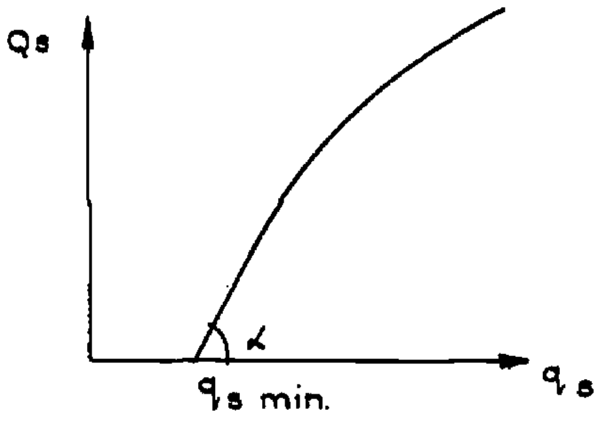


FIG-1f

SPECIFIC ACCUMULATION

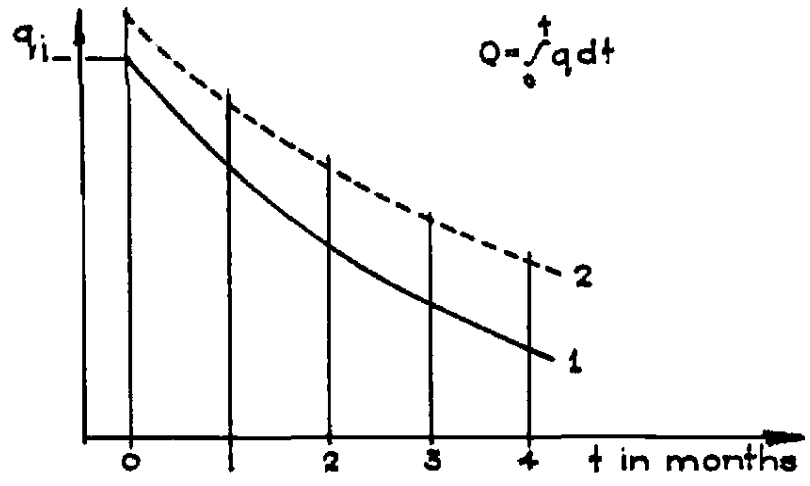


FIG-1g

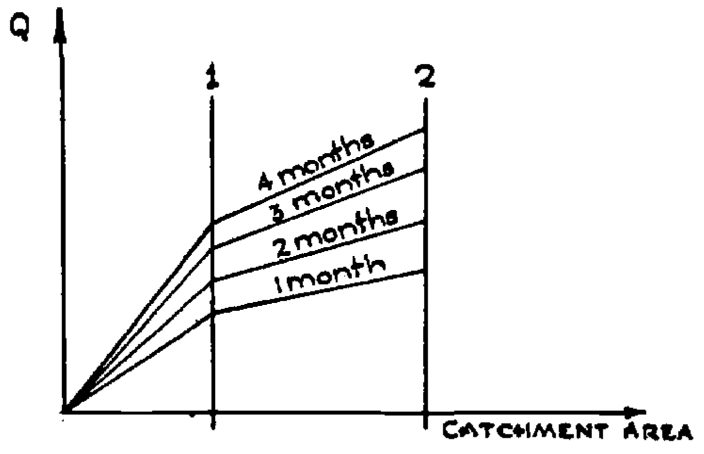


FIG-1h

POTENTIAL ACCUMULATION

PRINCIPAL SKETCHES.

FIG 1 a to h

LITTLE RUAHA

FIG X 2a
GROUNDWATER DEPLETION CURVES

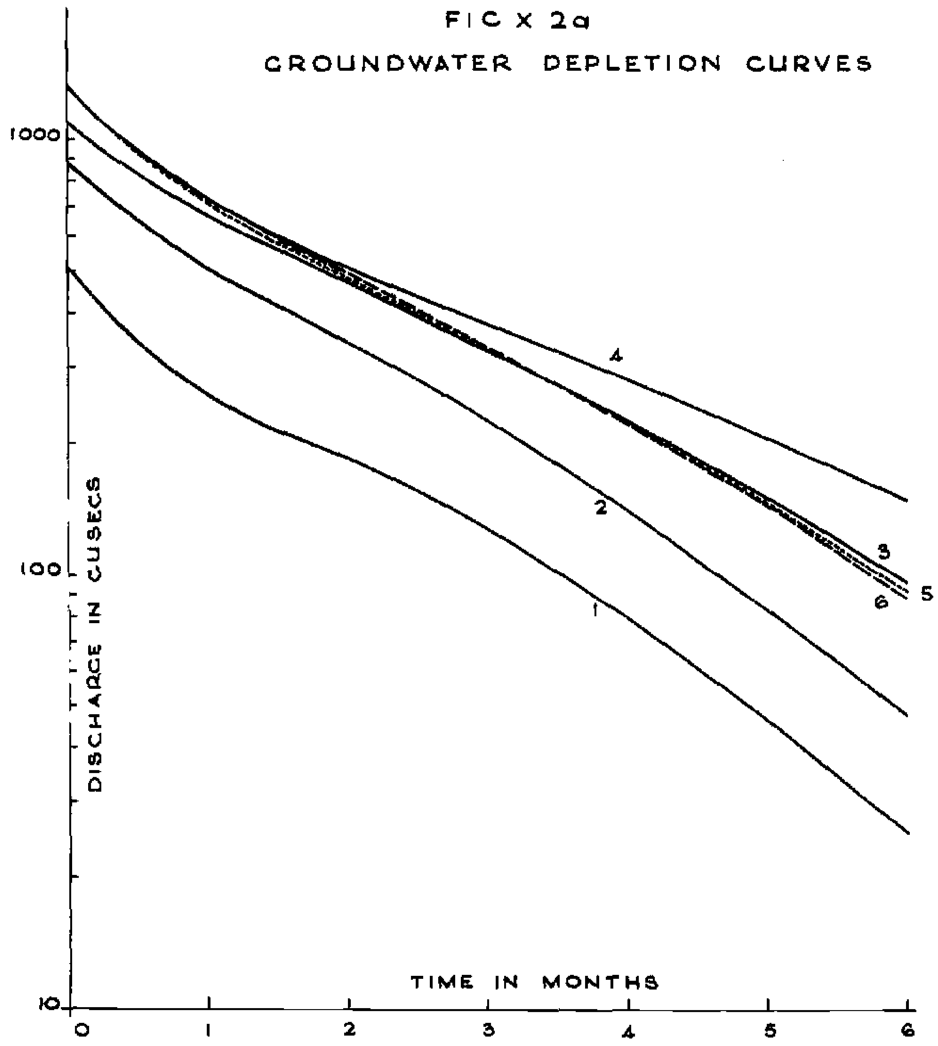
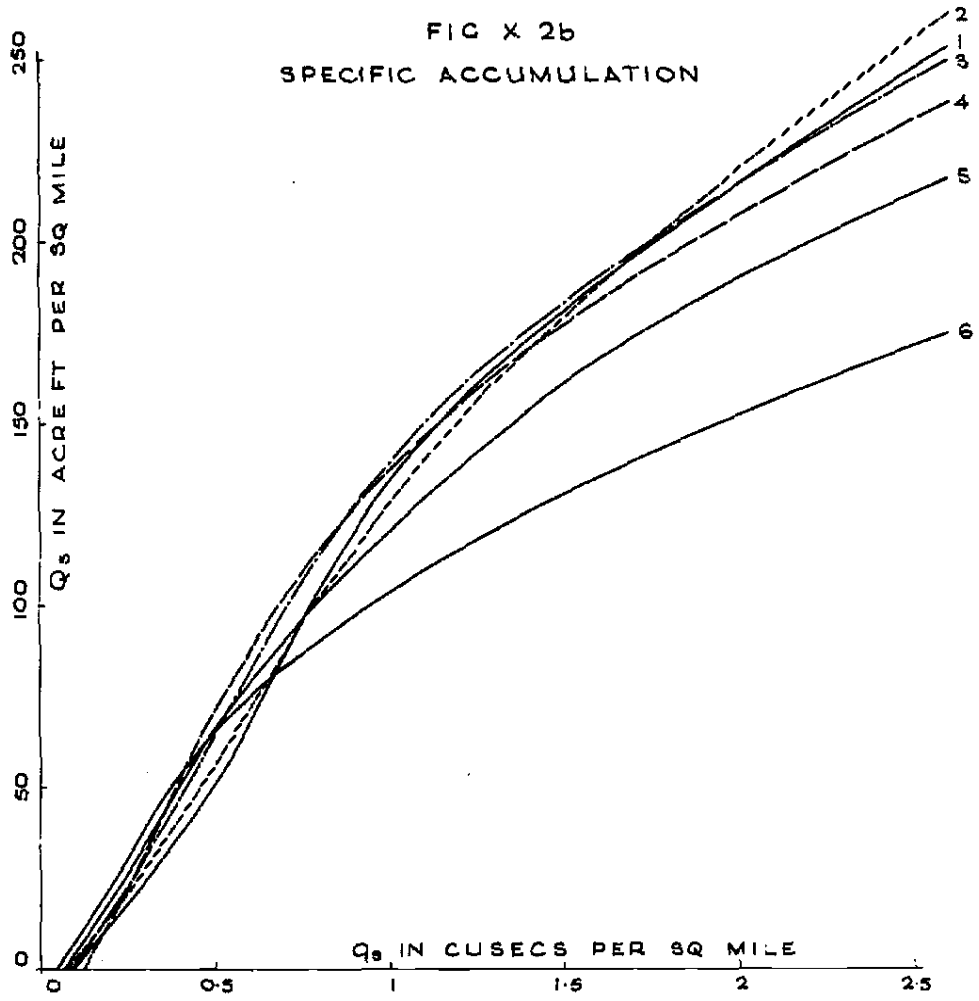


FIG X 2b
SPECIFIC ACCUMULATION



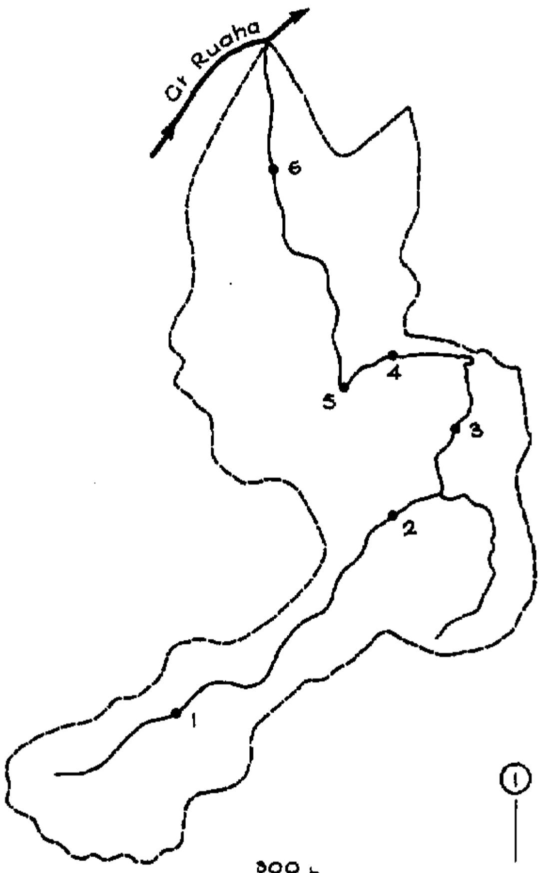
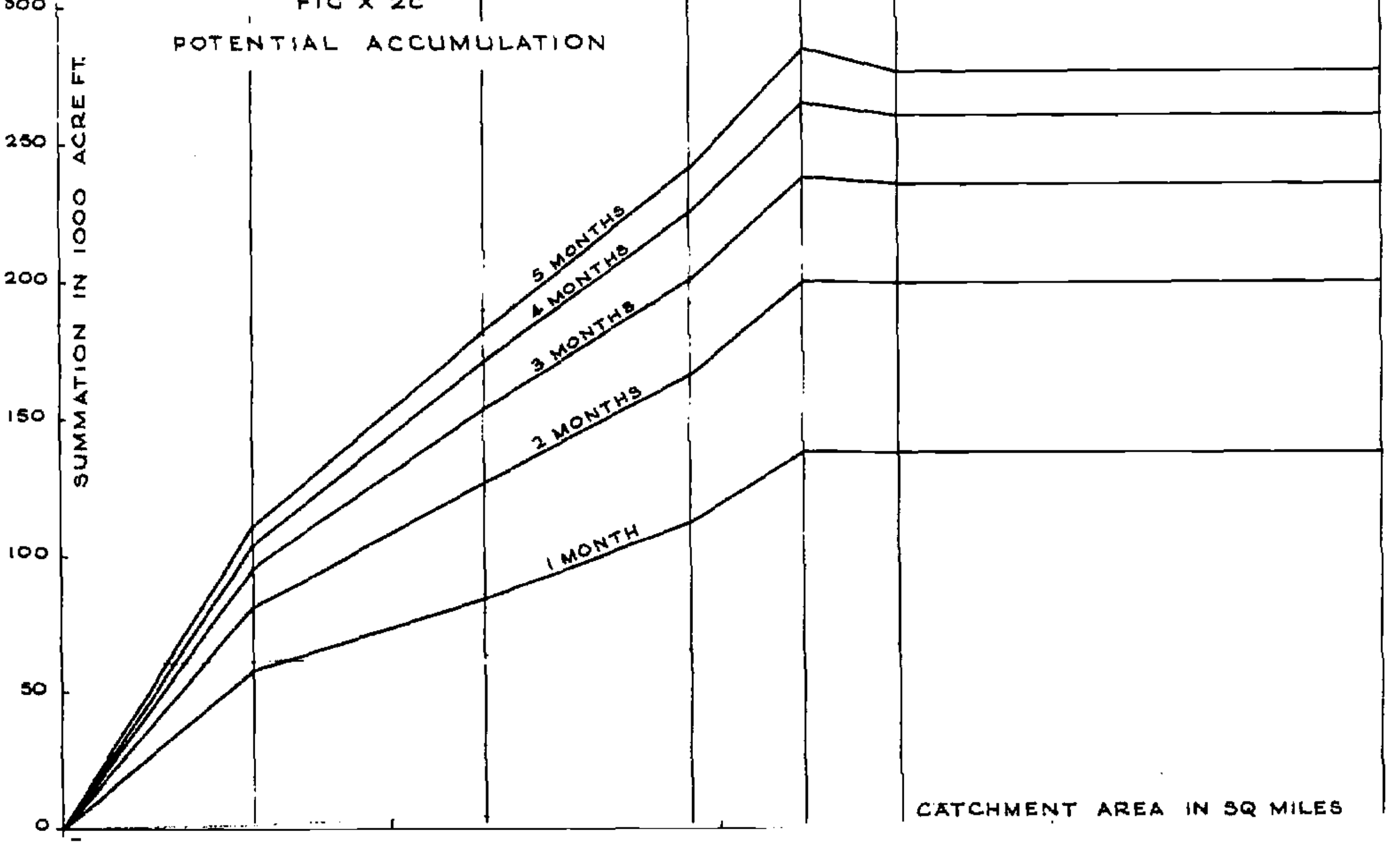


FIG X 2c
POTENTIAL ACCUMULATION



GREAT RUAHA

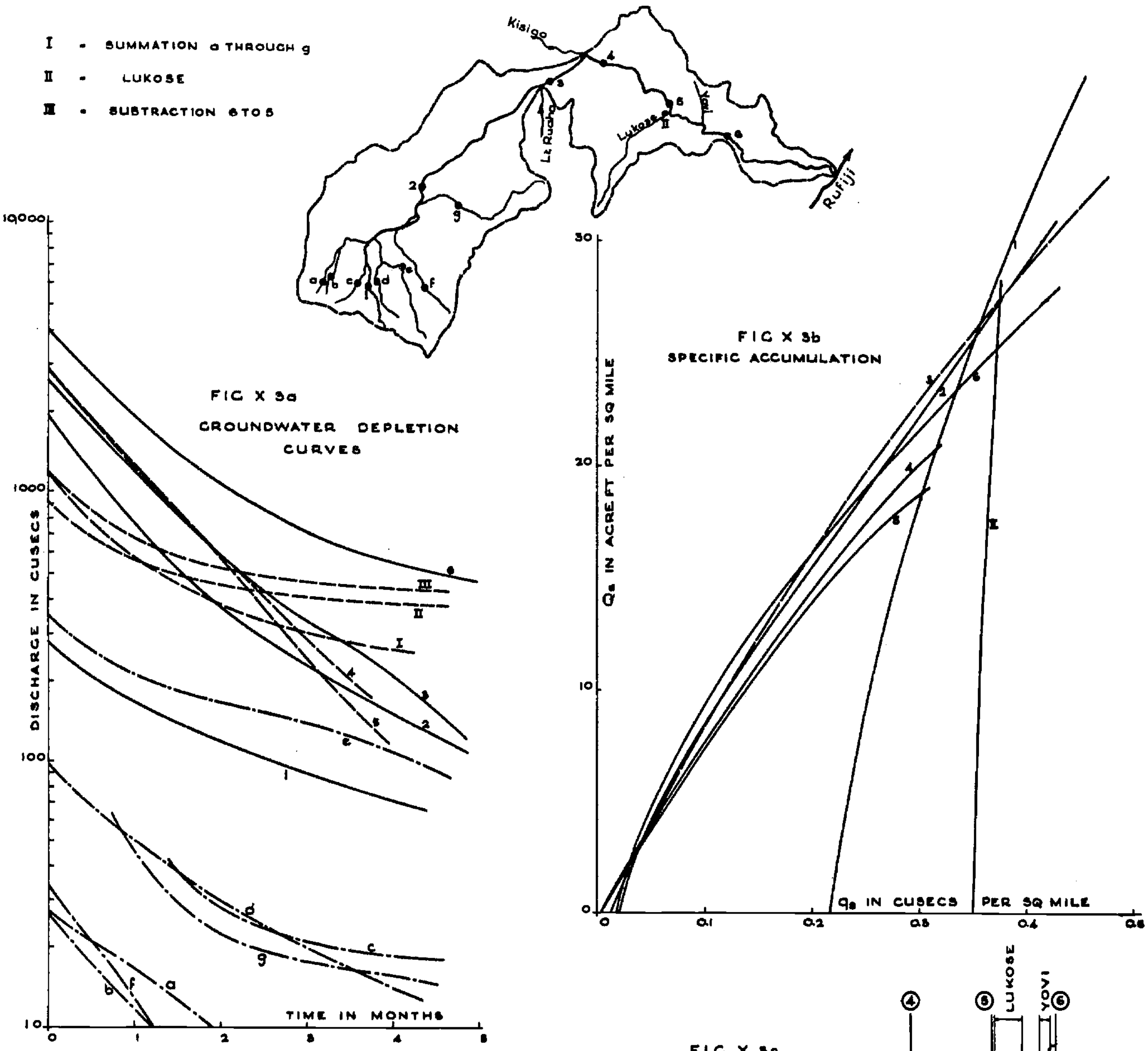


FIG X 3a
GROUNDWATER DEPLETION CURVES

FIG X 3b
SPECIFIC ACCUMULATION

FIG X 3c
POTENTIAL ACCUMULATION

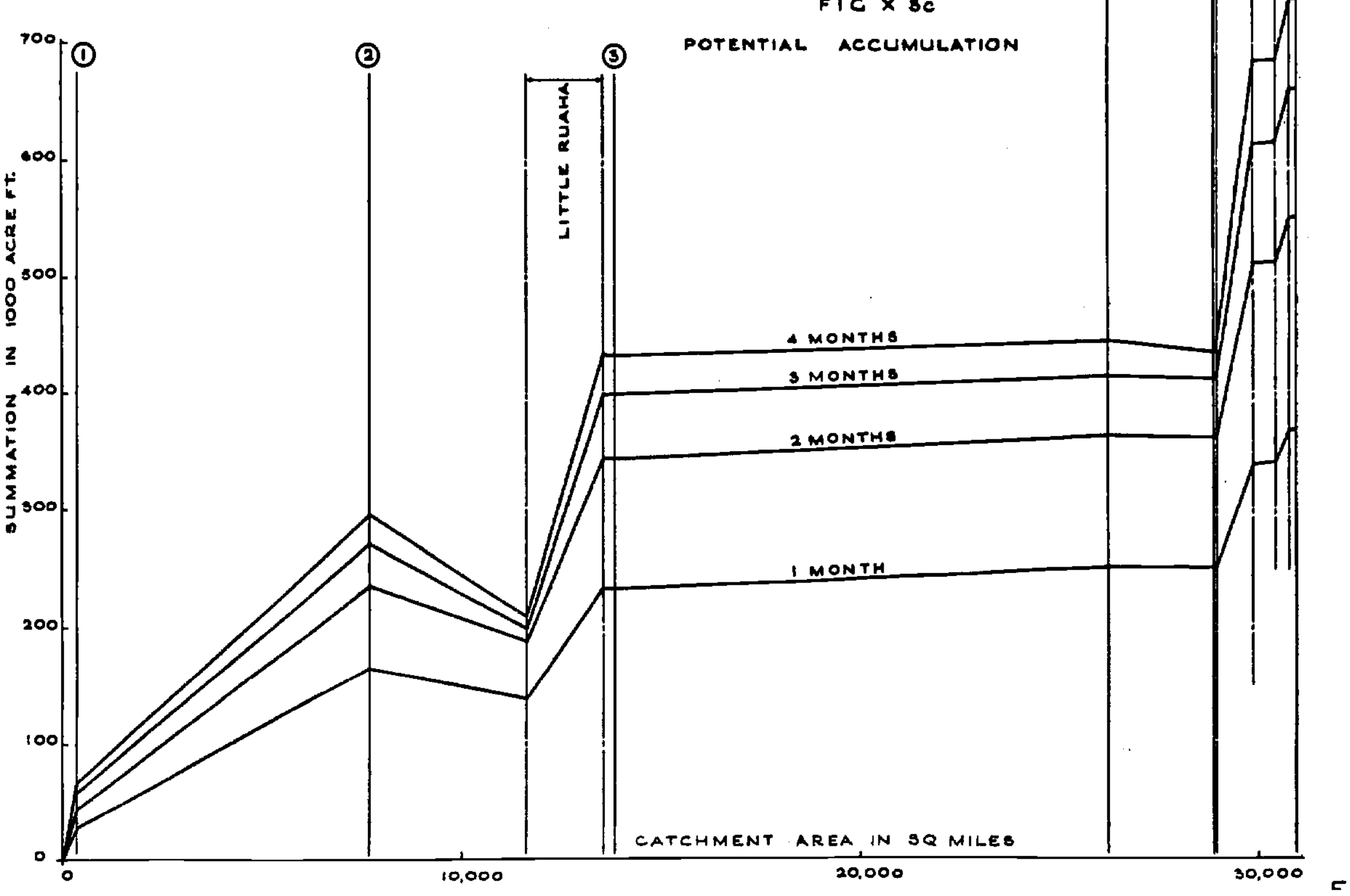
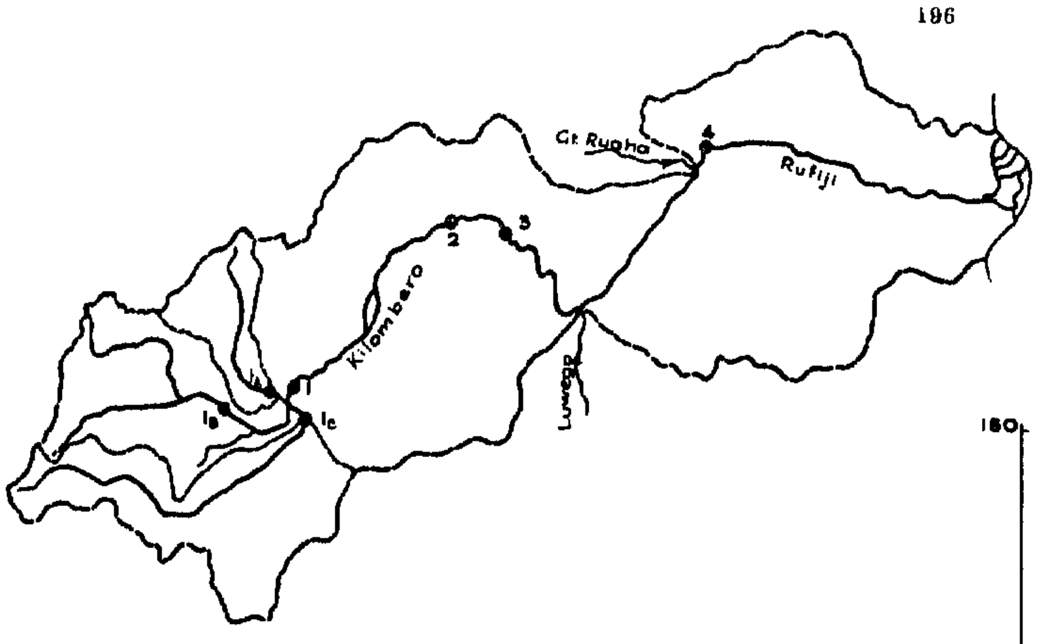


FIG 3

KILOMBERO - RUFIJI



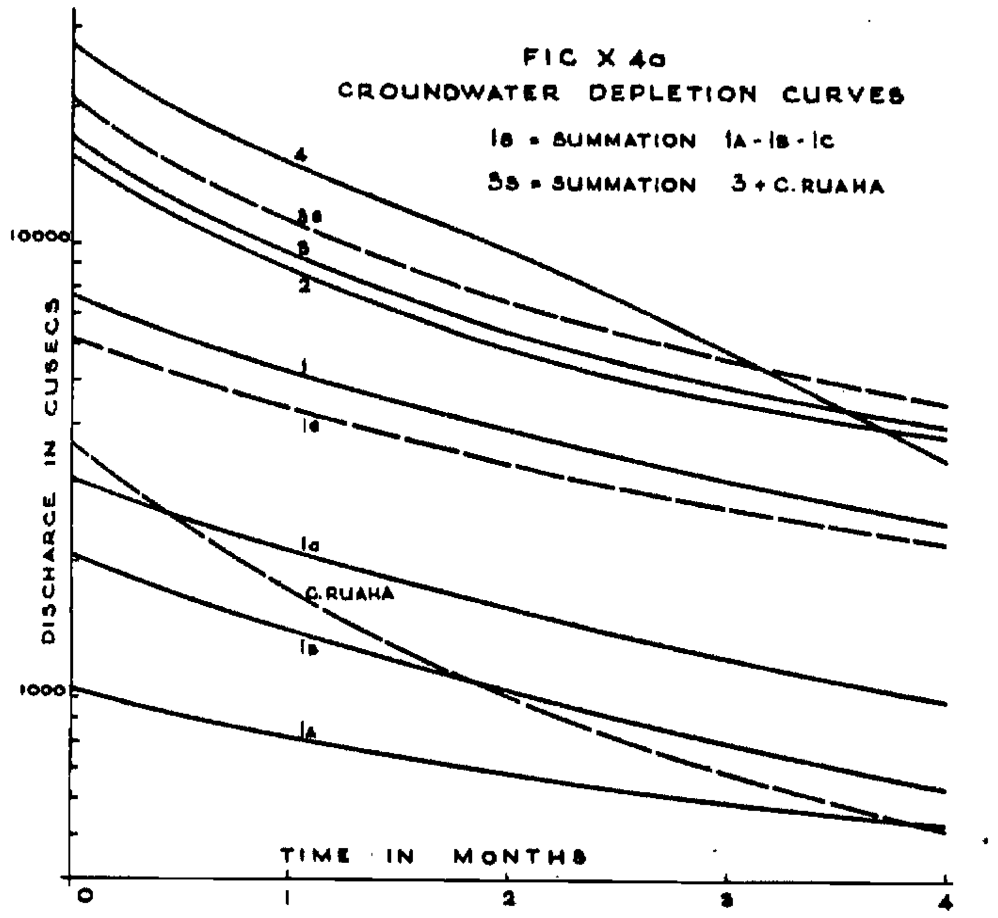


FIG X 4a
GROUNDWATER DEPLETION CURVES
1S = SUMMATION 1A - 1B - 1C
3S = SUMMATION 3 + G. RUAHA

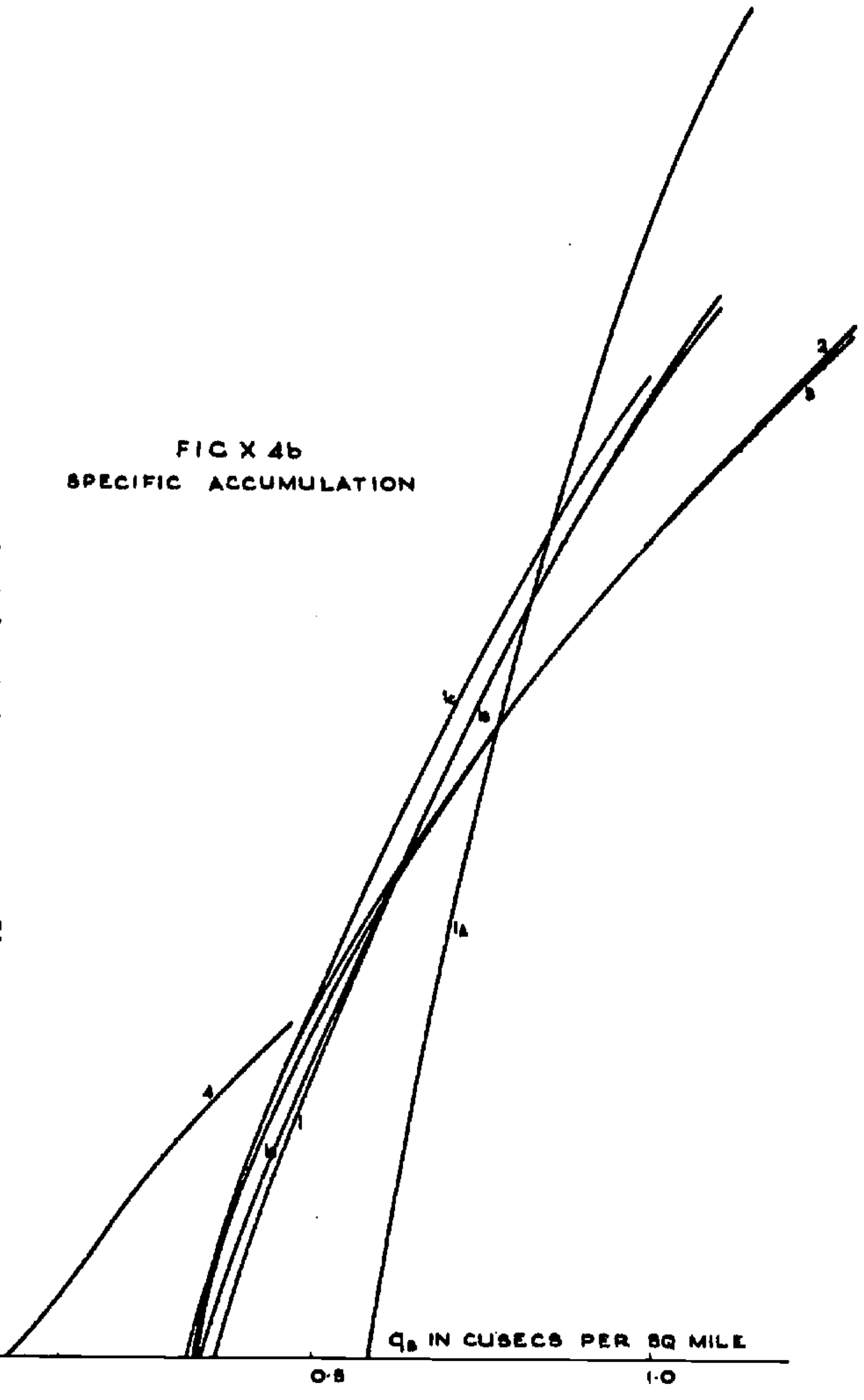


FIG X 4b
SPECIFIC ACCUMULATION

FIG X 4c
POTENTIAL ACCUMULATION

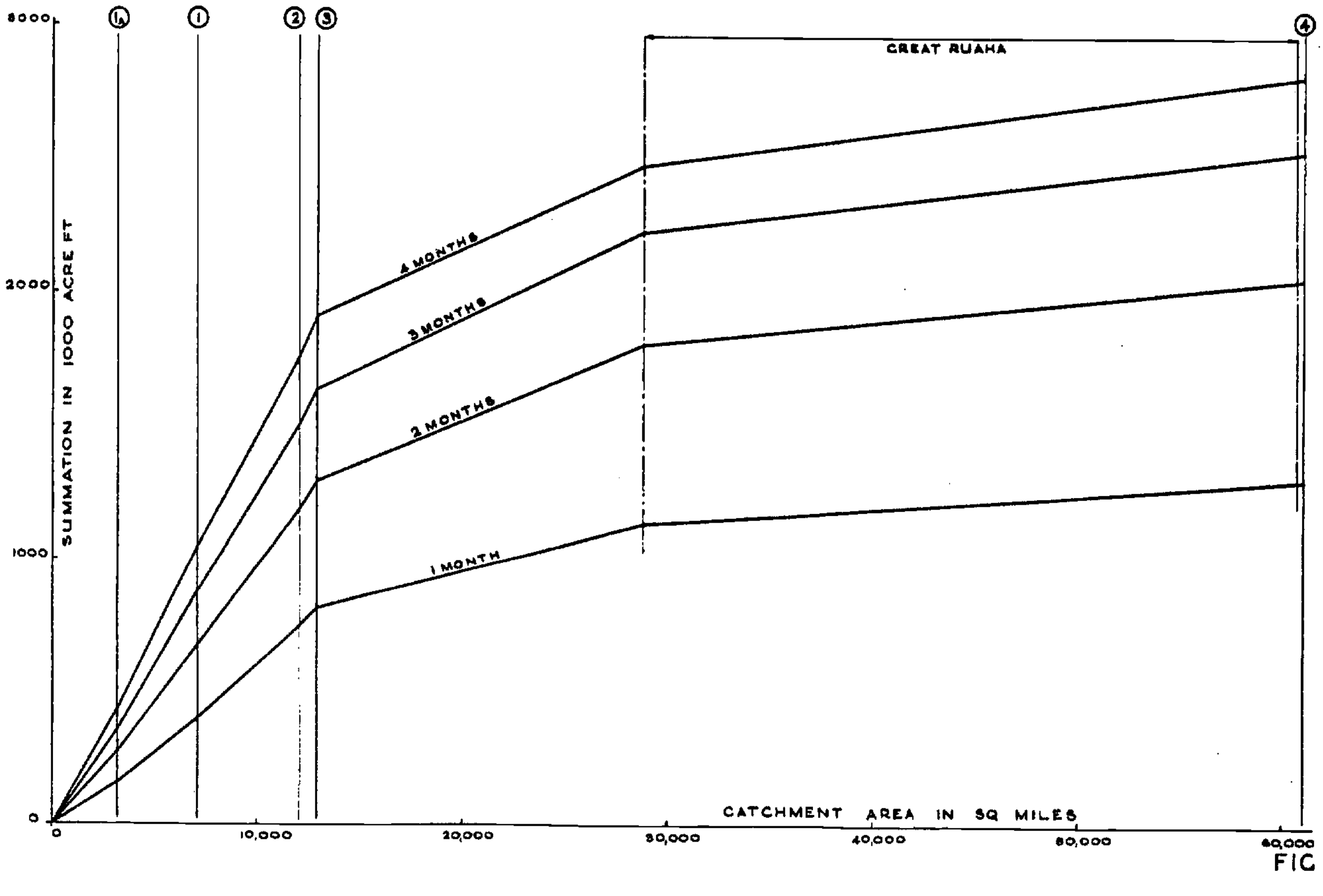


FIG 4 a,b,c

DEPLETION-DATE RELATION GRAPH FOR GR. RUAHA AT MTERA.

YEAR	DATE AT WHICH q_i OCCURRED	ANNUAL RUNOFF EXPRESSED AS A PERCENTAGE OF AVERAGE RUNOFF.
1955	1 MAY.	62
1956	7 JUNE.	205
1957	20 JUNE.	160
1958	4 JUNE.	126
1959	1 JUNE.	109
1953	MIN. YEAR.	42

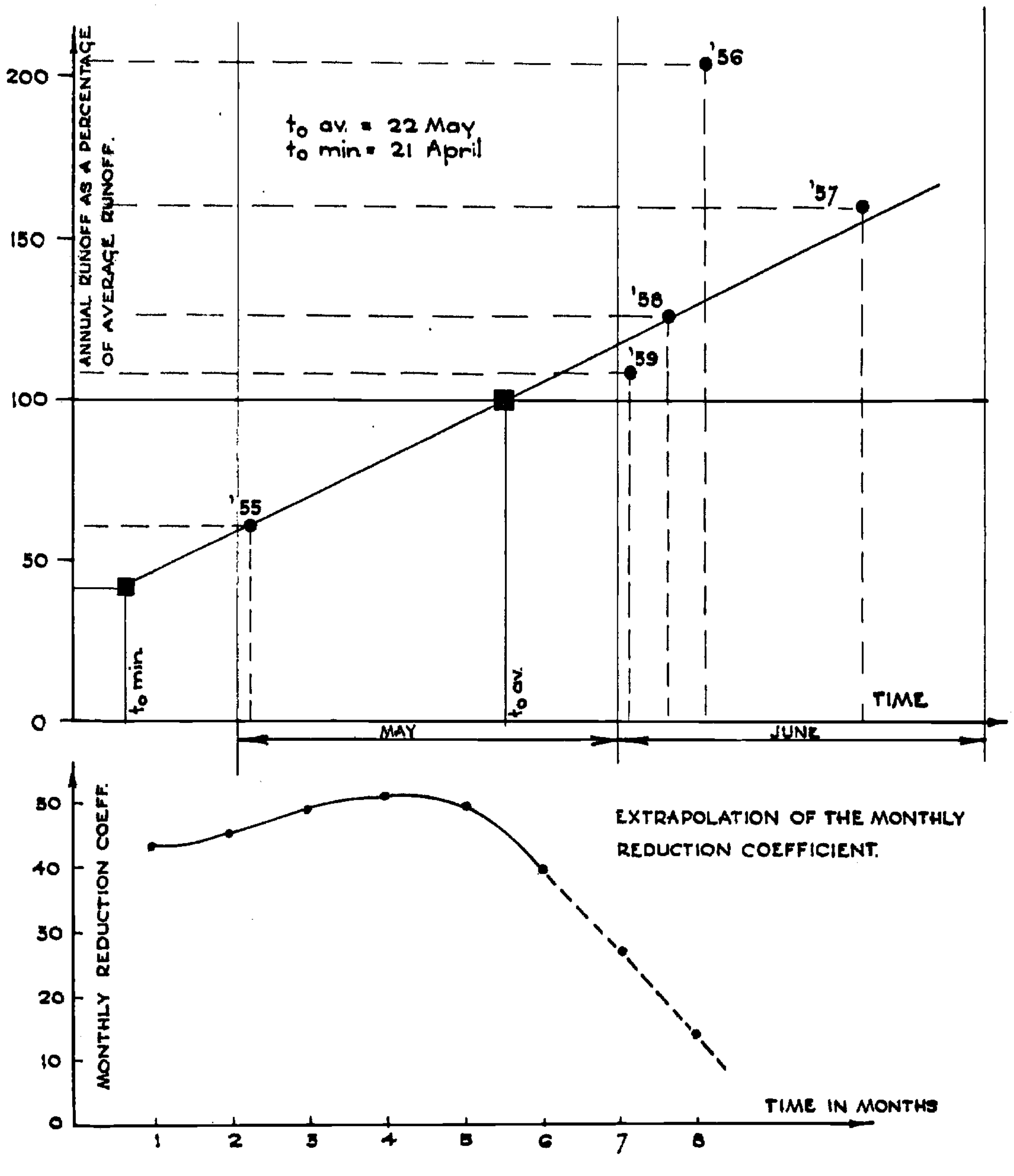
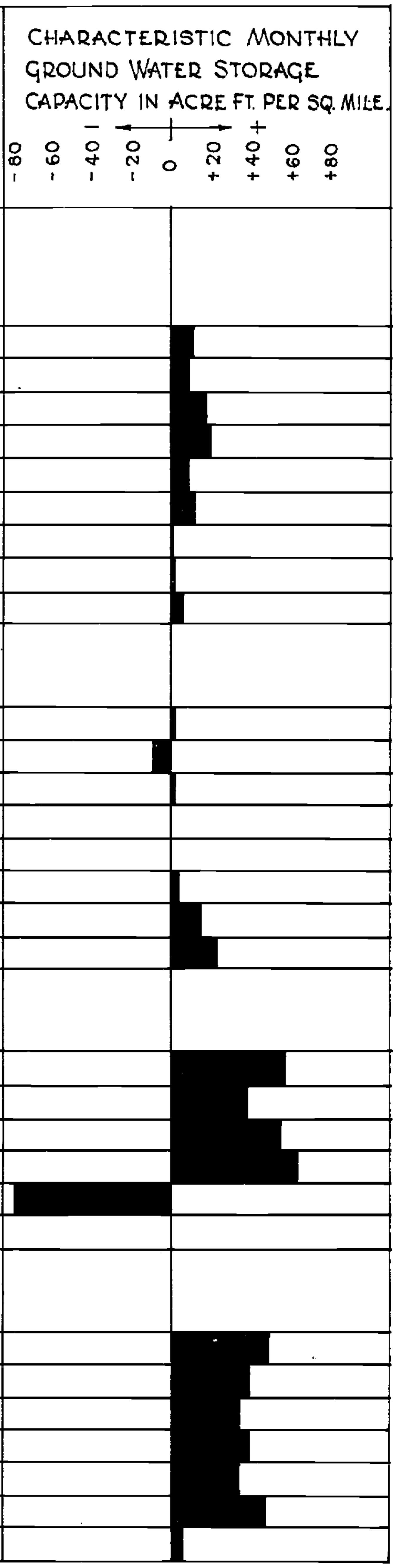


FIG. 5

CATCHMENT	CATCHMENT AREA IN SQ. MILES.
WESTERN MOUNTAIN TRIBUTARIES GREAT RUAHA	
MSWISWI	36
MAMBI	32
CHIMALA	85
GREAT RUAHA	328
KIMANI	173
MBARALI	762
HALALI	302
NDEMBERA	707
SUMMATION	2425
GREAT RUAHA between stations.	
1-2	7372
2-3 LITTLE RUAHA EXCLUDED	4139
2-3 LITTLE RUAHA INCLUDED	6144
3-4	12410
4-5	2020
5-6 LUKOSE EXCLUDED	1514
5-6 LUKOSE INCLUDED	2631
LUKOSE	1117
LITTLE RUAHA between stations.	
1	293
1-2	352
2-3	312
3-4	170
4-5	146
5-6	732
KILOMBERO-RUFIJI	
MPANGA	937
MNYERA	1950
RUHUJI	3294
1	7048
1-2	5015
2-3	852
3-4	48191



SPECIFIC GROUND WATER CONTRIBUTION.
Note. Station numbers refer to numbers given on Figs. 2, 3 & 4.

FIG. 6

11. SEDIMENT TRANSPORT BY RIVERS.

BY S. RAADSMA

a. INTRODUCTION

Some investigations on sediment transport have been carried out in the Rufiji Basin and it is hoped that these will provide some knowledge on the phenomena.

Sediment transport by rivers is the result of erosion in the drainage basin and when redeposited the sedimentary load may become an actual danger to the utility of expensive engineering works such as reservoirs and irrigation schemes.

A comprehensive investigation of sediment transport is an expensive task which requires specially designed instruments and equipment and also qualified and trained observers. With the facilities that were available in Tanganyika the procedure had to be simplified to a very great extent. On the following pages a short explanation is given of the methods applied. The results obtained are shown in tables and graphs and these data are discussed in brief.

b. BASIC CONSIDERATIONS

The material transported by a river can be divided into two groups:-

1. The Suspended Load which is the material carried in suspension by the water.
2. The Bed Load which is the material moving on or near the river bed by friction between the solid particles and the water.

The suspended load consists mainly of clay and silt particles as well as organic matters, while particles of the size of sand and larger, usually are concentrated near the river bed.

A river can carry enormous amounts of fine material in suspension and the suspended sediment load is therefore, to a greater extent a function of supply of material and velocity rather than of water discharge. A reliable estimate of the suspended sediment load of a river can only be made by sampling.

The rate of bed load transportation depends upon supply, but also on river bed roughness, size of particles and the dragging force of the water. The greatest and uninterrupted bed load movement takes place only during periods of high water, but in rivers with loose sandy beds and banks and in steep mountainous rivers, transportation of the bed load may take place at all stages. Direct bed load measurements with a bed load sampler, or trap, are usually questionable but better results can sometimes be obtained by either of the two following methods:

(a) Discharge the whole river into a reservoir, measure the total volume of sediment deposited during a certain lapse of time and subtract the suspended sediment load as measured upstream of the reservoir.

(b) Measure the total sediment load in rapids where a homogeneous mixture is assumed and subtract the suspended sediment load measured in more calmly flowing water upstream or downstream from this place.

Since both these methods require certain conditions in the river to be present, they can not always be applied. A very common practice for engineering purposes is therefore to make some allowance for the bedload transport by adding a certain percentage to the suspended sediment load. This percentage will, of course, vary greatly from river to river and with their gradients being such an uncertain factor. Applied figures are mostly found to lie between the limits of 10 and 50%.

Direct bed load investigations have not been carried out in the Rufiji Basin. The investigations were limited to determination of suspended sediment load only. In addition a number of grain size and mineralogical analyses were carried out. These will be dealt with separately at the end of this Chapter.

c. SAMPLING AND ANALYSING

River gauging stations nearest to proposed reservoirs and sites of water use have for practical purposes been selected for river water sampling. Altogether some 3000 samples have been collected from twenty rivers at twentyseven gauging stations. The samples were collected regularly once a week. During floods additional samples were taken when conditions permitted. The rivers, stations and period covered by sampling are listed in the Schedule of Gauging Stations. For locations reference is made to the Runoff Map in the Map Folder.

A number of the stations are located far away from roads, and especially during rainy seasons, the access was problematic and difficult. Visits could not always be made as frequently as desirable and the observers were therefore supplied with a sufficient stock of empty bottles and packing boxes to last for several months. In many cases it took months before the boxes could be returned to the laboratory, and in a few instances it was not possible to get them out before the end of the rainy season when the access roads had dried sufficiently to reach the place by land rover. All analysing work was done by the Government Chemist in the Laboratory, Dar es Salaam.

d. SAMPLING PROCEDURE

From a financial point of view it was impossible to supply all the stations with adequate and expensive sampling instruments. The sampling method had to be simple and straight forward and of course as uniform as possible. Much thought was given to the matter of simplifying the sampling method without reducing the accuracy of the investigations to any great extent, and it was decided to commence the sampling by filling water directly into a bottle at certain selected points on the rivers. The bottles used all had a capacity of 500 cc and an opening of 1.5 inches.

In rivers with waterfalls or rapids at or near to a gauging station, samples were collected by immersing the bottles into the turbulent flowing water by hand. At stations with more calmly flowing water, samples were taken in the middle of the stream at six tenths of the depth below the surface. Simple arrangements were made for a protecting wire cage complete with sinker and a supporting wire to pull the stopper out at the desired depth.

This crude, but cheap and easy method of sampling may have questionable results. During the initial inrush of fluid after pulling the stopper from the bottle, water may enter at a higher velocity than the sediment particles which tend to follow their original path, due to their higher specific gravity. This means that the sediment concentration in the bottle may be lower than in the river at the point of sampling. On the other hand the escaping air may cause so much turbulance that the influence of the initial inrush is negligible. Another aspect of this method is the possibility of sediment increase in the bottle while it is being pulled to the surface. The heavier sediment particles can not move away as quickly as water and may be caught in the bottle opening. It was obvious that this sampling method had to be checked and some calibration tests were carried out by the travelling field officers during the three years the sampling was in progress.

e. CHECKING OF SAMPLING METHOD

Two types of sediment samplers were used as checking instruments, against the very simple method described. One instrument of the horizontal instantaneous type was locally manufactured in Dar es Salaam early in 1957 using a Dutch design, and in the same year, a similar Italian instrument manufactured by STRA, Venice, type O.M.I., was made available by FAO.

Forty eight check measurements with an average of 6 measuring points in each were taken using these samplers. At the same time one or more bottles were collected in the usual way, and the results compared. Assuming that the relation is linear, the following equation could be established applying the method of the least squares:-

$$y = 0.916\ x + 3.9$$

y is the sediment concentrations in p.p.m. collected with the sampling instrument and x the corresponding values of the bottle samples. The correlation coefficient (r) is 0.98. The result is shown in illustration at the end of this chapter.

It seems that the samples collected with a bottle tend to give concentrations on the high side. On an average these results are 8% higher than those collected with the sampling instrument.

Of the 48 measurements 5 had a deviation of 50% or more from the corresponding instrument sample, 6 had a deviation between 25 and 50%, 18 between 10 and 25% and 19 showed deviations of less than 10%.

Another method of testing was carried out by collecting three or four bottles at the same time and point. The arithmetic mean of each set and the individual deviations from this mean were computed. Out of 100 such sets of samples 3 sets showed individual deviations of 50% or more, 17 sets had deviations between 25 and 50%, 28 sets between 10 and 25% and the remaining 52 sets had only individual deviations of less than 10%.

It may be concluded from the above that the individual error made by using a bottle for sampling seldom exceeds 50%. The errors are sometimes positive, and sometimes negative, but the total error in suspended sediment load computations for longer periods will be considerably less than indicated by the individual sample errors.

These considerations apply only because of the very low sediment load concentration of the investigated rivers. The errors made by such a simple sampling method would most likely be much greater in rivers with high sedimentary load.

f. CALCULATION OF SUSPENDED SEDIMENT LOAD

The suspended sediment load at time of sampling is computed with the function:

$$M = 86400 \frac{qc}{35.3 \times 10^6}$$

where M is the suspended sediment load in metric tons per day, q is the discharge in cuseos at time of sampling and c is the sediment concentration in milligrammes per litre. If q at time of sampling is taken as the daily average discharge, then the daily sediment transport is computed by simple multiplication.

Monthly and annual totals of suspended sediment load is very often found computed in the same way as runoff by applying rating curves. Two such curves are shown as an example at the end of this chapter. It will be seen that most of the individual measurements deviate considerably from a median rating curve and grave errors would be introduced if such a curve was applied directly in the computations.

The same considerations as in the Stout Method for runoff computations have therefore also been applied in the calculations of suspended sediment load. The method implies that deviations in waterlevel from an established median or balance sediment rating curve is computed for each date of sampling. These differences can give both positive and negative values. For days in between sampling dates, water level deviations are computed by interpolation and the observed water levels adjusted accordingly. When this is done the median curve can be applied in the computations and the derived result conforms to each individual sample which are consequently assumed correct. In practice this means that a new rating is established for each date of sampling and that the previous as well as the following sample are considered when this rating'is established. (For details see 9, p. 398-401). Discharge figures can, if preferred, be used in the computations instead of water levels.

g. TABULATION AND MAPPING OF RESULTS

Sampling stations with number, name of rivers and period covered by sampling, are listed in the Schedule of Gauging Stations, table I.

The actual observations and results of each individual sample and analysis are for space reasons not included in this report. All these data are given in a separate binder to the Department of Water Development and Irrigation, Dar es Salaam, and the more detailed information can be extracted from this source if required.

Table X. Contains suspended sediment load totals per month and year for the observation period at the various stations. The tabulation also includes suspended sediment concentrations which is the weight percentage of runoff, and finally the sediment production, which is the suspended sediment transport expressed in metric tons per sq. mile.

Table XI. Shows the maximum and minimum concentrations observed at each station.

Table XII. Summarizes the annual sediment concentration and production, and gives average values for the years of observation. The latter information is also shown on the Sketch Map, page 234.

h. DISCUSSIONS OF RESULTS

Great Ruaha River. In the headwater tributaries of the Great Ruaha the suspended sediment concentration differs very little. The Kimani, the Great Ruaha itself, the Mbarali and the Halali show average annual concentrations from 0.015 to 0.020%. The Chimala is remarkably low with 0.006% only. All these rivers are gauged at the Great North Road before they enter the Usangu Plain. The suspended sediment production on the Mbarali at Rujewa Trial Farm is approximately double that of Igawa, 15 miles upstream. This may be explained by the fact that the river enters the Usangu Plain just downstream of Igawa and frequently changes its course in the sandy alluvial plain. In addition, much sediment may be added by the Mlombosi, a tributary joining the Mbarali between Igawa and Rujewa.

The Ndembera and Little Ruaha carry very little suspended sediment at their sampling stations, Ilongo and Iringa.

The Kisigo is an intermittent river with very sudden and flashy floods, but the suspended sediment transport during the few months of runoff is very low. It is suspected that the bed load transport is comparatively high in this river.

On the Great Ruaha there is a trend of increase in the suspended sediments concentration from the headwaters down to Mtera and Mbuyuni. From Mbuyuni to Kidatu, no change of significance can be traced although the Lukosi tributary has a much lower concentration than the Great Ruaha itself.

Kilombero River. The rivers in the upper region of the Kilombero Valley, the Mpanga, the Mnyera and the Ruhuji, did not carry large amounts of suspended sediments in the year of observation. About the same amount as the total of these three was observed at Ifwema downstream of their confluence. Below Ifwema the Kilombero is joined by the Furua River which has a higher suspended sediment concentration than any of the other rivers investigated.

The Kilombero loses most of its suspended sediment load, approximately half a million tons per year, before it reaches Ifakara. The loss is particularly big during the rainy season when material is redeposited on the flood plains. The suspended sediment transport at Ifakara and Ifwema was higher in 1958-59 than in previous years. The flood was comparatively low in 1959 and the flow was to a greater extent restricted to the actual river channel where the velocity is higher and the possibility of redepositing considerably lessened.

On an average the Great Ruaha at Kidatu carries about three times as much suspended sediment load as the Kilombero at Ifakara. The average annual runoff, however, is about 1/5 only of that of the Kilombero, and consequently the sediment concentration is much higher on the Great Ruaha than on the Kilombero.

Rufiji River. The suspended sediment concentration on the Rufiji at Stiegler's Gorge is much higher than that of the Kilombero and Great Ruaha. The annual totals can be listed as follows:

Annual Suspended Sediment Transport in Tons

	Stiegler's Gorge	Swero plus Kidatu	Difference
1957-58	13,943,762	1,648,375	12,295,387
1958-59	15,857,620	1,001,239	14,856,381

The corresponding average monthly values are shown graphically on page 236.

By methods of analogy, the total suspended sediment transported in the entire Great Ruaha and Kilombero catchments can be estimated, and the contribution from the partial sub-catchment down to Stiegler's Gorge is represented by the difference between this and the Stiegler's Gorge figures. The resulting sediment production is comparatively high, 915 tons per sq.mile per year corresponding to a concentration of 0.45%.

Luwegu River. There is but little doubt that most of this suspended sediment comes from the Luwegu sub-catchment. Very little is known about the hydrology of this river except that sudden and very often early floods occur, probably causing some of the highest floods of the lower Rufiji. The area consists of Karroo and possibly younger continental sediments which erode at a faster rate than the crystalline rocks of the Great Ruaha and the Kilombero sub-catchments (cf. Haldemann, Vol VI part 1, 4 and part 2, 4).

i. GRAIN SIZE DISTRIBUTION OF SUSPENDED SEDIMENT

Particle size analyses have been carried out with a Bottom Withdrawal Tube according to a theory based on the Oden Curve and Stoke's Law. The method which is fully described in the literature (13) can be used to analyse size of particles with a diameter between 0.001 and 1 mm. in sediment concentrations between 300 and 10.000 parts per million. The method was successfully tried out at the Government Chemical Laboratory. Some fifty samples were analysed and cases with unsatisfactory results were generally due to insufficient quantities of suspended sediment in the samples. It was observed that many samples contained a comparatively small amount of clay and fine silt. This may be so, but there is a possibility of the fine material having coagulated into greater particles during the time lapse between sampling and analysing.

The grain size distribution of 19 samples is shown graphically, page 236. The amount of particles with diameter size as indicated are presented cumulatively as a weight percentage of the total overdried sediment in the sample.

The number of analyses is too small to draw any definite conclusion but it seems that the first flood after a dry spell carries a larger amount of fine material than the floods which occur later in the wet season. The amount of fine material seems also to be comparatively small and of a decreasing order in periods just following a high flood.

j. MINERALOGICAL ANALYSES

The Department of Geological Laboratory Service, Dodoma, has carried out some mineralogical analyses and maintains that the sand in any river load is almost bound to consist largely of quartz, felspar and mica. The rarer minerals are usually present only in very small quantities and proved in fact to be absent in the samples analysed.

k. CONCLUSIONS

The suspended sediment concentration is low for all the rivers investigated. The annual values are always less than 0.1% and even the highest monthly averages exceed this value at very few stations only. The sediment production is, with the exception of Furua and Luwegu, less than 400 tons per sq.mile per year.

Even if a safety margin of 100% is considered, the useful lifetime of future reservoirs will not be endangered by suspended sediment. An exceptional case is the Luwegu River.

Between 85 and 99% of the annual sediment transport takes place usually during the five months from January to May. The sediment concentration is highest during rising stages of a river and the maximum is generally observed during the first floods of the hydrological year in December and January. The maximum sediment production usually occurs during March and April, the months of maximum runoff. This is illustrated by three examples page 235.

l. FUTURE INVESTIGATIONS

It would be of great value if regular observations on suspended sediment transport could continue at a few stations for many years to come. It would be practical to select some representative stations and the following four are suggested.

1.	Rufiji River at Stiegler's Gorge	Station No. 1K3.
2.	Great Ruaha River at Mtera	Station No. 1KA5.
3.	Mbarali River at Igawa	Station No. 1KA11.
4.	Kilombero River at Swero	Station No. 1KB17.

When the number of sampling stations is reduced to four only it would be possible to equip the stations with adequate sampling instruments and collect samples at more frequent intervals than previously done.

In addition, it is most desirable that sampling should be carried out on tributaries not yet investigated. It is especially important that proper sampling should begin on the Luwegu. Where large areas are flooded observations should be made higher up, to assess the amount of sediment removed from catchments.

TABLE X - SUSPENDED SEDIMENT LOAD

River: Rufiji. Station: Stiegler's Gorge. No. 1K3. Catch.Area: 61106 sq.m.

Year	Tons	Concentration % of runoff	Production tons per sq. mile
1955/56			
Nov.	(20 000)	-	0.3
Dec.	(158 000)	-	2.6
Jan.	(465 000)	-	76.1
Feb.	8 973 000	0.158	146.8
Mar.	2 699 000	0.051	44.2
Apr.	9 418 000	0 103	154.1
May.	1 279 000	0.023	20.9
Jun.	387 000	0.014	6.3
Jul.	151 000	0.010	2.5
Aug.	58 000	0.005	0.9
Sep.	29 000	0.004	0.5
Oct.	14 000	0.002	0.2
Total :	27 836 000	0.076	455.5
1956/57			
Nov.	10 000	0.003	0.2
Dec.	125 000	0.025	2.0
Jan.	760 000	0.059	12.4
Feb.	1 111 000	0.047	18.2
Mar.	1 716 000	0.071	28.1
Apr.	3 124 000	0.065	51.1
May.	2 747 000	0.048	45.0
Jun.	417 000	0.016	6.8
Jul.	72 000	0.005	1.2
Aug.	33 000	0.003	0.5
Sep.	18 000	0.002	0.3
Oct.	15 000	0.003	0.2
Total :	10 148 000	0.046	166.1
1957/58			
Nov.	28 000	0.008	0.5
Dec.	165 000	0.030	2.7
Jan.	473 000	0.044	7.7
Feb.	1 289 000	0.074	21.1
Mar.	5 824 000	0.154	95.3
Apr.	4 088 000	0.071	66.9
May.	1 683 000	0.035	27.5
Jun.	250 000	0.012	4.1
Jul.	71 000	0.006	0.2
Aug.	24 000	0.003	0.4
Sep.	38 000	0.007	0.6
Oct.	13 000	0.004	0.2
Total :	13 946 000	0.061	227.2

TABLE X - SUSPENDED SEDIMENT LOAD

River: Rufiji. Station: Stiegler's Gorge. No: 1K3. Catch.Area: 61106 sq.m.

Year	Tons	Concentration % of runoff	Production tons per sq. mile
1958/59			
Nov.	7 000	0.003	-
Dec.	3 059 000	0.321	50.1
Jan.	2 517 000	0.188	41.2
Feb.	3 599 000	0.182	58.9
Mar.	4 786 000	0.132	78.3
Apr.	1 215 000	0.037	19.9
May.	432 000	0.015	7.1
Jun.	121 000	0.009	2.0
Jul.	47 000	0.005	0.8
Aug.	48 000	0.008	0.8
Sep.	12 000	0.003	0.2
Oct.	15 000	0.006	0.2
Total :	15 858 000	0.090	259 .5

TABLE X - SUSPENDED SEDIMENT LOAD

River: Little Ruaha. Station: Iringa. No: 1KA2. Catch. Area: 1127 sq.m.

Year	Tons	Concentration % of runoff	Production tons per sq.mile
1956/57			
Nov.	315	0.002	0.3 (Nov.ass.)
Dec.	1 354	0.005	1.2
Jan.	5 711	0.010	5.1
Feb.	4 617	0.006	4.1
Mar.	1 702	0.003	1.5
Apr.	4 575	0.003	4.1
May.	2 632	0.003	2.3
Jun.	1 840	0.003	1.6
Jul.	276	0.001	0.3
Aug.	1 514	0.004	1.3
Sep.	2 008	0.007	1.8
Oct.	684	0.003	0.6
Total :	27 229	0.004	24.2
1957/58			
Nov.	335	0.002	0.3
Dec.	540	0.002	0.5
Jan.	1 262	0.004	1.1
River: Little Ruaha Station: Ihimbu No.1KA21 Catchm.Area: 957 sq.m			
1957/58			
Feb.	2 251	0.004	2.3
Mar.	2 718	0.002	2.8
Apr.	711	0.001	0.7
May.	1 233	0.002	1.4
Jun.	926	0.002	1.0
Jul.	698	0.002	0.7
Aug.	529	0.002	0.5
Sep.	420	0.002	0.4
Oct.	199	0.001	0.2
Total :		0.002	(12.4)
1958/59			
Nov.	89	0.001	0.1
Dec.	684	0.003	0.7
Jan.	2 156	0.006	2.2
Feb.	3 031	0.007	3.2
Mar.	4 988	0.007	5.2
Apr.	7 657	0.009	8.0
May.	735	0.002	0.8
Jun.	440	0.001	0.5
Jul.	321	0.001	0.3
Aug.	302	0.001	0.3
Sep.	239	0.002	0.2
Oct.	200	0.002	0.2
Total :	20 842	0.005	21.8

TABLE X - SUSPENDED SEDIMENT LOAD

River: Great Ruaha. Station: Kidatu. No. 1KA3. Catch.Area: 30905 sq.m.

Year	Tons	Concentration % of runoff	Production tons per sq. mile
1956/57			
Nov.	1 568	0.004	0.05
Dec.	2 206	0.004	0.1
Jan.	52 340	0.037	1.7
Feb.	382 623	0.052	12.3
Mar.	195 457	0.029	6.3
Apr.	472 580	0.043	15.3
May.	102 243	0.011	3.3
Jun.	42 600	0.011	1.4
Jul.	11 130	0.006	0.4
Aug.	5 140	0.004	0.2
Sep.	2 760	0.004	0.1
Oct.	2 085	0.003	0.1
Total :	1 272 732	0.028	41.2
1957/58			
Nov.	1 538	0.003	0.05
Dec.	1 395	0.003	0.05
Jan.	9 248	0.011	0.3
Feb.	180 919	0.051	5.9
Mar.	265 983	0.040	8.6
Apr.	414 263	0.035	13.4
May.	200 529	0.029	6.5
Jun.	34 933	0.013	1.1
Jul.	11 470	0.008	0.4
Aug.	4 618	0.005	0.2
Sep.	1 827	0.003	0.05
Oct.	907	0.002	-
Total :	1 127 629	0.031	36.5
1958/59			
Nov.	633	0.002	—
Dec.	29 604	0.029	1.0
Jan.	32 916	0.029	1.1
Feb.	56 056	0.038	1.8
Mar.	186 124	0.034	6.0
Apr.	281 952	0.034	9.1
May.	74 296	0.016	2.4
Jun.	16 707	0.008	0.5
Jul.	7 582	0.006	0.2
Aug.	2 260	0.003	0.07
Sep.	1 062	0.002	0.03
Oct.	612	0.001	
Total :	689 804	0.025	22.3

TABLE X - SUSPENDED SEDIMENT LOAD

River: Great Ruaha. Station: Mbuyuni. No. 1KA4. Catch.Area: 28898 sq.m.

Year	Tons	Concentration % of runoff	Production Tons per sq. mile
1956/57			
Nov.	806	0.008	-
Dec.	2 360	0.013	0.1
Jan.	21 705	0.021	0.8
Feb.	217 399	0.034	7.5
Mar.	200 652	0.038	6.9
Apr.	378 856	0.041	13.1
May.	125 665	0.020	4.3
Jun.	36 728	0.015	1.3
Jul.	9 663	0.008	0.3
Aug.	4 594	0.006	0.2
Sep.	2 011	0.005	0.1
Oct.	1 217	0.005	-
Total :	1 001 656	0.030	34.7
1957/58			
Nov.	1 078	0.008	-
Dec.	3 162	0.018	0.1
Jan.	24 695	0.038	0.8
Feb.	101 476	0.030	3,5
Mar.	295 385	0.049	10.2
Apr.	194 637	0.022	6.7
May.	104 745	0.023	3.6
Jun.	28 007	0.017	1.0
Jul.	5 505	0.006	0.2
Aug.	3 064	0.006	0.1
Sep.	1 471	0.005	0.1
Oct.	1 500	0.007	0.1
Total :	764 723	0.028	26.5
1958/59			
Nov.			
Dec.			
Jan.			
Feb.			
Mar.	239 500	0.043	8.3
Apr.	254 040	0.037	8.8
May.	62 754	0.018	2.2
Jun.	17 775	0.014	0.6
Jul.	7 701	0.010	0.3
Aug.	1 967	0.005	0.1
Sep.	927	0.005	-
Oct.	807	0.007	-
Total :	693 552	0.032	(24)

TABLE X - SUSPENDED SEDIMENT LOAD

River: Great Ruaha. Station: Mtera. No: 1KA5. Catch.Area: 26254.

Year	Tons	Concentration % of runoff	Production tons per sq.mile
1956/57			
Nov.	(500)	0.004	-
Dec.	5 751	0.032	0.2
Jan.	49 332	0.042	1.9
Feb.	248 823	0.041	9.5
Mar.	123 652	0.022	4.7
Apr.	287 782	0.034	11.0
May.	52 956	0.009	2.0
Jun.	20 277	0.007	0.8
Jul.	10 799	0.008	0.4
Aug.	3 778	0.006	0.2
Sep.	3 503	0.010	0.1
Oct.	2 257	0.009	0.1
Total :	809 410	0.025	30.9
1957/58			
Nov.	529	0.004	-
Dec.	3 685	0.021	0.1
Jan.	22 453	0.030	0.9
Feb.	100 021	0.030	3.8
Mar.	129 800	0.025	5.0
Apr.	117 674	0.014	4.5
May.	77 303	0.017	2.9
Jun.	29 279	0.017	1.1
Jul.	14 233	0.016	0.5
Aug.	4 271	0.009	0.2
Sep.	2 965	0.010	0.1
Oct.	1 669	0.009	0.1
Total:	503 882	0.020	19.3
1958/59			
Nov.	425	0.005	-
Dec.	51 430	0.059	2.0
Jan.	25 981	0.029	1.0
Feb.	35 740	0.029	1.4
Mar.	170 324	0.032	6.5
Apr.	158 278	0.023	6.0
May.	102 736	0.027	3.9
Jun.	21 886	0.014	0.8
Jul.	10 082	0.013	0.4
Aug.	2 998	0.004	0.1
Sep.	1 045	0.005	-
Oct.	553	0.004	-
Total :	581 478	0.026	22.1

TABLE X - SUSPENDED SEDIMENT LOAD

River: Chimala. Station: Chimala. No: 1KA8. Catch.Area: 328 sq.m.

Year	Tons	Concentration % of runoff	Production tons per sq. mile
1956/57			
Nov.	58	0.003	0.7
Dec.	110	0.005	1.3
Jan.	335	0.004	3.9
Feb.	1 099	0.005	12.9
Mar.	2 931	0.020	34.5
Apr.	2 766	0.007	32.5
May.	231	0.002	2.7
Jun.	21	-	0.2
Jul.	14	-	0.2
Aug.	22	0.001	0.3
Sep.	32	0.002	0.4
Oct.	50	0.003	0.6
Total :	7 669	0.007	90.2
1957/58			
Nov.	102	0.006	1.2
Dec.	156	0.005	1.8
Jan.	462	0.009	5.4
Feb.	639	0.014	7.5
Mar.	1 324	0.007	15.6
Apr.	537	0.004	6.3
May.	193	0.002	2.3
Jun.	20	0.001	0.2
Jul.	30	0.001	0.4
Aug.	56	0.002	0.7
Sep.	55	0.003	0.6
Oct.	30	0.002	0.3
Total :	3 604	0.005	42.4
1958/59			
Nov.	127	0.006	1.5
Dec.	431	0.009	5.0
Jan.	327	0.004	3.8
Feb.	1 077	0.005	12.7
Mar.	3 105	0.007	36.5
Apr.	1 465	0.006	17.2
May.	435	0.004	5.1
Jun.	60	0.001	0.7
Jul.	24	0.001	0.3
Aug.	15	0.001	0.2
Sep.	16	0.001	0.2
Oct.	33	0.002	0.4
Total :	7 115	0.006	83.7

TABLE X - SUSPENDED SEDIMENT LOAD

River: Great Ruaha. Station: Gt.N.Road. N: 1KA8. Catch.Area: 328 sq.m.

Year	Tons	Concentration % of runoff	Production tons per sq. mile
1956/57			
Nov.	49	0.001	0.2
Dec.	126	0.002	0.4
Jan.	4 770	0.018	14.5
Feb.	17 522	0.018	53.4
Mar.	7 016	0.010	21.4
Apr.	21 630	0.015	65.9
May.	1 402	0.003	4.3
Jun.	91	-	0.3
Jul.	38	-	0.1
Aug.	22	-	0.1
Sep.	15	-	-
Oct.	18	-	-
Total :	52 699	0.012	160.7
1957/58			
Nov.	60	0.001	0.2
Dec.	856	0.007	2.6
Jan.	1 802	0.006	5.5
Feb.	18 102	0.032	55.2
Mar.	48 739	0.034	148.6
Apr.	27 742	0.039	84.6
May.	3 728	0.009	11.4
Jun.	183	0.001	0.6
Jul.	115	0.001	0.4
Aug.	86	0.001	0.3
Sep.	66	0.001	0.2
Oct.	34	0.001	0.1
Total :	101 513	0.025	309.5
1958/59			
Nov.	48	0.001	0.2
Dec.	1 194	0.006	3.6
Jan.	12 527	0.035	38.2
Feb.	12 191	0.015	37.2
Mar.	75 141	0.036	229.1
Apr.	11 883	0.016	36.2
May.	682	0.002	2.1
Jun.	149	0.001	0.5
Jul.	128	0.001	0.4
Aug.	140	0.001	0.4
Sep.	178	0.001	0.5
Oct.	182	0.001	0.5
Total :	114 443	0.021	348.9

TABLE X - SUSPENDED SEDIMENT LOAD

River: Kimani. Station: Gt.N.Road. No: 1KA9. Catch.Area: 173 sq. m.

Year	Tons	Concentration % of runoff	Production tons per sq.mile
1956/57			
Nov.	12	0.001	0.1
Dec	21	0.001	0.1
Jan.	107	0.001	0.6
Feb.	4 696	0.008	27.1
Mar.	2 140	0.004	12.4
Apr.	2 289	0.004	13.2
May.	380	0.002	2.2
Jun.	172	0.002	1.0
Jul.	124	0.002	0.7
Aug.	75	0.002	0.4
Sep.	41	0.002	0.2
Oct.	23	0.001	0.1
Total :	10 080	0.004	58.3
1957/58			
Nov.	14	0.001	0.1
Dec.	41	0.001	0.2
Jan.	380	0.003	2.2
Feb.	2 076	0.009	12.0
Mar.	6 838	0.009	39.5
Apr.	4 006	0.009	23.2
May.	395	0.003	2.3
Jun.	773	0.013	4.5
Jul.	750	0.020	4.3
Aug.	438	0.017	2.5
Sep.	196	0.010	1.1
Oct.	9	0.001	0.1
Total :	15 916	0.009	92.0
1958/59			
Nov.	5	0.001	-
Dec.	73	0.002	0.4
Jan.	1 594	0.011	9.2
Feb.	1 038	0.004	6.0
Mar.	60 670	0.071	351.0
Apr.	3 855	0.009	22.3
May.	68	-	0.4
Jun.	28	-	0.2
Jul.	35	0.001	0.2
Aug.	15	-	0.1
Sep.	14	0.001	0.1
Oct.	11	0.001	0.1
Total :	67 405	0.033	390.0

TABLE X - SUSPENDED SEDIMENT LOAD

River: Mbarali. Station: Igawa. No: 1KA11. Catch.Area: 619 sq.m.

Year	Tons	Concentration % of runoff	Production tons per sq.mile
1956/57			
Nov.	53	0.001	0.1
Dec.	669	0.004	1.1
Jan.	2 384	0.006	3.9
Feb.	8 889	0.009	14.4
Mar.	5 451	0.007	8.9
Apr.	13 641	0.011	22.0
May.	1 030	0.002	1.7
Jun.	119	-	0.2
Jul.	42	-	0.1
Aug.	176	0.001	0.3
Sep.	132	0.001	0.2
Oct.	98	0.001	0.2
Total :	32 685	0.006	52.8
1957/58			
Nov.	63	0.001	0.1
Dec.	855	0.004	1.4
Jan.	10 764	0.028	17.4
Feb.	12 987	0.028	21.0
Mar.	40 702	0.033	65.8
Apr.	7 269	0.012	11.7
May.	2 148	0.006	3.5
Jun.	341	0.002	0.6
Jul.	92	0.001	0.1
Aug.	166	0.001	0.3
Sep.	137	0.001	0.2
Oct.	129	0.001	0.2
Total :	75 653	0.018	122.2
1958/59			
Nov.	120	0.001	0.2
Dec.	2 688	0.013	4.3
Jan.	14 074	0.036	22.7
Feb.	7 307	0.019	11.8
Mar.	45 726	0.041	73.9
Apr.	13 579	0.017	21.9
May.	497	0.002	0.8
Juh.	278	0.001	0.4
Jul.	169	0.001	0.3
Aug.	85	0.001	0.1
Sep.	275	0.002	0.4
Oct.	164	0.001	0.3
Total :	84 962	0.021	137.3

TABLE X - SUSPENDED SEDIMENT LOAD

River: Halali. Station: Iyayi. No: 1KA12. Catch.Area: 302 sq.m.

Year	Tons	Concentration % of runoff	Production tons per sq. mile
1957/58			
Nov.	-	-	-
Dec.	(560)	0.025	1.9
Jan.	3 870	0.037	12.8
Feb.	2 157	0.015	7.1
Mar.	13 580	0.027	45.0
Apr.	957	0.005	3.2
May.	370	0.004	1.2
Jun.	54	0.002	0.2
Jul.	7	-	-
Aug.	3	-	-
Sep.	2	-	-
Oct.	1	-	-
Total :	21 561	0.019	71.4
1958/59			
Nov.	1	-	-
Dec.	350	0.024	1.1
Jan.	160	0.012	0.5
Feb.	1 750	0.022	5.8
Mar.	10 562	0.035	35.0
Apr.	5 420	0.021	17.9
May.	295	0.004	1.0
Jun.	64	0.002	0.2
Jul.	3	-	-
Aug.	2	-	-
Sep.	1	-	-
Oct.	5	-	-
Total :	18 613	0.023	61.6

TABLE X - SUSPENDED SEDIMENT LOAD

River: Ndembera. Station: Ilongo. No: 1KA15. Catch.Area: 404 sq. m.

Year	Tons	Concentration % of runoff	Production tons per sq. mile
1956/57			
Nov.	3	0.001	-
Dec.	33	0.006	0.1
Jan.	65	-	0.2
Feb.	160	0.001	0.4
Mar.	114	0.001	0.3
Apr.	182	-	0.5
May.	117	-	0.3
Jun.	76	0.001	0.2
Jul.	34	0.001	0.1
Aug.	17	0.001	-
Sep.	9	0.001	-
Oct.	6	0.001	-
Total :	816	-	2.0
1957/58			
Nov.	3	0.001	-
Dec.	4	0.001	-
Jan.	49	0.001	0.1
Feb.	107	0.001	0.3
Mar.	200	0.001	0.5
Apr.	239	0.001	0.6
May.	98	0.001	0.2
Jun.	29	0.001	0.1
Jul.	17	0.001	-
Aug.	12	0.001	-
Sep.	6	0.001	-
Oct.	-	-	-
Total :	764	0.001	1.9

TABLE X - SUSPENDED SEDIMENT LOAD

River: Mbarali. Station: Rujewa. No: 1KA19. Catch.Area: 762 sq.m.

Year	Tons	Concentration % of runoff	Production tons per sq.mile
1958/59			
Nov.	(210)	0.002	0.3
Dec.	(5 524)	0.023	7.2
Jan.	47 043	0.103	61.7
Feb.	15 912	0.037	20.9
Mar.	75 329	0.057	98.9
Apr.	60 804	0.065	79.8
May.	2 648	0.008	3.5
Jun.	1 112	0.005	1.5
Jul.	593	0.003	0.8
Aug.	624	0.004	0.8
Sep.	451	0.004	0.6
Oct.	422	0.004	0.6
Total :	210 672	0.045	276.5

River: Njombe Station: Ifumba No:1KA29 Catchm.Area: 5438 sq.m

1957/58			
Nov.	-	-	-
Dec.	-	-	-
Jan.	-	-	-
Feb.	4 213	0.005	0.8
Mar.	7 117	0.008	1.3
Apr.	3 433	0.015	0.6
May.	302	0.002	-
Jun.	8	0.009	-
Jul.	-	-	-
Aug.	-	-	-
Sep.	-	-	-
Oct.	-	-	-

TABLE X - SUSPENDED SEDIMENT LOAD

River: Lukosi. Station: Mtandika. No: 1KA37. Catch.Area: 1117 sq.m.

Year	Tons	Concentration % of runoff	Production tons per sq.mile
1956/57			
Nov.	-	-	-
Dec.	-	-	-
Jan.	-	-	-
Feb.	-	-	-
Mar.	-	-	-
Apr.	-	-	-
May.	-	-	-
Jun.	-	-	-
Jul.	-	-	-
Aug.	1 061	0.003	0.9
Sep.	831	0.002	0.7
Oct.	527	0.002	0.5
Total :			
1957/58			
Nov.	201	0.001	0.2
Dec.	1 453	0.004	1.3
Jan.	5 592	0.017	5.0
Feb.	4 982	0.011	4.5
Mar.	23 581	0.028	21.1
Apr.	28 780	0.023	25.8
May.	9 097	0.011	8.1
Jun.	1 144	0.002	1.0
Jul.	759	0.002	0.7
Aug.	752	0.002	0.7
Sep.	1 100	0.003	1.0
Oct.	762	0.002	0.7
Total :	78 200	0.013	70.0
1958/59			
Nov.	980	0.003	0.9
Dec.	4 838	0.011	4.3
Jan.	2 579	0.007	2.3
Feb.	3 348	0.008	3.0
Mar.	6 465	0.012	5.8
Apr.	5 962	0.011	5.3
May.	3 777	0.008	3.4
Jun.	815	0.003	0.7
Jul.	961	0.003	0.9
Aug.	730	0.003	0.6
Sep.	339	0.001	0.3
Oct.	493	0.002	0.4
Total :	31 287	0.007	28.0

TABLE X - SUSPENDED SEDIMENT LOAD

River: Kisigo. Station: Kinunguru. No: 1KA42. Catch.Area: 9476 sq.m.

Year	Tons	Concentration % of runoff	Production tons per sq. mile
1957/58			
Nov.	-	-	-
Dec.	-	-	-
Jan.	-	-	-
Feb.	-	-	-
Mar.	64 741	0.041	6.8
Apr.	4 645	0.016	0.5
May.	4 614	0.024	0.5
Jun.	-	-	-
Jul.	-	-	-
Aug.	-	-	-
Sep.	-	-	-
Oct.	-	-	-
Total :			
1958/59			
Nov.	-	-	-
Dec.	-	-	-
Jan.	4 514	0.020	0.5
Feb.	1 875	0.012	0.2
Mar.	46 105	0.028	4.9
Apr.	13 458	0.031	1.4
May.	-	-	-
Jun.	-	-	-
Jul.	-	-	-
Aug.	-	-	-
Sep.	-	-	-
Oct.	-	-	-
Total :			

TABLE X - SUSPENDED SEDIMENT LOAD

River: Njombe. Station: Isanga. No: 1KA43. Catch.Area: 1457 sq.m.

Year	Tons	Concentration % of runoff	Production tons per sq. mile
1957/58			
Nov.	-	-	-
Dec.	-	-	-
Jan.	-	-	-
Feb.	34	0.012	-
Mar.	292	0.001	0.2
Apr.	66	0.001	-
May.	36	0.005	-
Jun.	1.5	0.014	-
Jul.	-	-	-
Aug.	-	-	-
Sep.	-	-	-
Oct.	-	-	-
Total :	429	0.001	0.3
1958/59			
Nov.	-	-	-
Dec.	11	0.007	-
Jan.	9	0.003	-
Feb.	84	0.011	0.1
Mar.	3 933	0.009	2.7
Apr.	163	0.002	0.1
May.	9	0.004	-
Jun.	-	-	-
Jul.	-	-	-
Aug.	-	-	-
Sep.	-	-	-
Oct.	-	-	-
Total :	4 209	0.008	2.9

TABLE X - SUSPENDED SEDIMENT LOAD

River: Kilombero. Station: Ifakara. No: 1KB2. Catch.Area: 12063 sq.m.

Year	Tons	Concentration % of runoff	Production tons per sq.mile
1956/57			
Nov.	15 804	0.004	1.3
Dec.	11 542	0.003	1.0
Jan.	29 688	0.005	2.5
Feb.	20 261	0.003	1.7
Mar.	16 578	0.002	1.4
Apr.	54 184	0.002	4.5
May.	46 206	0.001	3.8
Jun.	34 956	0.002	2.9
Jul.	20 700	0.003	1.7
Aug.	21 148	0.003	1.7
Sep.	18 488	0.004	1.5
Oct.	14 436	0.003	1.2
Total :	303 991	0.002	25.2
1957/58			
Nov.	17 513	0.005	1.5
Dec.	25 999	0.007	2.2
Jan.	32 037	0.006	2.6
Feb.	28 197	0.005	2.3
Mar.	13 669	0.001	1.1
Apr.	25 092	0.001	2.1
May.	17 841	-	1.5
Jun.	12 925	0.001	1.0
Jul.	23 034	0.003	1.9
Aug.	22 488	0.004	1.9
Sep.	19 927	0.004	1.7
Oct.	21 934	0.005	1.8
Total :	260 656	0.002	21.6
1958/59			
Nov.	16 755	0.005	1.4
Dec.	14 537	0.004	1.2
Jan.	18 776	0.003	1.6
Feb.	31 998	0.004	2.7
Mar.	54 097	0.005	4.5
Apr.	69 339	0.005	5.7
May.	74 822	0.005	6.2
Jun.	38 736	0.007	3.2
Jul.	30 919	0.007	2.6
Aug.	25 030	0.006	2.1
Sep.	15 592	0.005	1.3
Oct.	8 560	0.003	0.7
Total :	399 161	0.005	33.1

TABLE X - SUSPENDED SEDIMENT LOAD

River: Lumemo. Station: Ifakara. No: 1KB3. Catch.Area: 165 sq.m.

Year	Tons	Concentration % of runoff	Production tons per sq.mile
1956/57			
Nov.	184	0.002	1.1
Dec.	2 960	0.026	17.9
Jan.	11 757	0.049	71.3
Feb.	2 877	0.016	17.4
Mar.	2 227	1.010	13.5
Apr.	27 965	0.032	169.5
May.	7 279	0.000	44.1
Jun.	1 612	0.004	9.8
Jul.	974	0.003	5.9
Aug.	422	0.002	2.6
Sep.	1 913	0.014	11.6
Oct.	444	0.003	2.7
Total :	60 614	0.016	367.4
1957/58			
Nov.	240	0.002	1.5
Dec.	258	0.002	1.6
Jan.	332	0.003	2.0
Feb.	1 296	0.012	7.9
Mar.	6 018	0.012	36.5
Apr.	18 039	0.017	109.3
May.	4 262	0.006	25.8
Jun.	1 640	0.007	9.9
Jul.	679	0.003	4.1
Aug.	297	0.002	1.8
Sep.	315	0.003	1.9
Oct.	83	0.001	0.5
Total :	33 459	0.009	202.8

TABLE X - SUSPENDED SEDIMENT LOAD

River: Kilombero. Station: Ifwema. No: 1KB4. Catch.Area: 7048 sq.m.

Year	Tons	Concentration % of runoff	Production tons per sq. mile
1956/57			
Nov.	6 703	0.003	1.0
Dec.	30 156	0.009	4.3
Jan.	108 229	0.018	15.4
Feb.	116 648	0.014	16.6
Mar.	71 432	0.009	10.1
Apr.	216 302	0.016	30.7
May.	(98 213)	0.010	13.9
Jun.	(55 621)	0.009	7.9
Jul.	(46 285)	0.009	6.6
Aug.	(36 150)	0.009	5.1
Sep.	20 523	0.006	2.9
Oct.	17 616	0.005	2.5
Total :	823 869	0.011	116.9
1957/58			
Nov.	(11 003)	0.005	1.6
Dec.	(55 078)	0.013	7.8
Jan.	(82 323)	0.014	11.7
Feb.	89 870	0.016	12.8
Mar.	66 576	0.007	9.4
Apr.	97 062	0.008	13.8
May.	78 349	0.008	11.1
Jun.	54 943	0.010	7.8
Jul.	.35 804	0.009	5.1
Aug.	20 108	0.006	2.9
Sep.	18 426	0.007	2.6
Oct.	11 139	0.003	1.6
Total:	620 681	0.009	88.1
1958/59			
Nov.	13 133	0.006	1.9
Dec.	119 285	0.029	16.9
Jan.	111 388	0.021	15.8
Feb.	144 716	0.029	20.5
Mar.	245 940	0.027	34.9
Apr.	129 304	0.015	18.3
May.	59 346	0.009	8.5
Jun.	10 843	0.003	1.5
Jul.	30 080	0.010	4.2
Aug.	28 537	0.011	4.1
Sep.	20 376	0.010	2.9
Oct.	14 585	0.007	2.0
Total:	927 533	0.017	131.6

TABLE X - SUSPENDED SEDIMENT LOAD

River: Luhombero. Station: Ilonga. No: 1KB5. Catch.Area: 395 sq.m.

Year	Tons	Concentration % of runoff	Production tons per sq.mile
1957/58			
Nov.	647	0.008	1.6
Dec.	1 627	0.016	4.1
Jan.	1 813	0.017	4.6
Feb.	10 640	0.037	26.9
Mar.	13 253	0.036	33.6
Apr.	30 495	0.039	77.2
May.	20 420	0.036	51.7
June.	3 677	0.020	9.3
July.	253	0.002	0.6
Aug.	477	0.005	1.2
Sep.	255	0.004	0.6
Oct.	184	0.004	0.5
Total :	83 741	0.014	212.0
1958/59			
Nov.	83	0.002	0.2
Dec.	4 641	0.054	11.7
Jan.	24 234	0.126	61.4
Feb.	17 466	0.105	44.2
Mar.	8 827	0.029	22.3
Apr.	8 045	0.055	20.4
May.	2 180	0.018	5.5
June.	497	0.007	1.3
July.	187	0.003	0.5
Aug.	124	0.003	0.3
Sep.	60	0.002	0.1
Oct.	32	0.002	0.1
Total :	66 376	0.015	168 .0

TABLE X - SUSPENDED SEDIMENT LOAD

River: Kigogo-Ruaha. Station: Frick's Bridge. No: 1KB6. Catch.Area:511 sq.m.

Year	Tons	Concentration % of runoff	Production tons per sq. mile
1957/58			
Nov.	(209)	0.003	0.4
Dec.	(188)	0.003	0.4
Jan.	(800)	0.003	1.6
Feb.	637	0.001	1.2
Mar.	777	0.001	1.5
Apr.	1 389	0.001	2.7
May.	948	0.001	1.8
Jun.	548	0.002	1.1
Jul.	544	0.002	1.1
Aug.	455	0.002	0.9
Sep.	460	0.003	0.9
Oct.	321	0.003	0.6
Total:	7 278	0.002	14.2
1958/59			
Nov.	362	0.004	0.7
Dec.	624	0.003	1.2
Jan.	547	0.0025	1.1
Feb.	462	0.0015	0.9
Mar.	1 182	0.002	2.3
Apr.	1 314	0.002	2.6
May.	728	0.002	1.4
Jun.	393	0.002	0.8
Jul.	293	0.002	0.6
Aug.	324	0.003	0.6
Sep.	224	0.002	0.4
Oct.	208	0.003	0.4
Total :	6 661	0.002	13.0
River: Fuagi Station: Idege No:1KB7 Catchm.Area: 24 sq.m			
1956/57			
Nov.	10	0.001	0.4
Dec.	26	0.002	1.1
Jan.	74	0.002	3.1
Feb.	35	0.001	1.4
Mar.	-	-	(4.0)
Apr.	-	-	(9.0)
May.	76	0.003	3.2
Jun.	40	0.002	1.7
Jul.	38	0.002	1.6
Aug.	31	0.002	1.3
Sep.	24	0.002	1.0
Oct.	14	0.001	0.6
Total	(682)	0.002	(28.4)

TABLE X - SUSPENDED SEDIMENT LOAD

River: Mpanga. Station: Mpanga. No: 1KB8. Catch. Area: 937 sq.m.

Year	Tons	Concentration % of runoff	Production tons per sq. mile
1958/59			
Nov.	380	0.001	0.4
Dec.	8 983	0.011	9.6
Jan.	16 016	0.021	17.1
Feb.	7 688	0.010	8.2
Mar.	16 482	0.014	17.6
Apr.	16 886	0.014	18.0
May.	4 712	0.005	5.0
Jun.	1 379	0.002	1.5
Jul.	1 171	0.002	1.2
Aug.	1 008	0.002	1.1
Sep.	640	0.001	0.7
Oct.	534	0.001	0.5
Total:	74 871	0.009	79.9

River: Mnyera Station: Taveta No: 1KB9 Catchm.Area: 1950 sq.m

1958/59			
Nov.	1 592	0.002	0.8
Dec.	14 172	0.011	7.3
Jan.	13 767	0.009	7.1
Feb.	30 569	0.017	15.7
Mar.	74 198	0.025	38.1
Apr.	25 630	0.010	13.1
May.	11 115	0.007	5.7
Jun.	3 167	0.003	1.6
Jul.	3 476	0.004	1.8
Aug.	3 779	0.004	1.9
Sep.	2 412	0.003	1.2
Oct.	2 784	0.004	1.4
Total:	186 661	0.011	95.7

River: Ruhuji Station: Mwayamalungu No: 1KB10 Catchm.Area: 3294 sq.m

1958/59			
Nov.	6 331	0.007	1.9
Dec.	71 335	0.039	21.6
Jan.	119 294	0.043	36.2
Feb.	62 107	0.025	18.8
Mar.	224 205	0.048	68.1
Apr.	155 117	0.039	47.1
May.	33 016	0.014	10.0
Jun.	11 864	0.008	3.6
Jul.	7 316	0.007	2.2
Aug.	6 408	0.007	1.9
Sep.	4 490	0.006	1.4
Oct.	5 418	0.007	1.6
Total:	706 901	0.029	214.6

TABLE X - SUSPENDED SEDIMENT LOAD

River: Furua. Station: Malinyi. No: 1KB16. Catch.Area: 507 sq.m.

Year	Tons	Concentration % of runoff	Production tons per sq. mile
1957/58			
Nov.	(235	0.002	0.5
Dec.	(7 000)	0.032	13.8
Jan.	11 611	0.045	22.9
Feb.	27 413	0.057	54.1
Mar.	153 080	0.105	301.9
Apr.	161 014	0.088	317.6
May.	48 790	0.039	96.2
Jun.	3 051	0.006	6.0
Jul.	970	0.003	1.9
Aug.	634	0.003	1.2
Sep.	346	0.002	0.7
Oct.	220	0.002	0.4
Total :	414 364	0.060	817.3
1958/59			
Nov.	293	0.003	0.6
Dec.	63 866	0.297	126.0
Jan.	128 890	0.188	254.2
Feb.	111 280	0.172	219.4
Mar.	122 943	0.118	242.5
Apr.	15 455	0.021	30.5
May.	8 868	0.018	17.5
Jun.	2 584	0.011	5.1
Jul.	775	0.004	1.5
Aug.	646	0.005	1.3
Sep.	350	0.004	0.7
Oct.	296	0.004	0.6
Total :	456 246	0.091	899.9

TABLE X - SUSPENDED SEDIMENT LOAD

River: Kilombero. Station: Swero. No: 1KB17. Catch.Area: 12915 sq.m.

Year	Tons	Concentration % of runoff	Production tons per sq. mile
1957/58			
Nov.	(12 000)	0.004	0.9
Dec.	14 054	0.003	1.2
Jan.	21 418	0.003	1.7
Feb.	25 245	0.004	2.0
Mar.	45 409	0.003	3.5
Apr.	165 556	0.004	12.8
May.	105 895	0.002	8.2
Jun.	49 501	0.003	3.9
Jul.	30 045	0.004	2.3
Aug.	22 078	0.004	1.7
Sep.	17 052	0.004	1.3
Oct.	12 493	0.003	0.9
Total :	520 746	0.004	40.3
1958/59			
Nov.	11 186	0.004	0.8
Dec.	13 514	0.004	1.0
Jan.	37 494	0.005	2.9
Feb.	27 573	0.004	2.3
Mar.	44 529	0.004	3.4
Apr.	54 989	0.004	4.3
May.	42 104	0.003	3.3
Jun.	25 088	0.004	1.9
Jul.	16 410	0.004	1.3
Aug.	11 784	0.003	0.9
Sep.	13 710	0.004	1.1
Oct.	13 054	0.005	1.0
Total :	311 435	0.004	24.1

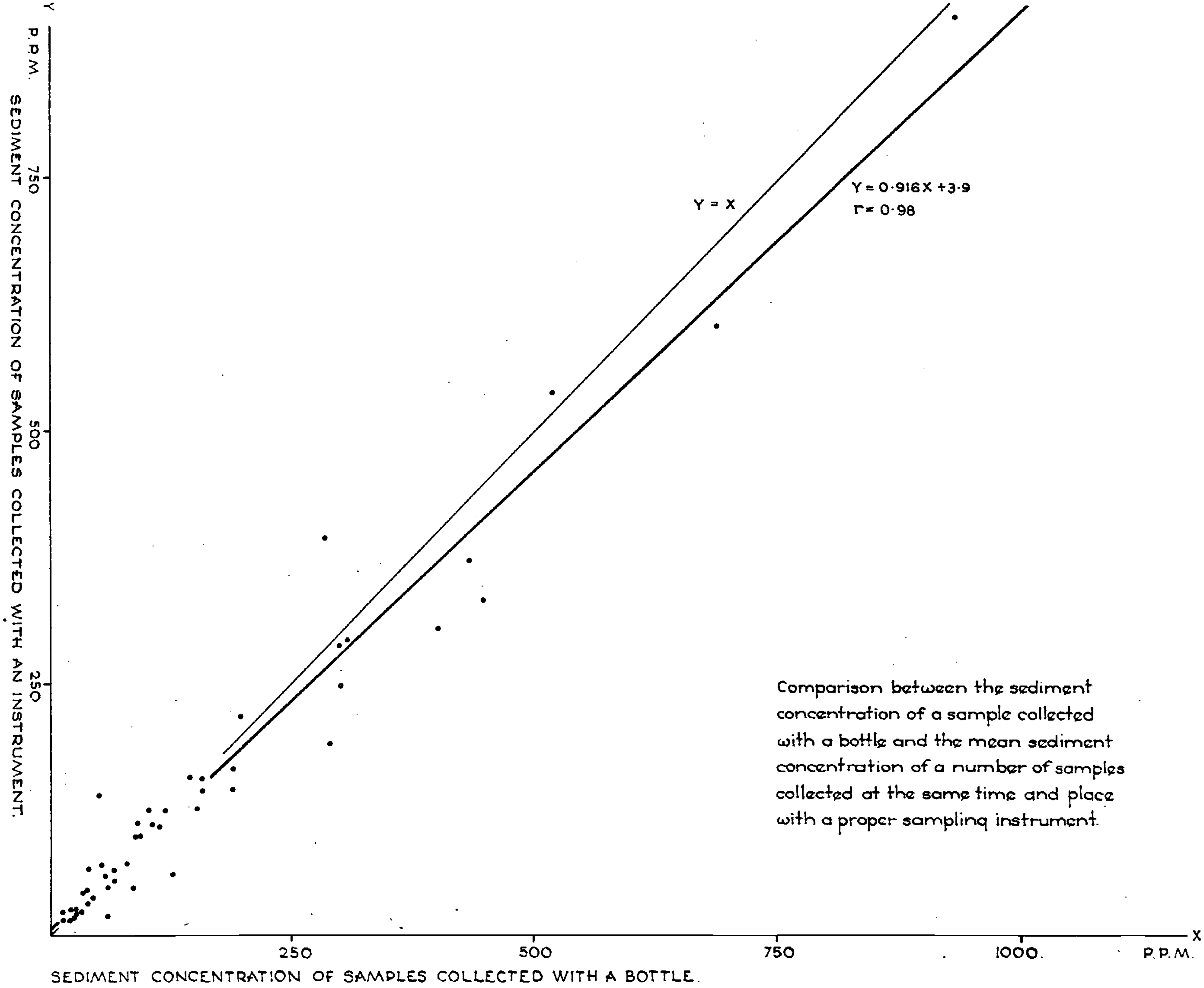
TABLE X1 - MAXIMUM AND MINIMUM SUSPENDED SEDIMENT OBSERVED AT EACH STATION

River	Station	No.	Suspended Sediment in milligram per litre	
			Maximum	Minimum
Chimala	Chimala	1KA7	1770	trace[x]
Kimani	Gt. N.Road	1KA9	354	trace
Mbarali	Igawa	1KA11	898	trace
Mbarali	Rujewa Farm +	1KA19	1028	23
Halali	Iyayi	1KA12	926	11
Gt.Ruaha	Gt. N.Road	1KA8	680	trace
Ndembera	Ilongo	1KA15	45	trace
Little Ruaha	Ihimbu	1KA21	160	trace
Kisigo	Kinunguru	1KA42	630	trace
Gt. Ruaha	Mtera	1KA5	1130	trace
Gt. Ruaha	Mbuyuni	1KA4	711	12
Gt. Ruaha	Kidatu	1KA3	847	trace
Lukosi	Mtandika	1KA37	426	trace
Kigogo-Ruaha	Frick's Bridge	1KB6	69	trace
Mnyera	Taveta +	1KB9	708	22
Ruhuji	Mwayamalungu +	1KB10	1268	40
Mpanga	Mpanga +	1KB8	444	11
Kilombero	Ifwema	1KB4	442	trace
Furua	Malinyi	1KB16	3002	13
Lumemo	Ifakara	1KB3	1174	trace
Kilombero	Ifakara	1KB2	240	trace
Kilombero	Swero	1KB17	94	trace
Luhombero	Ilongo	1KB5	1634	trace
Rufiji	Stiegler's Gorge	1K3	5900	trace

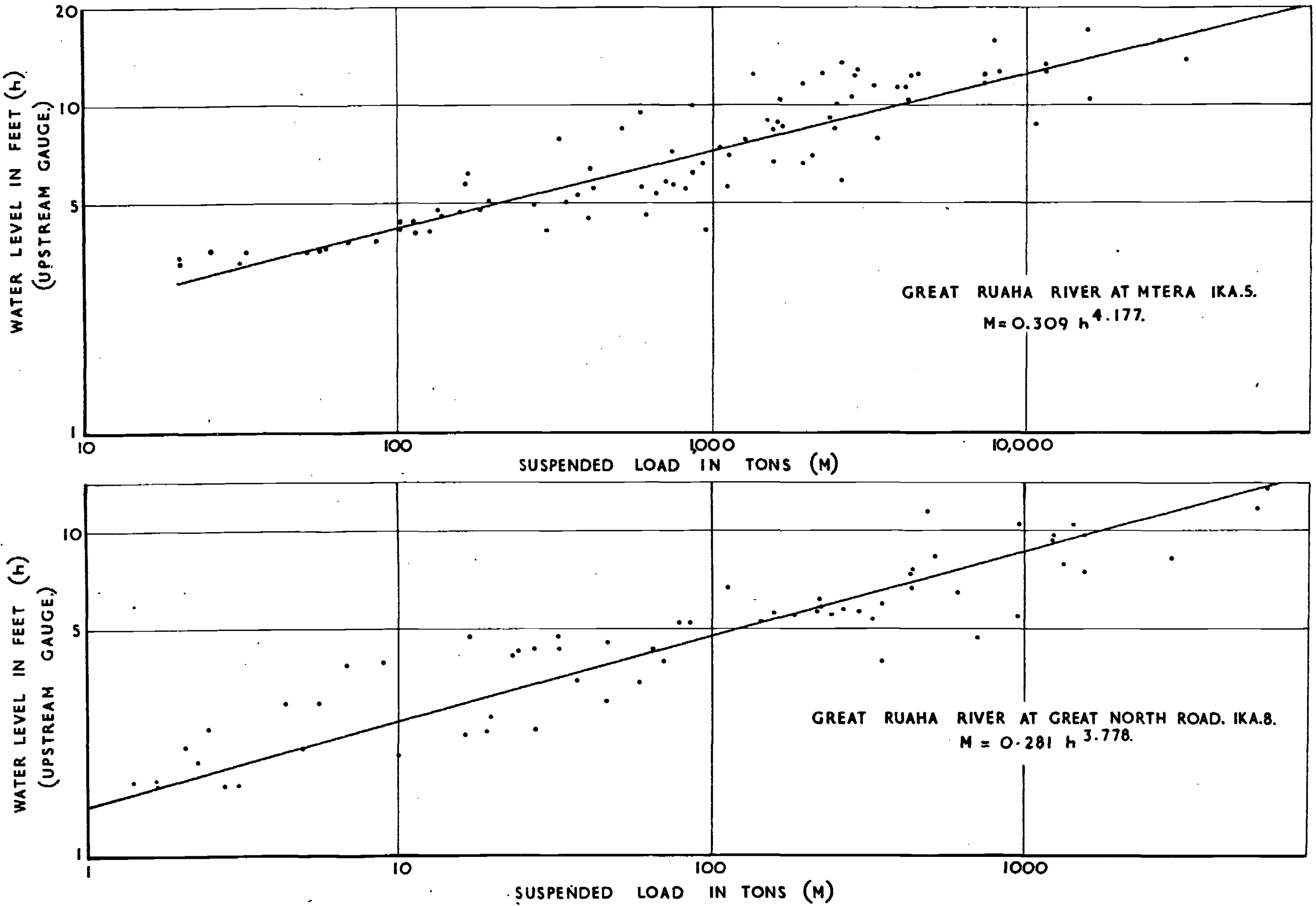
x trace: less than 10 milligram per litre.
+ Stations with one year of observation only.

TABLE XII - SUSPENDED SEDIMENT CONCENTRATION AND PRODUCTION

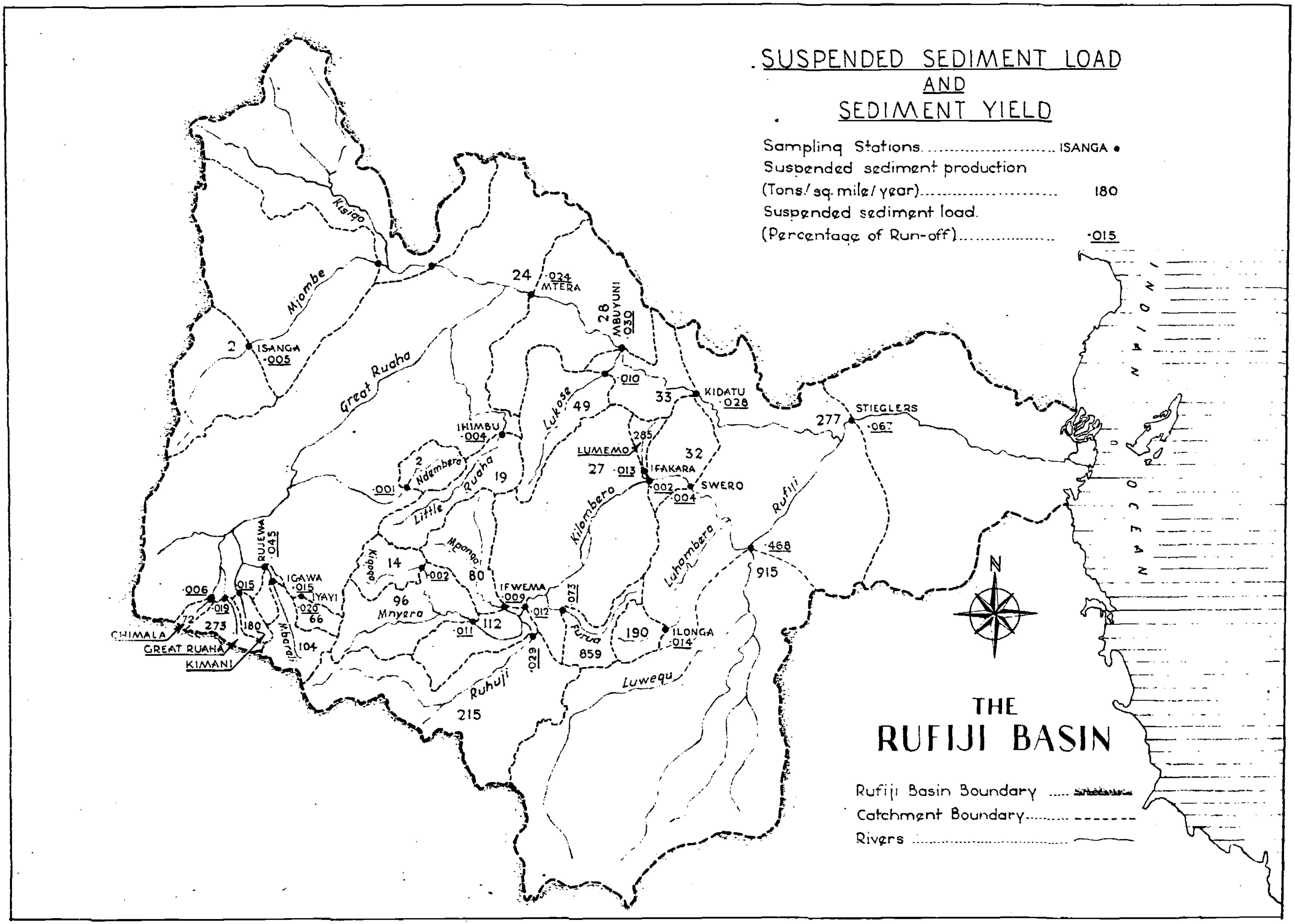
No.	Station	1955/56.		1956/57.		1957/58.		1958/59.		Average	
		%	Prod.	%	Prod.	%	Prod.	%	Prod.	%	Prod.
1K3	Rufiji at Stiegler's Gorge	0.076	455.5	0.046	166.1	0.061	227.2	0.090	259.5	0.067	277.1
1KA2	Little Ruaha at Iringa-Ihimbu			0.004	24.2	0.002	12.4	0.005	21.8	0.004	19.5
1KA3	Great Ruaha at Kidatu			0.028	41.2	0.031	36.5	0.025	22.3	0.028	33.3
1KA4	Great Ruaha at Mbuyuni			0.030	34.7	0.028	26.5		(24)	0.029	28.4
1KA5	Great Ruaha at Mtera			0.025	30.9	0.020	19.3	0.026	22.1	0.024	24.1
1KA7	Chimala at Chimala			0.007	90.2	0.005	42.4	0.006	83.7	0.006	72.1
1KA8	Gt.Ruaha at Great North Road			0.012	160.7	0.025	309.5	0.021	348.9	0.019	273.0
1KA9	Kimani at Great North Road			0.004	58.3	0.009	92.0	0.033	390.0	0.015	180.1
1KA11	Mbarali at Igawa			0.006	52.8	0.018	122.2	0.021	137.3	0.015	104.1
1KA12	Halali at Iyaya D/S					0.019	71.4	0.023	61.6	0.020	66.5
1KA15	Ndembera at Ilongo			0.001	2.0	0.001	1.9			0.001	2.0
1KA19	Mbarali at Rujewa Farm							0.045	276.5		
1KA37	Lukosi at Mtandika					0.013	70.0	0.007	28.0	0.010	49.0
1KA43	Njombe at Isanga					0.001	0.3	0.008	2.9	0.005	1.6
1KB2	Kilombero at Ifakara			0.002	25.2	0.002	21.6	0.005	33.1	0.003	26.6
1KB3	Lumemo at Ifakara			0.016	367.4	0.009	202.8			0.013	285.1
1KB4	Kilombero at Ifwema			0.011	116.9	0.009	88.1	0.017	131.6	0.012	112.1
1KB5	Luhombero at Ilonga					0.014	212.0	0.015	168.0	0.014	190.0
1KB6	Kigogo-Ruaha at Frick's Bridge					0.002	14.2	0.002	13.0	0.002	13.6
1KB7	Fuagi at Idege			0.002	28.4						
1KB8	Mpanga at Mpanga Mission							0.009	79.9		
1KB9	Mnyera at Taveta							0.011	95.7		
1KB10	Ruhuji at Mwayamalungu							0.029	214.6		
1KB16	Furua at Malinyi					0.060	817.3	0.091	899.9	0.073	858.6
1KB17	Kilombero at Swero					0.004	40.3	0.004	24.1	0.004	32.2

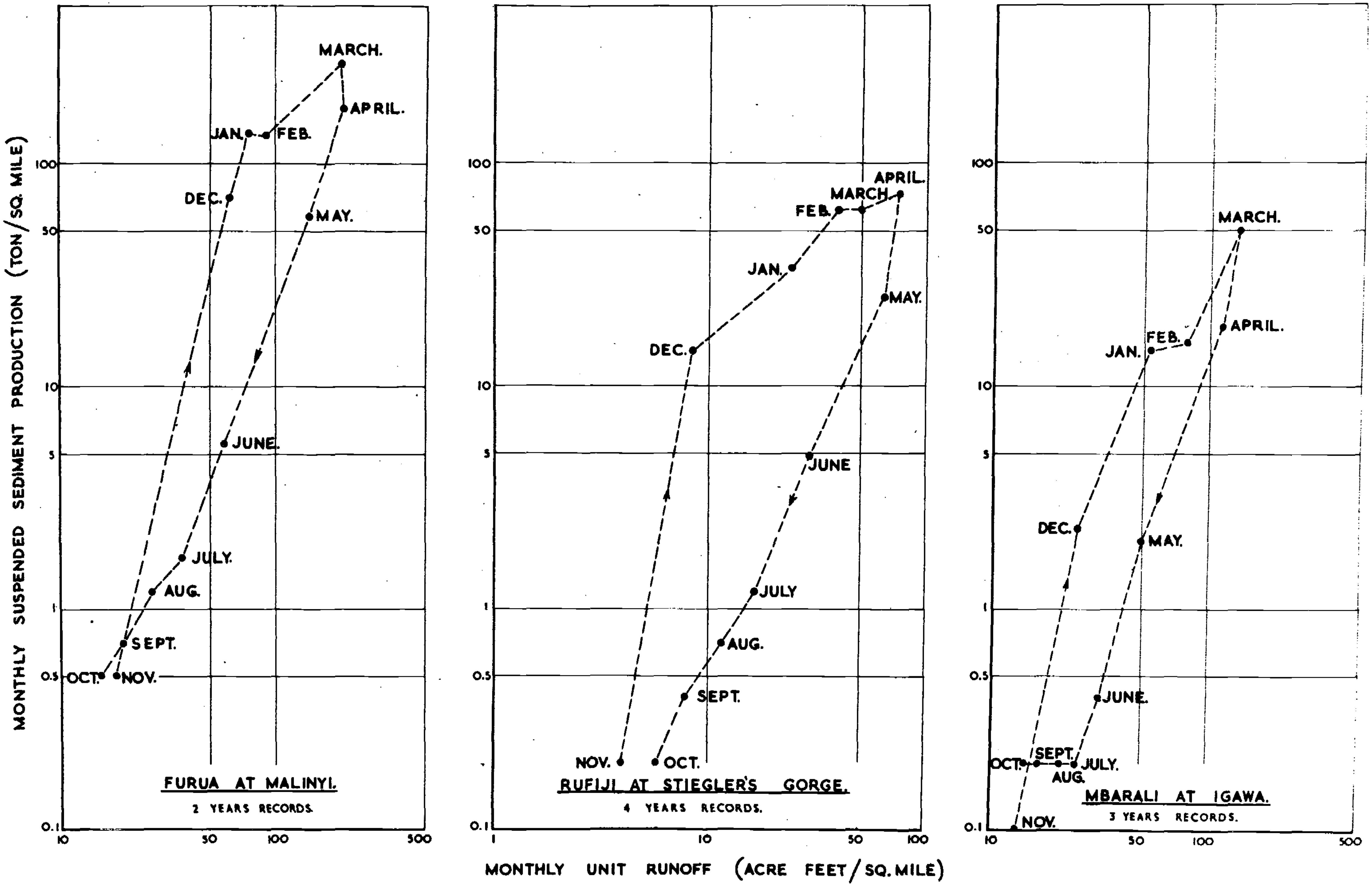


Comparison between the sediment concentration of a sample collected with a bottle and the mean sediment concentration of a number of samples collected at the same time and place with a proper sampling instrument.

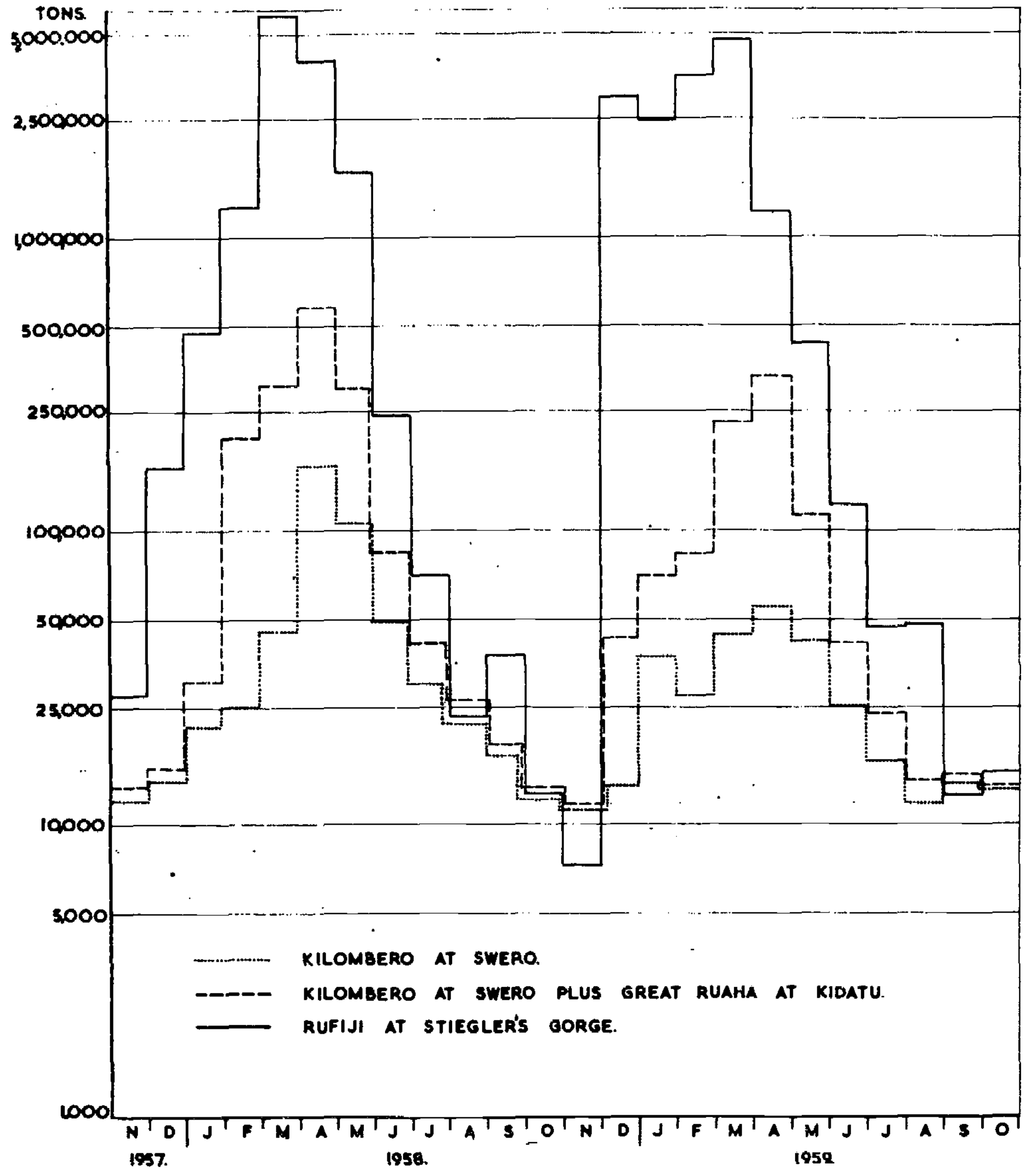


SUSPENDED SEDIMENT LOAD — WATER LEVEL RELATION GRAPHS

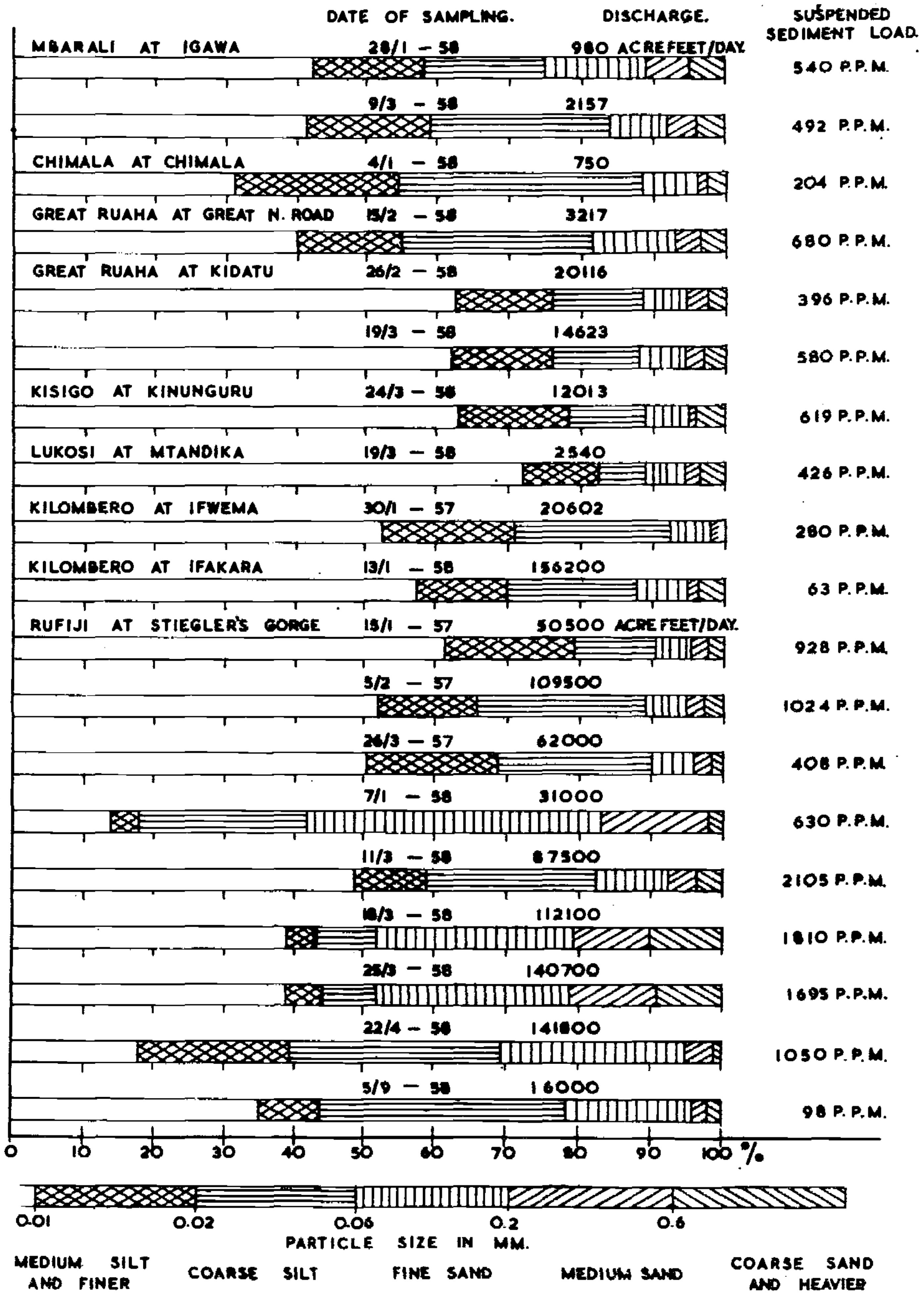

SUSPENDED SEDIMENT LOAD
AND
SEDIMENT YIELD
Sampling Stations ISANGA ●
Suspended sediment production
(Tons/sq. mile/year) 180
Suspended sediment load.
(Percentage of Run-off) ·015
THE
RUFIJI BASIN
Rufiji Basin Boundary
Catchment Boundary
Rivers
N
INDIAN
OCEAN
Kisigo
Mjombe
Great Ruaha
2
ISANGA
·005
24
·024
MTERA
28
MBUYUNI
·030
·010
49
Lukose
33
KIDATU
·028
277
STIEGLERS
·067
IHIMBU
·004
2
Ndembera
19
Little Ruaha
·001
285
LUMEMO
27
·013
IFAKARA
·002
32
SWERO
·004
Kilombero
Rufiji
Luhombero
·468
915
RUJEWA
·045
·006
·015
·019
IGAWA
·015
IYAYI
·020
66
72
273
180
104
CHIMALA
GREAT RUAHA
KIMANI
Mbarali
Kigogo
14
·002
Mpanga
80
96
Mnyera
IFWEMA
·009
·073
·012
·011
112
·029
Furua
859
190
ILONGA
·014
Luwegu
Ruhuji
215



MONTHLY AVERAGES OF SUSPENDED SEDIMENT PRODUCTION AND UNIT RUN OFF, ILLUSTRATING THE DIFFERENCE IN SUSPENDED SEDIMENT CONTENT IN DRY AND WET SEASONS.



MONTHLY SUSPENDED SEDIMENT LOAD (IN TONS) OF THE KILOMBERO, GREAT RUAHA AND RUFIJI RIVERS INDICATING THE SUSPENDED SEDIMENT LOAD OF LUWEGU-RUFIJI RIVER SYSTEM.



GRAIN SIZE DISTRIBUTION OF SUSPENDED SEDIMENT SAMPLES.

12. THE QUALITY OF RIVER WATER

BY S. RAADSMA

a. INTRODUCTION

A number of water samples have been chemically analysed. This was done to test the suitability of the river waters for irrigation. All analysing work was carried out by the Government Chemical Laboratory, Dar es Salaam. Altogether 326 samples have undergone chemical analyses for irrigation purposes and 21 samples have been qualitatively and quantitatively analysed.

b. SAMPLING AND ANALYSING

The name and location of sampling stations and the period covered by sampling are listed in the Schedule of Gauging Stations. The method of sampling is explained in the previous chapter.

While sample bottles of one pint capacity were found sufficient for suspended sediment analyses a double quantity had to be collected to facilitate the necessary chemical analyses. As the consistency of the water did not vary to a great extent, monthly analyses were originally found sufficient and, after an initial period of sampling, this number was reduced even further, to five or four a year. Care was taken that these samples covered a wide range of river flow. Thus by reducing the number of samples per year it was possible to commence sampling for this purpose at other stations and at the same time keep the whole task within the laboratory facilities available.

c. WATER QUALITIES

Irrigation water can be classified according to four main characteristics:

1. The total concentration of soluble salts in the water as expressed by the electrical conductivity and indicating the salinity hazard.
2. The concentration of sodium and the relative proportion of sodium to other cations expressed by the sodium adsorbtion ratio (SAR) and indicating the sodium alkali hazard.
3. The concentration of bicarbonates and carbonates as expressed by the residual sodium carbonate (RSC).
4. The ion concentrations which are found to be possibly toxic to plants, especially the boron concentration.

Apart from these four characteristics the pH was tested regularly and the surface water temperature was taken as a matter of routine, at the time of sampling. A qualitative and quantitative analyses of the water has been carried out once or twice during the sampling period for most of the rivers. The results of these, as well as bacteriological examinations, will indicate the suitability of water for domestic purposes.

d. THE ELECTRICAL CONDUCTIVITY

For the purpose of classification of irrigation water, the total concentration of soluble salts can be readily expressed by the electrical conductivity as follows: (7)

Class C_1,	Water with an electrical conductivity (at 25° C) between 0 and 250 micromhos/cm. Low salinity water suited for irrigation of nearly all crops on most soils.
Class C_2,	Water with an electrical conductivity (at 25° C) between 250 and 750 micromhos/cm.; Moderate salinity water which can be used for irrigation of all but salt sensitive plants.
Class C_3,	Water with an electrical conductivity (at 25° C) between 750 and 2250 micromhos/cm. Medium to high salinity water to be used only on soils of moderate and good permeability-salinity control of soil may be required and plants with good salt tollerance should be selected.
Class C_4,	Water with an electrical conductivity (at 25° C) between 2250 and 4000 micromhos/cm. High to very high salinity water which generally should not be used except for irrigation of soils with good permeability and under provision of leaching. Only very salt-tolerant crops should be grown.

The electrical conductivity is shown graphically on page 254 to 276. As will be seen, it is very low for all observed rivers and well within the C_1 limit. The salinity hazard is therefore very low and in this respect the water can safely be used for irrigation.

In the larger rivers the electrical conductivity tends to increase in the downstream direction. This can be observed on the Kilombero (page 253) from Ifwema to Ifakara and it is believed that this increase is caused by evaporation and also by return of water from flooded areas.

Analyses from the Great Ruaha (page 253)show partly the same result. There is an increase of about 100% in salt concentration from the head-waters at Chimala down to Mtera. The area at and above Mtera is very dry, large swamps retain flood water, therefore the evaporation rate is high. At Mbuyuni, further downstream, no great changes are apparent in salinity. There must be some balancing effect from inflowing water resulting in the electrical conductivity remaining about the same as at Mtera. At Kidatu, however, the electrical conductivity shows a great drop, which undoubtedly is caused by the mountain streams joining the main river between Mbuyuni and Kidatu. The records from the Lukosi River will indicate this and the following tabulation will explain the conditions:-

Electrical Conductivity, micromhos/cm.

Period	GREAT RUAHA				LUKOSI
	Chimala	Mtera	Mbuyuni	Kidatu	Mtandika
Nov. 56 to Feb. 57	64	127	164	103	62
Mar. 57 to Jun. 57	45	137	124	113	60
Jul. 57 to Oct. 57	59	137	157	98	47
Nov. 57 to Feb. 58	73	147	139	113	65
Mar. 58 to Jun. 58	67	142	135	119	67
Jul. 58 to Oct. 58	68	125	150	101	52

At Stiegler's Gorge the electrical conductivity is about the same as at Kidatu but much higher than that of the Kilombero. Taking into consideration the fact that the Kilombero carries much more water than the Great Ruaha, there is an indication of a general rise in the electrical conductivity in the downstream direction of the entire river system. The Luwegu which joins the Kilombero to become the Rufiji carries a great deal of water. No water analyses have been carried out for this river, but it is draining a catchment occupied by Karroo rocks which in that area represent a poor source for salt.

e. THE SODIUM ADSORPTION RATIO

Sodium can affect soil conditions in a rather adverse way. The extent to which sodium ions can be adsorbed by soils, however, does not only depend upon the total concentration of sodium, but also on the proportion of this concentration to the other two main cations, calcium and magnesium. Thus both the total and the proportional concentration of sodium ions define the sodium alkali hazard of irrigation water.

To express the relative amount of sodium, use is made of the sodium adsorbtion ratio (SAR) for which the expression is $Na^+/\sqrt{(Ca^{++} + Mg^{++})/2}$ in which Na^+, Ca^{++} and Mg^{++} are the concentration of sodium, calcium and magnesium ions in milliequivalents per litre.

The SAR is only a relative indicator and must be considered together with the total amount of soluble salts indicated by the electrical conductivity. The adapted classification of water is shown on diagram, page 252.

The SAR of the investigated rivers has never been found to exceed the value three and is generally below one. This is well within the S_1 limit and the sodium hazard is very low.

The concentration of calcium and magnesium is very low, hardly ever exceeding 1 meq/l. The sodium concentration is also very low and generally less than 2 meq/l. Therefore none of these elements are present in concentrations which may lead to toxic reactions to plants.

f. BICARBONATES AND CARBONATES

Discriptions of bicarbonates and carbonates in irrigation water and their influence on soils have been given by Eaton (5, p. 123-133). The term "Residual Sodium Carbonate" (RSC) has been used which is expressed as $(CO_3^{--} + HCO_3^-) - (Ca^{++} + Mg^{++})$. The symbols stand for concentrations in milliequivalents per litre of carbonates, bicarbonates, calcium and magnesium.

The following classification according to RSC have been adopted:-

1. Water containing less than 1.25 meq/1 RSC can safely be used.
2. Water containing 1.25 to 2.5 meq/l RSC may be used but are marginal.
3. Water containing more than 2.5 meq/l RSC are not suitable for irrigation.

The RSC for investigated rivers in the Rufiji Basin is well within the safe limit of 1.25 meq/l. It has been proved that the RSC invariably consisted of bicarbonates only but not in concentrations significantly excessive to the total concentrations of calcium and magnesium.

g. TOXIC ION CONCENTRATIONS

Boron has proved to be present in all rivers of the Rufiji Basin, but never in concentrations exceeding 1 p.p.m., and is therefore within satisfactory limits for irrigation purposes.

As mentioned above the concentrations of sodium, calcium and magnesium are far too small to harm plant life. Apart from this it has been proved that no other ions exist in concentrations dangerous to plants.

h. THE pH OF RIVER WATER

The pH varies from river to river and can change rapidly in each individual stream, but is generally found to be between the values 6.0 and 7.5. The pH is shown graphically on graphs page 254 to 276.

Very often a considerable time elapsed between sampling and analysing and it was thought possible that the pH might have changed due to biochemical reactions. The pH was therefore occasionally measured at the riverside at time of sampling, but no noteworthy differences were found.

i. CONCLUSIONS

The analyses of river water carried out during three years have shown that the water is excellent for irrigation. It is well within the C_1-S_1 group for classification of irrigation water. The water is also well within the safe limits as far as bicarbonates, carbonates and boron are concerned. No ions in quantities sufficient to be toxic to plants were discovered.

j. FUTURE INVESTIGATIONS

With such an excellent quality of water, it should not be necessary to continue with extensive analyses. Three or four samples per year at a limited number of stations should be sufficient, and the same stations as selected for suspended sediment load studies can be chosen as a matter of convenience. These are as follows:-

1.	Rufiji River at Stiegler's Gorge.	No. 1K3
2.	Great Ruaha River at Mtera.	No. 1KA3
3.	Mbarali River at Igawa.	No. 1KA11
4.	Kilombero River at Swero.	No. 1KB17

Under special circumstances and if deterioration of water is for some reason suspected, more detailed investigations would, of course, have to be carried out.

TABLE XIII

RESULTS OF CHEMICAL ANALYSES OF RIVER WATER SAMPLES

Year and Month	Boron p.p.m	Calcium me/1	Magnesium me/1	Sodium me/1	Residual Sodium Carb. me/1	Sodium Absorption Ratio	Class
River: Rufiji Station: Stiegler's Gorge No.1K3							
1956							
Jan.19		.44	.23	1.37	.45	2.36	C1- S1
Feb.21		.48	.23	1.36	.65	2.26	"
Mar.20	.04	.40	.23	1.17	.09	2.09	"
Apr.17		.52	.42	.67	.26	.97	"
May.29		.32	.27	.41	.21	.76	"
Jul. 3		.32	.24	.39	.32	.74	"
Aug. 7		.32	.27	.35	.13	.65	"
Sep.25		.44	.14	.43	.30	.81	"
Oct.30		.32	.24	.25	.16	.47	"
Dec. 4		.36	.12	.57	.16	1.16	"
1957							
Jan.15		.64	.28	.51	.44	.97	"
Feb.12		.52	.23	.43	.16	.68	"
Mar.12		.32	.16	.93	.64	1.9	"
Apr. 9		.44	.16	.41	.28	.76	"
May. 8		.28	.32	.34	.20	.62	"
Jun. 4		.32	.12	.35	.28	.77	"
Jul. 2		.36	.12	.39	.32	.79	"
Nov.12	0	.35	.35	.44	.18	.75	"
1958							
Feb. 4	0	.48	.16	.43	.32	.76	"
Apr. 8	0	.48	.44	.43	.20	.63	"
Sep.13		.26	.20	.32	.34	.67	"
Nov.22		.24	.16	.28	.24	.63	"
Dec.20		.48	.12	.31	.12	.57	"
1959							
Feb.28		.36	.24	.31	.44	.57	"
May.16		.24	.22	.32	.34	.67	"
Jul.11		.28	.20	.37	.32	1.04	"
Oct.31		.20	.12	.27	.16	.68	"
River: Gt.Ruaha Station: Kidatu No.1KA3							
1956							
Aug.29	.15	.40	.27	.37	.37	.64	"
Oct.24		.56	1.00	.38		.41	"
Nov.14		.60	.08	.62	.24		"
Dec.19		.52	.08	.41	.12	.75	"
1957							
Jan.25		.40	.24	.47	.16	.83	"
Feb.20		.48	.30	.69	.34	1.10	"
Mar.20		.50	.23	.94	.71	1.55	"
Apr.10		.32	.32	.58	.32	1.02	"
May.15		.48	.12	.57	.44	1.04	"
Jun.12		.24	.04	.52		1.4	"
Jul.31		.32	.40	.28	.16	.47	"
Dec.11	0	.24	.48	.37	.34	.62	"

TABLE XIII

Year and Month	Boron p.p.m	Calcium me/l	Magnesium me/l	Sodium me/l	Residual Sodium carb me/l	Sodium Absorption Ratio	Class
River: Gt.Ruaha Station: Kidatu No.1KA3 (cont'd)							
1958							
Oct.15	<.1	.28	.28	.47	.16	.89	C_1- S_1
Nov.26		.24	.32	.35	.16	.65	"
Dec.17		.28	.28	.26	.16	.49	"
1959							
Apr.22		.32	.24	.54	.56	1.0	"
Apr.29		.28	.40	.44	.14	0.76	"
Jun.24		.32	.28	.52	.12	0.94	"
Aug.26		.32	.24	.43	.08	.81	"
River: Great Ruaha Station: Mbuyuni No.1KA4							
1956							
Aug.29		.62	.26	.83	.38	1.25	"
Oct. 3		.80	.20	.84	.62	1.19	"
Nov.21		.92	.36	1.13	.48	1.41	"
Dec.12		.76	.36	.75	.56	1.00	"
1957							
May. 8		.28	.04	.70	.80	1.75	"
Oct.30	.18						
1958							
Apr. 2	<.1	.44	.28	.65	.32	1.1	"
Aug.13	<.1	.52	.32	.64	.28	.99	"
1959							
Mar. 4		.40	.28	.44	.28	.75	"
Apr.29		.36	.24	.60	.14	1.09	"
Jun.14		.40	.28	.52	.14	0.9	"
Aug.12		.44	.40	.44	.14	.68	"
Oct.28		.68	.40	.69	.36	.94	"
River: Great Ruaha Station: Mtera No.1KA5							
1956							
Dec.28		.56	.44	.57	.28	.71	"
1957							
Jan.25		.64	.12	.62	0	1.0	"
Feb.22		.76	.24	.74	.44	1.05	"
Mar.22		1.0	1.2	.37	.04	.35	"
May. 3		.40	.20	.68	.60	1.24	"
May.31		.36	.12	.61	.64	1.3	"
Jun.21		.32	.04	.60	.36	1.4	"
Jul.19	0	.28	.28	.65	.56	1.2	"
Aug.30		.36	.32	.58	0	1.0	"
Sep.27		.48	.32	.77	.56	1.22	"
Oct.25		.48	.32	.38	.24	.60	"
1958							
Feb.14	<.1	.36	.32	.54	.20	.93	"
Jun.27	<.1	.36	.24	.69	.60	1.30	"
Jul.25		.28	.32	.69	.44	1.28	"
Nov.21		.48	.28	.53	.28	.88	"
1959							
Mar.20		.24	.20	.39	.44	0.83	"
Apr.17		.32	.24	.54	.56	1.0	"
May.15		.32	.28	.64	.14	1.17	"
Jun.12		.28	.28	.56	.14	1.06	"
Oct.10		.48	.28	.55	.44	..89	"

TABLE XIII

Year and Month	Boron p.p.m	Calcium me/l	Magnesium me/l	Sodium me/l	Residual Sodium carb me/l	Sodium Absorption Ratio	Class
River:	Chimala	Station:	Chimala	No.1KA7			
1956							
Oct.13		.28	.24	.47	.44	.92	C_1- S_1
Nov.10		.28	.20	.47	.40	.96	"
Dec. 8		.32	.08	.47	.56	1.12	"
1957							
Jan. 5		.32	.24	.47	.44	.87	"
Feb. 9		.20	.08	.37	.56	.99	"
Mar. 2		.20	.16	.39	.46	.92	"
Apr.13		.08	.04	.26	.44	.57	"
May.18		.08	.12	.30	.44	.86	"
Jun. 8		.24	.12	.43	.44	1.0	"
Aug.24		.15	.17	.46	.48	1.1	"
Oct.26	<1.0	.24	.16	.44	.48	.98	"
1958							
Apr.19	.9	.32	.12	.47	.44	1.0	"
Jun.14	<.1	.40	.16	.63	.40	1.2	"
Aug.23	<.1	.28	.08	.42	.32	.99	"
Nov. 2		.24	.08	.39	.32	.98	"
1959							
Feb.24		0.16	0.08	0.26	0.24	0.72	"
Apr.11		.12	0.08	.24	0.28	0.73	"
May. 9		0.12	0.08	.25	.36	0.76	"
Jun. 6		0.20	0.08	.37	0.44	0.85	"
Oct.31		0.28	0.12	0.38	0.52	0.85	"
River:	Great Ruaha	Station:	Chimala	No.1KA8			
1956							
Jan.19	.08	.44	0	.92	.12	1.37	"
Feb. 8		.36	.44	.94	0	1.05	"
Oct.13		.32	.12	.33	0	.70	"
Nov.10		.28	.24	.42	.36	.82	"
Dec. 8		.24	.20	.40	.36	.85	"
1957							
Jan. 5		.24	.16	.26	.24	.58	"
Feb. 9		.16	.08	.29	.56	.84	"
Mar. 2		.12	.12	.24	.56	.69	"
Apr.13		.12	.08	.15	.36	.43	"
May.11		.12	.08	.17	.20	.48	"
Jun. 8		.08	.08	.23	.88	.8	"
Jun. 6		.13	.13	.23	.30	.64	"
Aug.24		.17	.14	.26	.25	.68	"
Sep.21		.17	.18	.26	.29	.63	"
Oct.26	<.1	.18	.22	.26	.24	.58	"
1958							
Mar.22	.11	.12	.12	.23	.24	.66	"
Sep.20	<.1	.16	.20	.31	.28	.73	"
Nov.29		.28	.12	.25	.24	.56	"

TABLE XIII

Year and Month	Boron p.p.m	Calcium me/l	Magnesium me/l	Sodium me/l	Residual Sodium carb me/l	Sodium Absorption Ratio	Class
River: Great Ruaha		Station: Chimala		No.1KA8 (cont'd)			
1959							
Jan. 3		.20	.24	.37	.60	.76	C1- S1
Mar. 7		.08	.27	.22	.37	0.54	"
Apr.11		.16	.08	.19	.24	.54	"
May.16		.12	.08	.19	.28	.58	"
Jun.27		.14	.10	.22	.32	.63	"
Oct.24		.20	.12	.24	.36	.60	"
River: Kimani		Station: Great N.Road		No.1KA9			
1956							
Feb.11	.04	.38	.15		0		
Oct.13		.20	,07	.12	.05	.32	"
Nov.10		.04	.14	.10	.14	.33	"
Dec. 8		.12	.28	.14	.40	.31	"
1957							
Jan. 5		.08	.08	.13	.16	.46	"
Feb. 9		.08	.08	.17		.60	"
Mar. 9		.08	.08	.17		.60	"
Apr. 6		.08	.04	.16	.20	.64	"
May. 4		.08	0	.15		.75	"
Jun.29		0	0	.09			"
Jul.24	<1.0	.06	.06	.10	.12	.42	"
Aug.24		.06	.02	.09	.12	.45	"
Sep.21		.05	.03	.09	.08	.45	"
Oct.19	<1.0	.05	.03	.09	.16	.45	"
1958							
Mar.15	.33	.08	.04	.13	.04	.53	"
May.17	<.1	.40	.60	.19	.25	.85	"
Sep. 6	<.1	.08	.08	.30	.06	1.06	"
Nov. 8		.08	.12	.11	0	.35	"
1959							
Jan.21		.04	.08	.13	.12	.52	"
Apr.18		0.08	0.08	.13	0	0.46	"
May.16		.04	.04	.09	.12	.45	"
Jun.13		.04	.04	.08	.08	.40	"
River: Mbarali		Station:Igawa		No.1KA11			
1956							
Feb.21	.19	.48	1.72	.04	0	.03	"
Feb.23		1.12	trace	.97	0	.92	"
Oct.13		.32	.14	.32	.34	.47	"
Nov.10		.24	.27	.32	.29	.45	"
Dec. 8		.32	.23	.60	.33	1.14	"
1957							
Mar.23		.28	.16	.48	.52	1.0	"
Apr.20		.48	.52	1.13	0	1.6	"
May.25		.12	.04	.28		1.0	"
Jun.29		.12	.08	.28		.9	"
Jul.27		.12	.04	.38		1.3	"

TABLE XIII

Year and Month	Boron p.p.m	Calcium me/1	Magnesium me/1	Sodium me/1	Residual Sodium carb me/1	Sodium Absorption Ratio.	Class
River: Mbarali Station: Igawa No.1KA11							
1958							
Oct.21	<.1	.20	.24	.31	.20	.22	C_1- S_1
Nov. 1		.24	.16	.37	.32	.81	"
Dec. 9		.24	.08	.34	.28	.85	"
1959							
Jan.17		.16	.12	.22	.12	.58	"
Feb.22		.08	.24	.27	.24	.67	"
Apr. 4		.24	.08	.22	.32	.55	"
May. 9		.16	.20	.26	.28	.61	"
Jul. 4		.18	.18	.28	.27	.61	"
Oct.31		.24	.20	.30	.36	.64	"
River: Halali Station: Iyayi No.1KA12							
1958							
Jun. 7	0	.48	.28	.78	0	1.3	"
1959							
Mar. 3		.28	.24	.60	.36	1.17	"
Mar.28		.12	.36	.54	.48	1.10	"
River: Ndembera Station: Ilonga No.1KA15							
1956							
Dec.12		.40	.12	.70	.20	1.37	"
1957							
Feb.18		.40	.16	.47	.48	.89	"
Mar.18		.72	.16	.47	.24	.71	"
Apr.15		.16	.08	.33	.64	.97	"
May.13		.24	.08	.43	.48	1.1	"
Jun.10	0	.32	.12	.42	.36	.90	"
Jul. 8		.24	.24	.69	1.28	1.4	"
Aug.26		.24	.16	.45	.48	1.02	"
Sep.23		.28	.28	.45	.16	.85	"
Dec.16		.56	.08	.67	.48	1.18	"
1958							
Feb.17	<.1	.44	.20	.47	.48	.90	"
Apr.14		.48	.16	.52	.56	.92	"
River: Mbarali Station: Rujewa Farm No.1KA19							
1958							
Nov.31	<.1	.24	.24	.40	.32	.51	"
1959							
Mar. 2		.24	.20	.28	.28	.60	"
Apr.11		.08	.24	.27	.24	.68	"
Apr.27		.32	.08	.32	.48	.71	"
Jun.19		.12	.24	.31	.28	.74	"
River: Little Ruaha Station: Iringa No.1KA2							
1956							
Dec.22		.24	.08	.63	.56	1.58	"

TABLE XIII

Year and month	Boron p.p.m	Calcium me/1	Magnesium me/1	Sodium me/1	Residual Sodium carb me/1	Sodium Absorption Ratio	Class
River: Little Ruaha Station: Iringa No.1KA2 (cont'd)							
1957							
Jan. 26		.24	.12	.40	.20	.67	$C_1 - S_1$
Feb. 23		.36	.08	.35	.2	.75	"
Mar. 23		.80	.16	.50	1.04	.72	"
Apr. 28		.16	.16	.20	.32	.50	"
May. 25		.16	.12	.35	.28	.94	"
Jun. 29		.08	.05	.25	.40	1.0	"
Jul. 27		.08		.29	.48		
Sep. 7		.20	.12	.22	.16	.55	"
Sep. 14		.32	.08	.24		.58	"
Oct. 5		.16	.12	.30	.20	.81	"
Little Ruaha Station: Ihimbu No.:1KA.21							
1958							
Mar. 29		.28	.12	.21	.16	.47	"
May. 17	0	.32	.08	.25	.26	.56	"
Aug. 2	<.1	.24	.04	.14	.28	.37	"
Oct. 11	<.1	.24	.04	.14	.28	.37	"
Nov. 8		.16	.12	.24	.04	.64	"
Dec. 6		.16	.16	.23	.08	.58	"
1959							
Jan. 8		.08	.20	.24	.20	.63	"
Feb. 5		.08	.12	.22	.20	.67	"
Mar. 19		.04	.20	.24	.24	.69	"
Apr. 16		.08	.20	.22	.20	.58	"
May. 14		.08	.16	.19	.16	.56	"
Jun. 11		.28	.14	.33	.38	.43	"
Jun. 16		.12	.08	.20	.05	.63	"
Oct. 29		.20	.08	.23	.28	.61	"
River: Njombe Station: Ifumba No.1KA29							
1958							
Mar. 15		.44	.36	.44	.32	.70	"
May. 6		1.04	.80	.22	1.20	.23	"
Jun. 3		.60	.48	.61	.44	.83	"
River: Lukosi Station: Mbuyuni No.1KA37							
1956							
Jan. 23	0	trace	1.43	.66	0	.55	"
1958							
Apr. 30	<.1						
May. 14	<.1						
Dec. 29		.40	.16	.31	0	.59	"
1959							
Mar. 4		.16	.16	.26	0	.65	"
Jun. 8		.16	.08	.28	.06	0,80	"
River: Kisigo Station: Kinunguru No.1KA42							
1958							
Mar. 10	.07	.56	.28	.39	.28	.60	"
Apr.		.40	.24	.29	.16	.51	"
Jun. 22		.60	.52	.80	.32	1.06	"
1959							
Jan. 2		.44	.40	.41	.04	.63	"
Jan. 16		.40	.24	.24	.0	.34	"

TABLE XIII

Year and Month	Boron p.p.m	Calcium me/1	Magnesium me/1	Sodium me/1	Residual Sodium carb me/1	Sodium Absorption Ratio	Class
River: Njombe Station: Isanga No: 1KA43							
1958							
May. 3		.20	.20	.48	.40	1.1	C_1- S_1
Jun.14		.36	.20	.61	.48	1.2	"
Dec.27		.20	.12	.44	.16	1.1	"
1959							
Feb.17		.16	.12	.14	.04	.37	"
River: Kilombero Station: Ifakara No:1KB2							
1955							
Dec.18	0	.73	trace	.11	0	.13	"
1956							
Aug.29	0	.24	.16	.10	.24	.22	"
Sep.26		.16	.19	.71	.65	1.7	"
Oct.24		.44	.19	2.05	.01	3.6	"
Dec.26		.34	.28	.39	.02	.7	"
1957							
Jan.23		.38	.08	.46	.26	.96	"
Feb.20		.28	.10	.51	.26	1.17	"
Mar.20		.16	.36	.30	0	.59	"
Apr.10		.48	.32	.56	.24	.89	"
May. 8		.04	.04	.29	.40	1.4	"
Jun. 5		.32	.20	.42	.52	1.6	"
1958							
Jan.29		.16	.04	.24	.28	.77	"
Oct.15		.22	.06	.34	.28	.91	"
Nov.26		.16	.16	.23	.24	.58	"
Dec.17		.20	.16	.24	.20	.57	"
1959							
Mar.11		.08	.24	.24	.48	.60	"
Jul.29		0.06	0.06	0.28	0.52	1.12	"
River: Lumemo Station: Ifakara No:1KB3							
1955							
Oct.12	.06	1.10	.63	.51	0	.39	"
1956							
Aug.29	.34	.28	.65	.58	0	.85	"
Sep.26	.04	.28	.54	.28	0	.44	"
Oct.24		.28	.60	.20	0	.30	"
Dec.26		.40	.20	.24	0	.44	"
1957							
Feb. 6		.32	.36	.35	.81	.60	"
Mar.20		.80	.48	1.09	1.81	1.37	"
Apr.17		.28	.12	.30	.32	.67	"
Jun.19		.20	.08	.27	.36	1.9	"
Jul.17		.16	.40	.28	.08	.55	"
Aug.14		.28	.16	.24		.51	"
Sep.18		.24	.20	.26	.40	.53	"
Dec.26		.28	.20	.40	.08	.82	"
1958							
Mar.31	0	.32	.12	.18	.12	.38	"
Apr.30	<.1	.24	.28	.30	.04	.59	"

TABLE XIII

Year and Month	Boron p.p.m	Calcium me/1	Magnesium me/1	Sodium me/1	Residual Sodium carb me/1	Sodium Absorption Ratio	Class
River: Kilombero Station: Ifwema No: 1KB4							
1955							
Dec.17	0	2.64	0	.61	0	.37	Cl - Sl
1956							
Sep.19		.28	.19	1.44	.09	2.9	"
Oct.17		.20	.50	1.12	0	1.85	"
Nov.14		.20	.20	.21	.16	.47	"
Dec.19		.20	.04	.26	.40	.77	"
1957							
Jan.16		.20	.08	.26	.20	0.69	"
Feb.13		.16	.08	.26	.24	.77	"
Mar.13		.16	.12	.37	.20	1.0	"
Apr.10		.20	.08	.27	.28	.73	"
1958							
Jan.22	<.1	.17	.11	.24	0	.64	"
Aug.13		.12	.08	.26	.12	.87	"
Oct.22		.08	.16	.19	.24	.54	"
Dec. 3	< 1	.12	.08	.28	.06	.87	"
1959							
Jan.28		.12	.08	.20	.05	.63	"
Feb.11		.04	.11	.22	.25	.82	"
Mar.25		.04	.15	.18	.29	.47	"
Oct.28		.14	.04	.24	.38	.80	"
River: Luhombero Station Ilonga No:1KB5							
1956							
Aug.29		.40	.32	.40	.40	0.66	"
Sep.27		.40	.20	.27	.28	.53	"
Oct.25		.48	.24	.39	.48	.65	"
1958							
Feb.12	<.1	.32	.36	.43	.20	.74	"
Sep.24	<.1	.60	.44	.63	.60	.87	"
Dec.10		.92	.48	.44	.40	.48	"
1959							
Jan.14		.28	.40	.30	.24	.52	"
May. 6		.44	.52	.35	.24	.51	"
Ayg. 5		.44	.44	.07	.24	.11	"
Sep. 2		.40	.32	.33	.88	.55	"
River: Kigogo-Ruaha Station: Frick's Bridge No:1KB6							
1958							
Mar.15	.13	.52	.12	.41	.32	.72	"
Apr.12	0	.16	.16	.25	.08	.62	"
Nov.18		.16	.12	.15	0	.40	"
1959							
Feb.28		.08	.12	.11	.36	.33	"
Mar.14		.08	.04	.17	.04	.67	"
River: Mpanga Station: Mpanga nO: 1KB8							
1958							
Dec.27		.12	.08	.22	.28	.66	"

TABLE XIII

Year and Month	Boron p.p.m	Calcium me/l	Magnesium me/l	Sodium me/l	Residual Sodium carb me/l	Sodium Absorption Ratio	Class
River: Mpanga Station Mpanga No: 1KB8 (cont'd)							
1959							
Jan.17		.08	.08	.18	.32	.72	C_1 - S_1
feb.28		.08	.12	.20	.28	.61	"
Mar.14		.08	.08	.24	.24	.96	"
May. 2		.08	.04	.19	0.36	0.76	"
Jun.27		.14	.06	.25	.36	.78	"
Aug.15		.20	.04	.28	0.32	0.80	"
River: Mnyera Station:Taveta No:1KB9							
1959							
Feb. 2		.12	.04	.34	.48	1.21	"
Mar.28		.08	.04	.28	.44	1.17	"
Jun.27		.12	.04	.27	.48	.96	"
Aug.15		.12	.08	.33	.52	1.03	"
Sep.26		.24	.08	.40	.56	1.00	"
Oct. 8		.24	.08	.70	.56	1.75	"
Nov.29		.12	.04	.29	.56	1.04	"
River: Ruhuji Station: Mwyalangu No:1KB10							
1958							
Nov.24		.12	.08	.28	.05	.89	"
Dec.10		.12	.08	.36	.05	1.13	"
Dec.24		.12	.16	.06	.04	0.16	"
1959							
Jan.16		.08	.12	.12	.04	0.37	"
May. 9		.12	.12	.32	.07	.91	"
Jun.13		.12	.08	.28	.07	.87	"
Jul.18		.08	.16	.56	.05	1.60	"
Aug. 8		.12	.08	.28	.05	0.87	"
Oct.29		.08	.12	.19	.28	0.59	"
River: Furua Station: Malinyi No: 1KB16							
1958							
Jan.14	<.1	.20	.32	.31	.12	.61	"
Apr.1	<.1	.16	.24	.34	.24	.78	"
Jul. 8	<.1	.28	.20	.36	.24	.74	"
Aug.19		.11	.27	.27	.26	.61	"
Sep.30		.16	.32	.27	.16	.66	"
Nov.11		.16	.32	.27	.24	.66	"
Nov.18		.42	.11	.31	.27	.60	"
Dec. 9		.64	.26	.30	.20	.44	"
1959							
Feb.24		.08	.20	.27	.12	.71	"
Mar. 3		.08	.20	.32	.20	.84	"
Apr.28		.16	.40	.16	.07	0.30	"
Jun.16		.24	.28	.36	.08	0.71	"
Sep.15		.28	.20	.26	.08	0.53	"
Nov. 3		.20	.24	.25	.20	0.53	
River: Kilombero Station: Swero No:1KB17							
1958							
May. 3		.20	.16	.31	.12	.58	"
Sep.20	.1	.24	.16	.30	.16	.75	"
Dec.13		.04	.20	.21	.24	.60	"
1959							
FEB.14		.16	.16	.22	.24	.55	"
May. 1		.08	.16	.20	.32	.57	"
Oct. 8		.08	.04	.21	.28	.90	

TABLE XIV

COMPLETE CHEMICAL ANALYSES OF RIVER WATER SAMPLES OF VARIOUS RIVERS IN THE RUFIJI BASIN.

	1	2	3	4	5	6	7	
Elect.Cond.25°	131	117	156	138	31	52	64	
pH (mean)	6.7	6.7	6.9	6.8	6.5	6.8	6.8	
Alkalinity	40	44	56	48	16	28	32	p.p.m
Total hardness	28	78	96	34	12	36	48	"
Chlorides	0	4	4	4.0	0	0	0	"
O_2 absorbed	4.55	-	5.85		1.55	1.65	4.75	"
Free NH3	0	-	0	-	-	0.02	trace	"
Alb. NH_3	0.18	-	0.20	-	-	0.22	0.26	"
Nitrite	trace	trace	0	-	trace	trace	trace	"
Nitrate	nil	nil	trace	-	trace	trace	trace	"
Fluoride	0	0	0	-	0	0.4	0.2	"
Silica	17.0	23.0	20.0	-	15.0	10.5	23.0	"
Sulphate	0	7.0	11.95	-	3.7	0.4	4.94	"
Calcium	7.2	8.0	11.2	8.8	3.6	2.8	5.6	"
Magnesium	2.40	4.56	4.80	2.9	0.72	2.64	2.40	"
Sodium	8.80	9.10	12.80	13.2	2.25	4.25	4.90	"
Iron	2.40	0.70	0.80	-	0.80	0.30	0.90	"
Tot.dis.solids	134	162	138	224	104	46	224	"

	8	9	10	11	12	13	14	
Elect.Cond.25°	131	47	59	67	98	66	96	
pH (mean)	6.8	6.6	6.9	6.6	6.8	6.3	6.9	
Alkalinity	48	20	20	28	48	28	52	p.p.m
Total hardness	28	19	14	20	32	16	32	"
Chlorides	4	0	0	0	0	0	0	"
O_2 absorbed	6.70	4.85	-	3.0	-	4.5	2.0	"
Free NH3	-	-	-	0	-	0	0	"
Alb. NH_3	-	-	-	0.16	-	0.25	0.10	"
Nitrite	nil	trace	-	0	-	0	0	"
Nitrate	trace	trace	-	trace	-	trace	0	"
Fluoride	0	0	-	0	-	0	0.05	"
Silica	26.5	16.0	-	11.0	-	10.0	14.0	"
Sulphate	3.7	3.3	-	trace	-	trace	0	"
Calcium	2.4	2.8	4.0	4.8	8.8	4.0	6.4	"
Magnesium	5.28	2.88	0.96	1.92	2.4	1.44	3.84	"
Sodium	14.00	4.25	5.2	8.00	6.5	5.50	13.00	"
Iron	0.90	1.10	-	1.60	-	4.50	1.40	"
Tot.dis.solids	430	76	101	96	222	131	115	"

TABLE XIV

COMPLETE CHEMICAL ANALYSES OF RIVER WATER SAMPLES OF VARIOUS RIVERS IN THE RUFIJI BASIN (cont'd)

	15	16	17	18	19	20	21	
Electr.Cond.25°	62	52	109	83	45	72	83	
pH (mean)	6.6	6.7	7.1	6.8	6.4	6.2	6.7	
Alkalinity	24	28	48	36	20	40	32	p.p.m
Total hardness	18	16	40	44	12	28	22	"
Chlorides	0	0	0	0	0	0	0	"
O_2 absorbed	-	-	2.5	-	-	2.8	-	"
Free NH_3	-	-	0	-	-	0	-	"
Alb.NH_3	-	-	0.16	-	-	0.08	-	"
Nitrite	-	-	0	0	-	trace	-	"
Nitrate	-	-	trace	0	-	trace	-	"
Fluoride	-	-	0	0	-	0	-	"
Silica	-	-	15.0	13.5	-	19.6	-	"
Sulphate	-	-	2.47	2.88	-	0	-	"
Calcium	4.0	4.8	9.6	4.4	3.2	5.6	4.8	"
Magnesium	1.92	0.96	3.84	2.64	0.96	3.36	2.4	"
Sodium	4.55	6.2	7.00	4.25	5.0	6.50	7.0	"
Iron	-	-	2.00	1.20	-	3.20	-	"
Tot.dis.solids	68	152	151	102	115	101	158	"

1.	1K3	Rufiji at Stiegler's Gorge	Sampling	date	7.1.58
2.	1KA.3	Great Ruaha at Kidatu	"	"	5.1.58
3.	1KA.4	Great Ruaha at Mbuyuni	"	"	4.1.58
4.	1KA.5	Great Ruaha at Mtera	"	"	20.2.59
5.	1KA.7	Kimani at Main Road	"	"	24.1.58
6.	1KA.8	Great Ruaha at Chimala	"	"	24.1.58
7.	1KA.11	Mbarali at Igawa	"	"	28.1.58
8.	1KA.12	Halali at Iyayi	"	"	28.1.58
9.	1KA.21	Little Ruaha at Ihimbu	"	"	30.1.58
10.	1KA.21	Little Ruaha at Ihimbu	"	"	19.2.59
11.	1KA.37	Lukosi at Mtandika	"	"	4.1.58
12.	1KA.42	Kisigo at Kinunguru	"	"	21.2.59
13.	1KB.2	Kilombero at Ifakara	"	"	13.1.58
14.	1KB.3	Lumemo at Ifakara	"	"	12.1.58
15.	1KB.3	Lumemo at Ifakara	"	"	19.3.59
16.	1KB.4	Kilombero at Ifwema	"	"	29.3.59
17.	1KB.5	Luhombero at Ilonga	"	"	10.1.58
18.	1KB.6	Kigogo-Ruaha at Frick's Bridge	"	"	28.1.58
19.	1KB.8	Mpanga at Mpanga	"	"	31.3.59
20.	1KB.16	Furua at Malinyi	"	"	14.1.58
21.	1KB.16	Furua at Malinyi	"	"	1.4.59

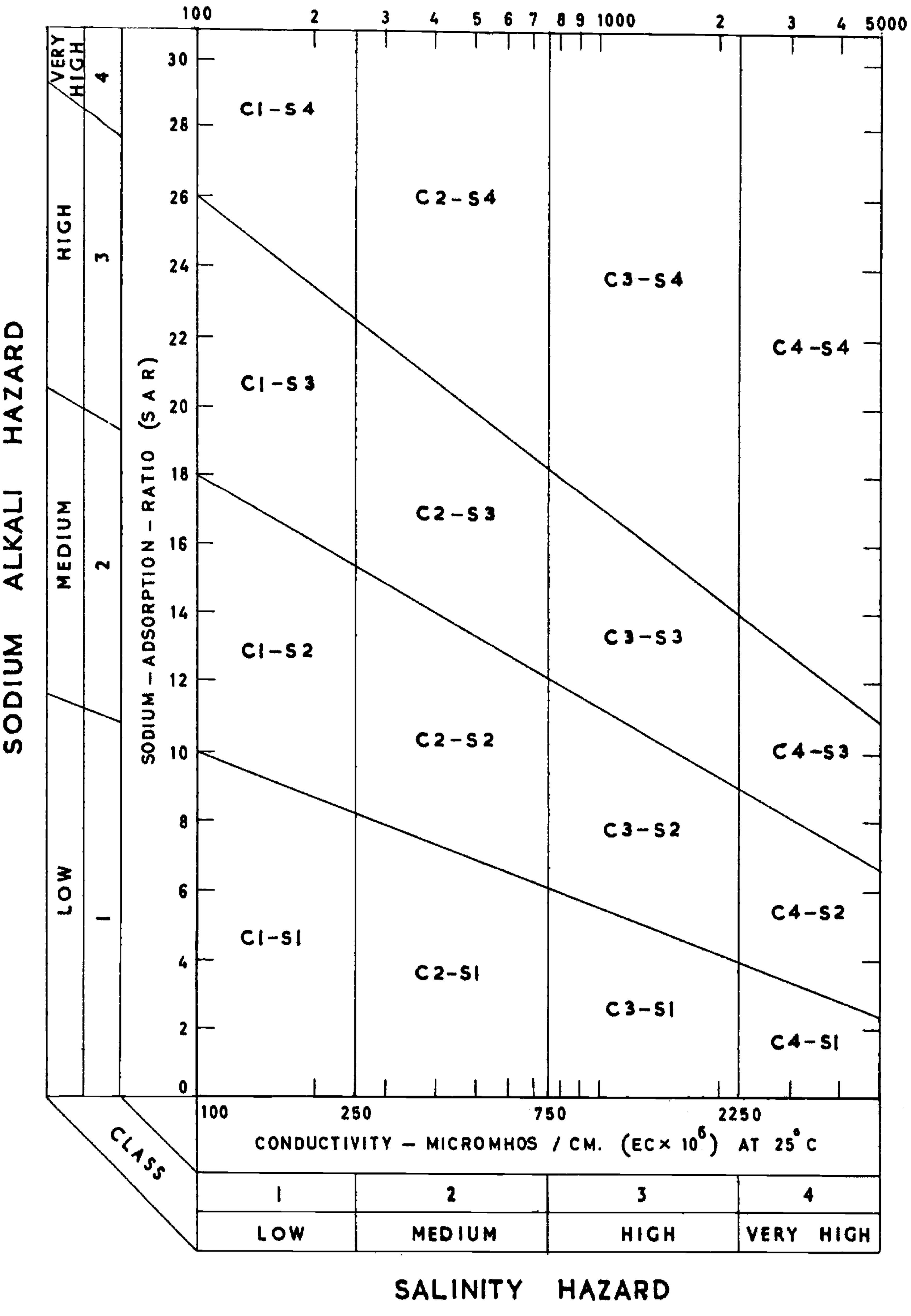
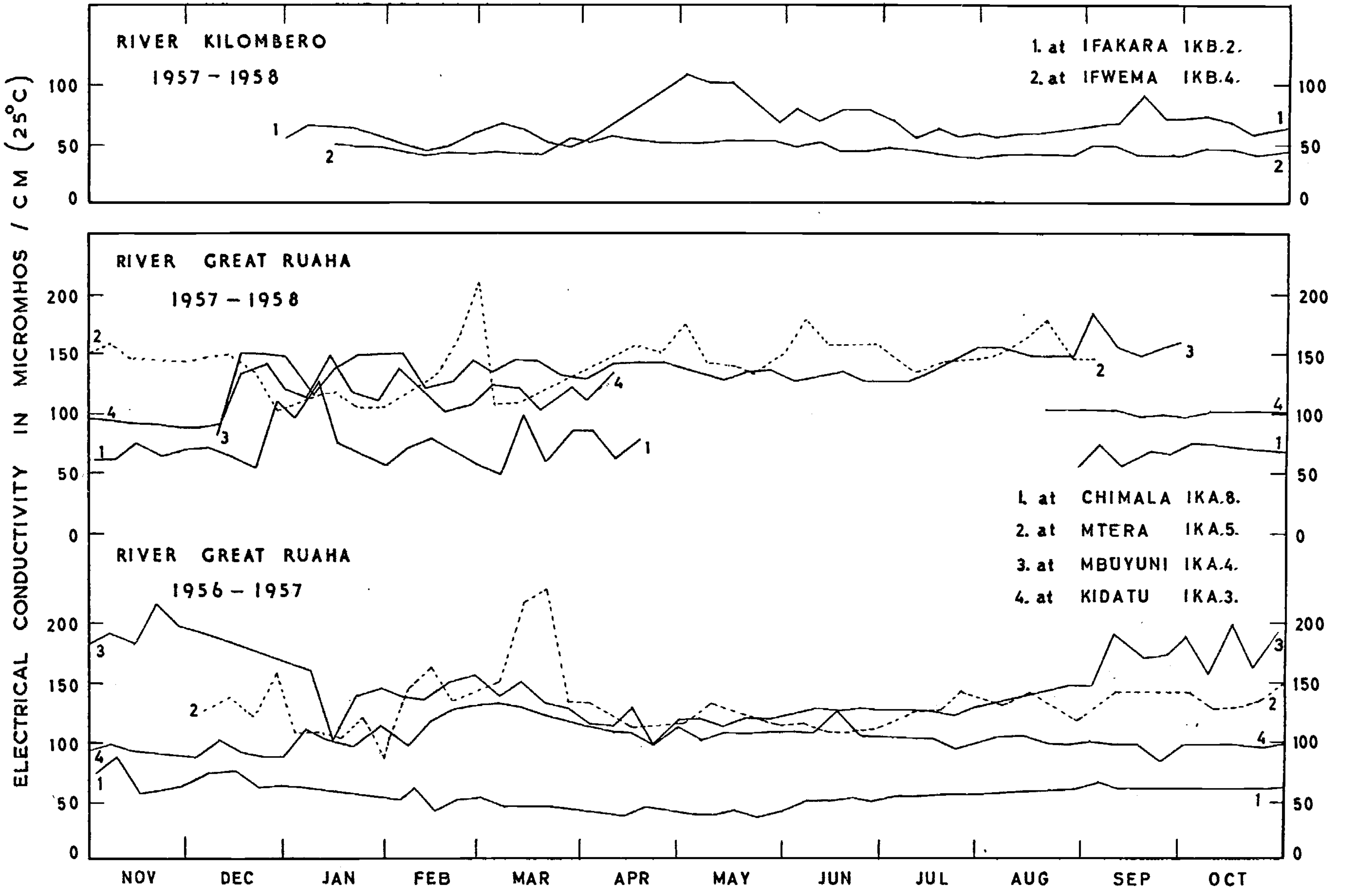


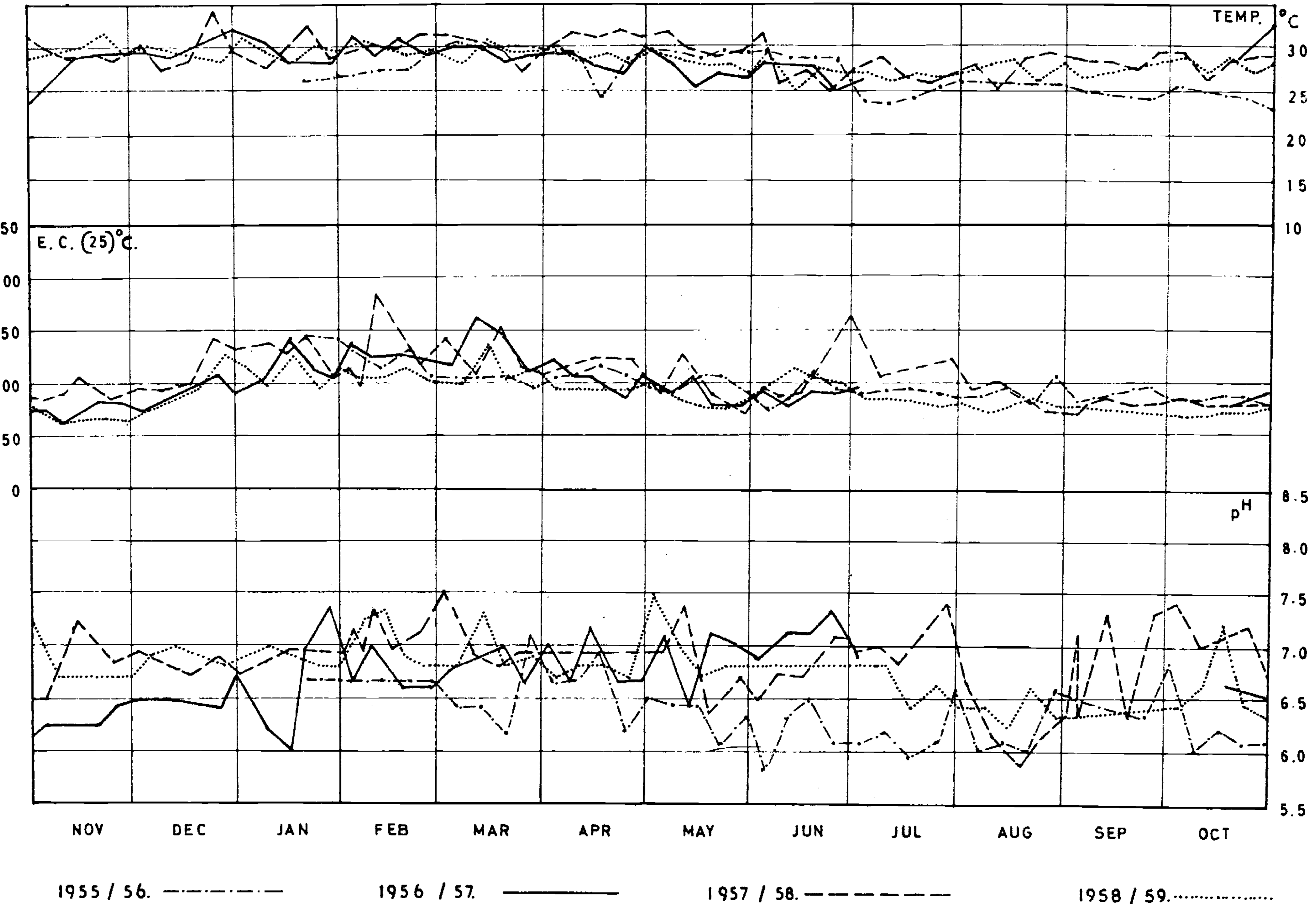
DIAGRAM FOR THE CLASSIFICATION OF IRRIGATION WATERS

FROM AGRICULTURE HANDBOOK 60, U. S. DEPT. OF AGRICULTURE

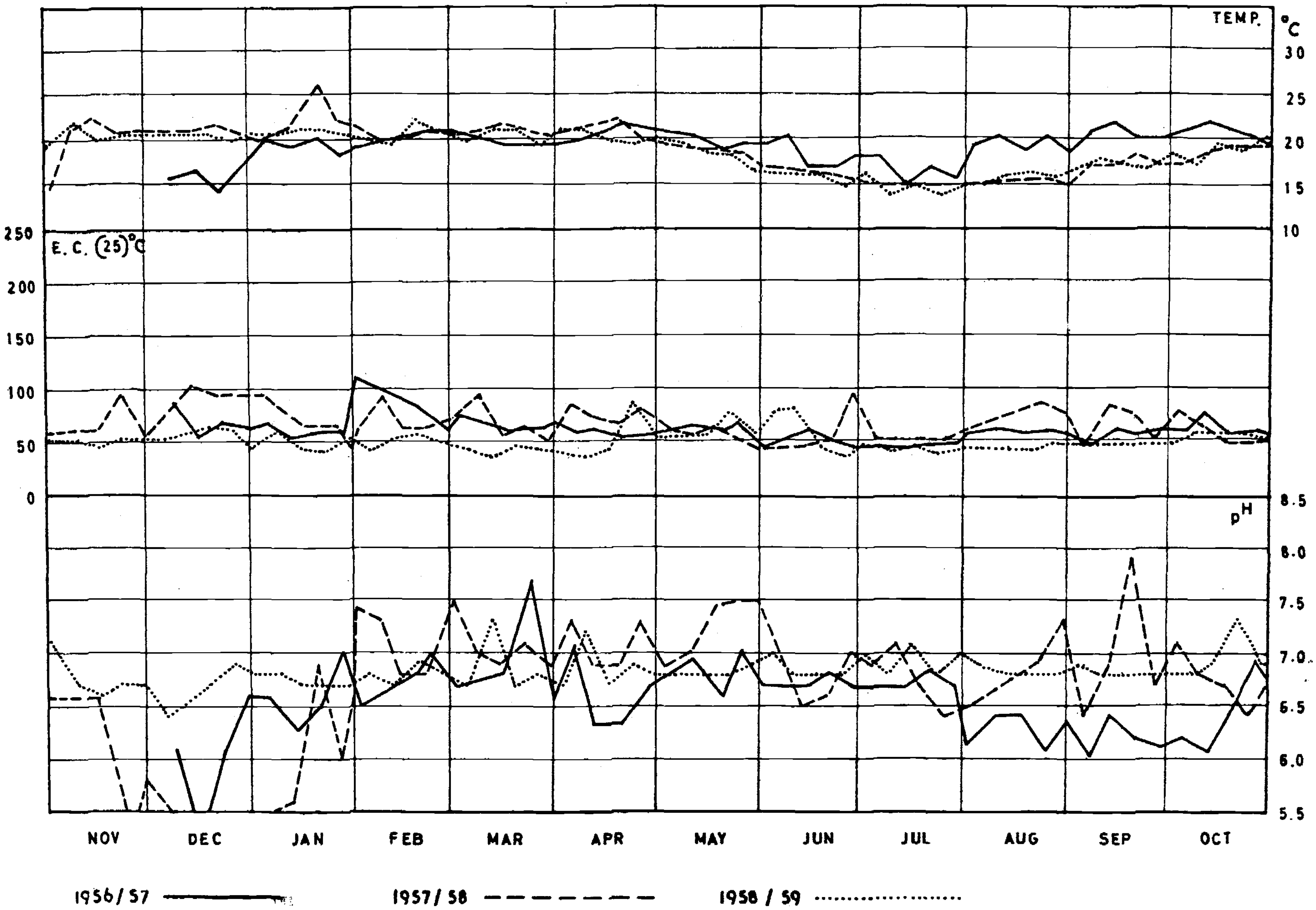
ELECTRICAL CONDUCTIVITY OF RIVER WATER AT SELECTED STATIONS



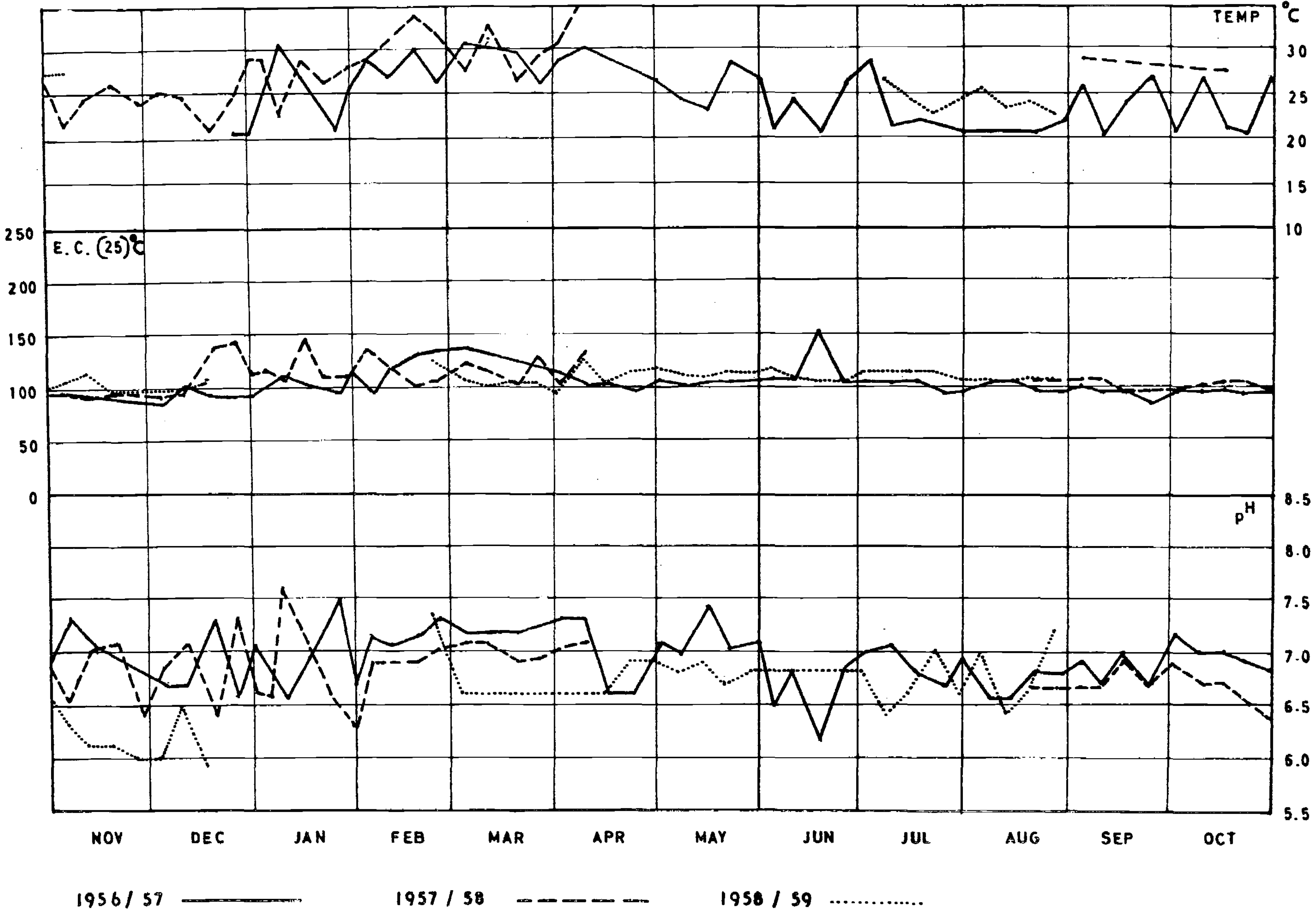
RIVER; RUFIJI STATION: STIEGLER'S GORGE No. IK 3



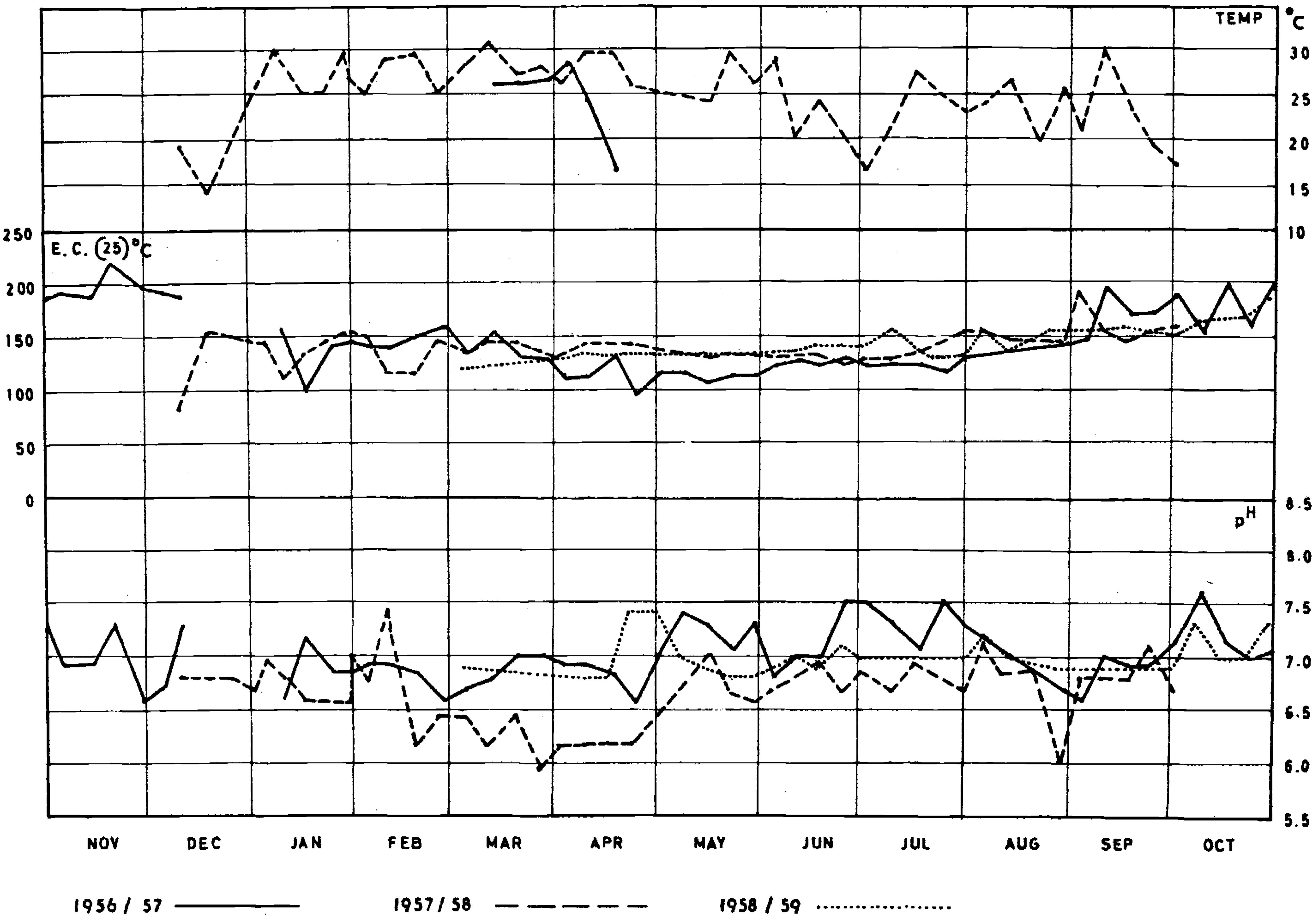
RIVER: LITTLE RUAHA STATION: IRINGA(From 30/1/58 at IHIMBU) No. IKA.2. & IKA.2..



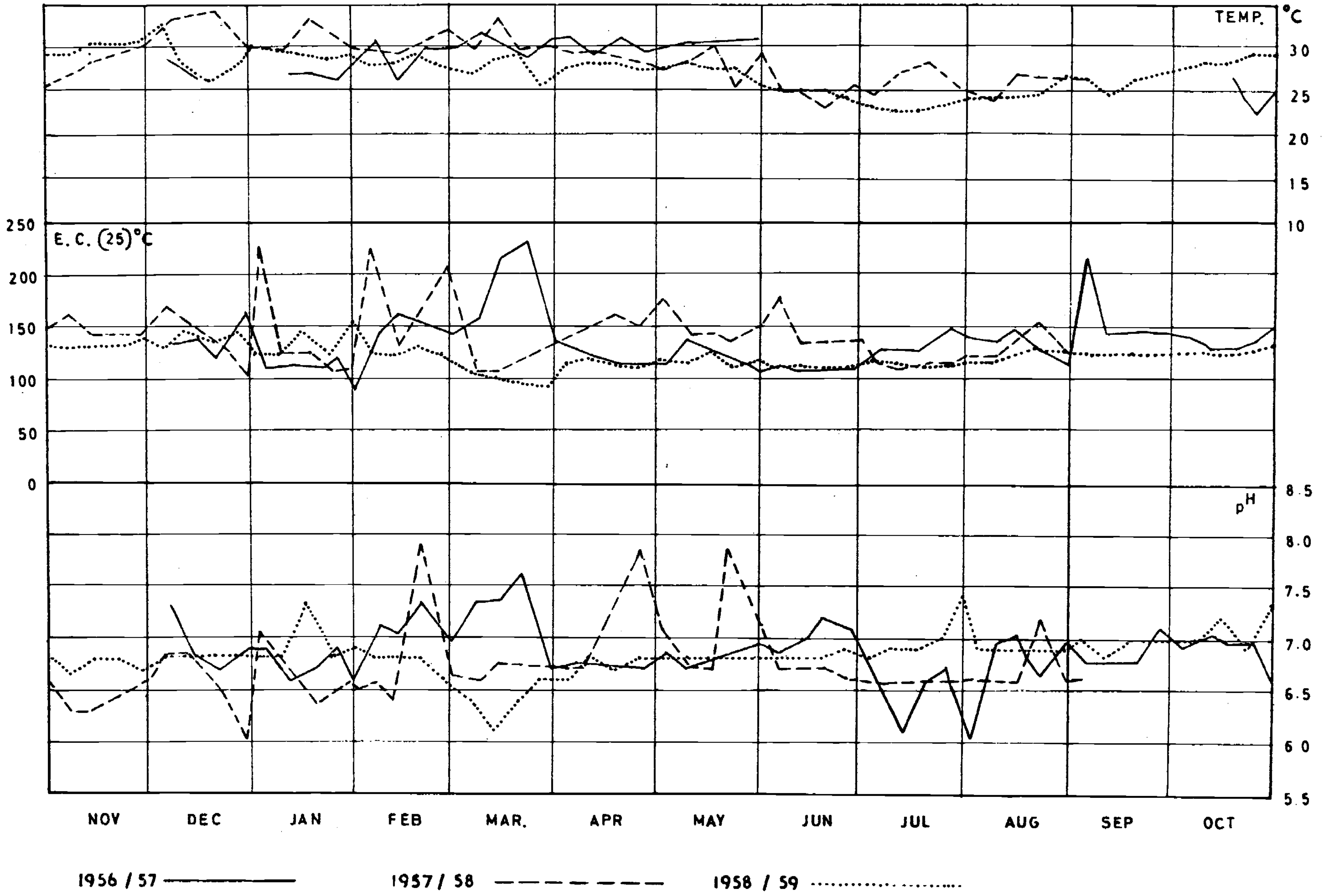
RIVER: GREAT RUAHA. STATION: KIDATU. NO: IKA. 3.



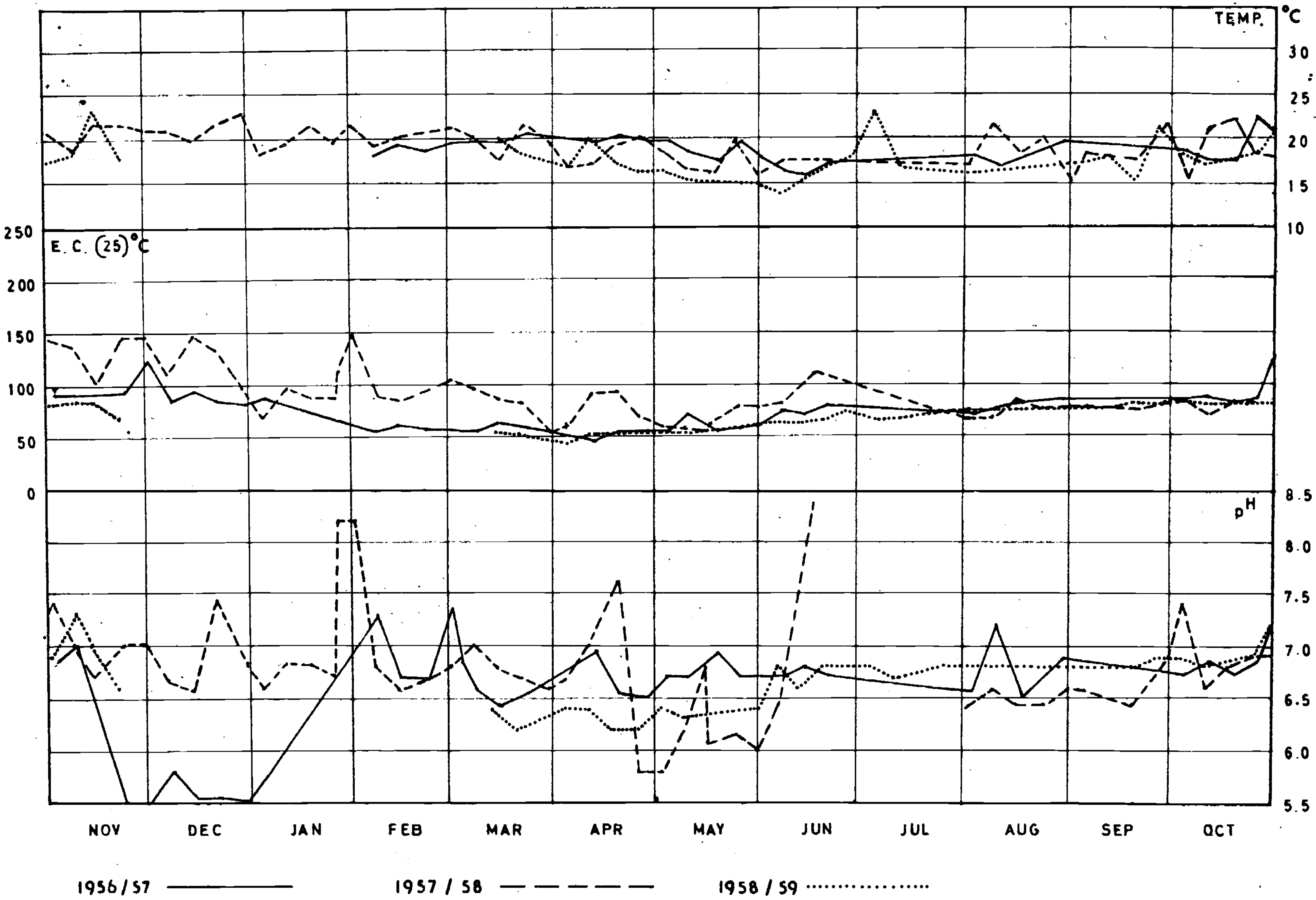
RIVER: GREAT RUAHA **STATION: MBUYUNI** **No. IKA 4**



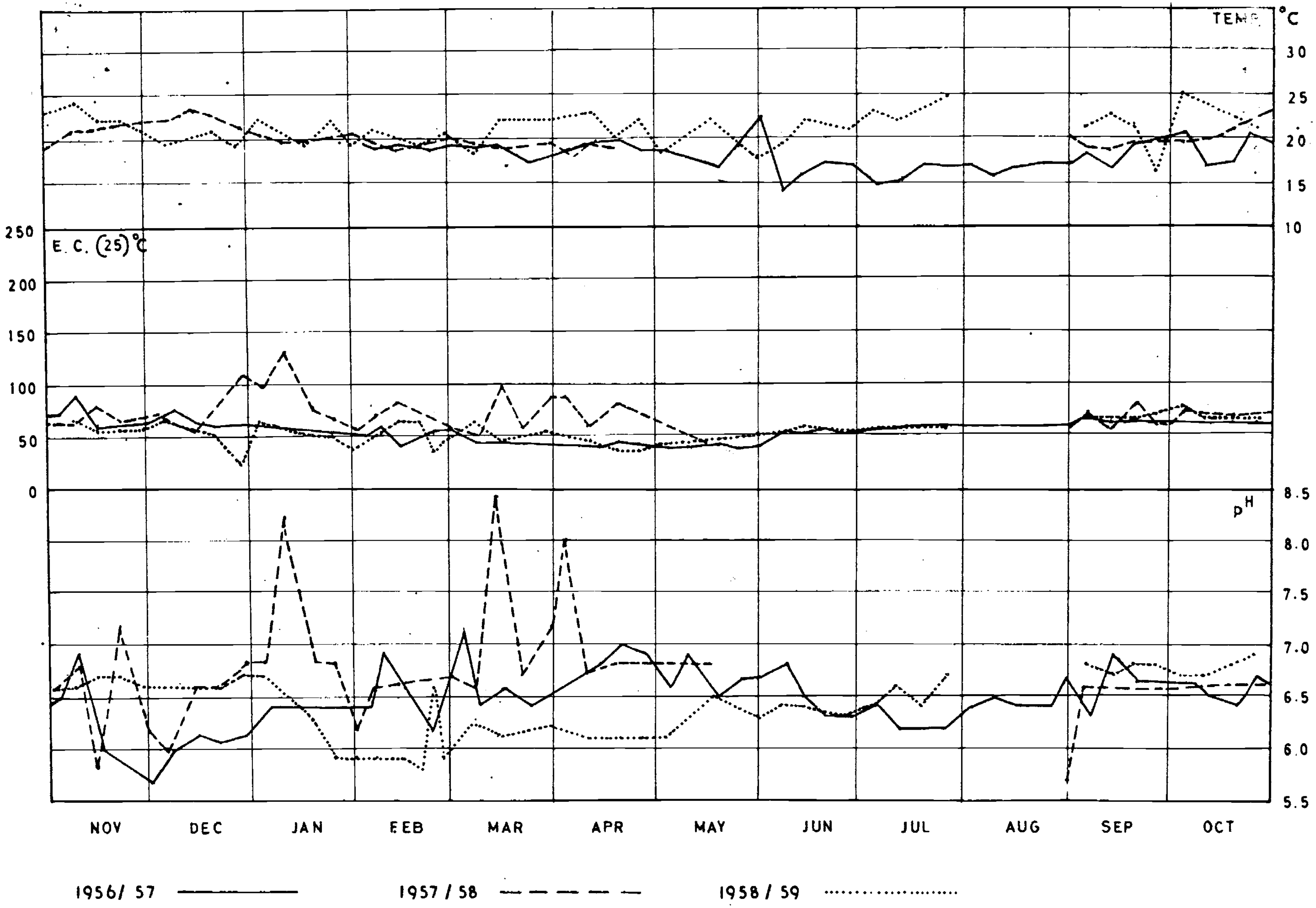
RIVER: GREAT RUAHA **STATION: MTERA** **No. IKA.5.**



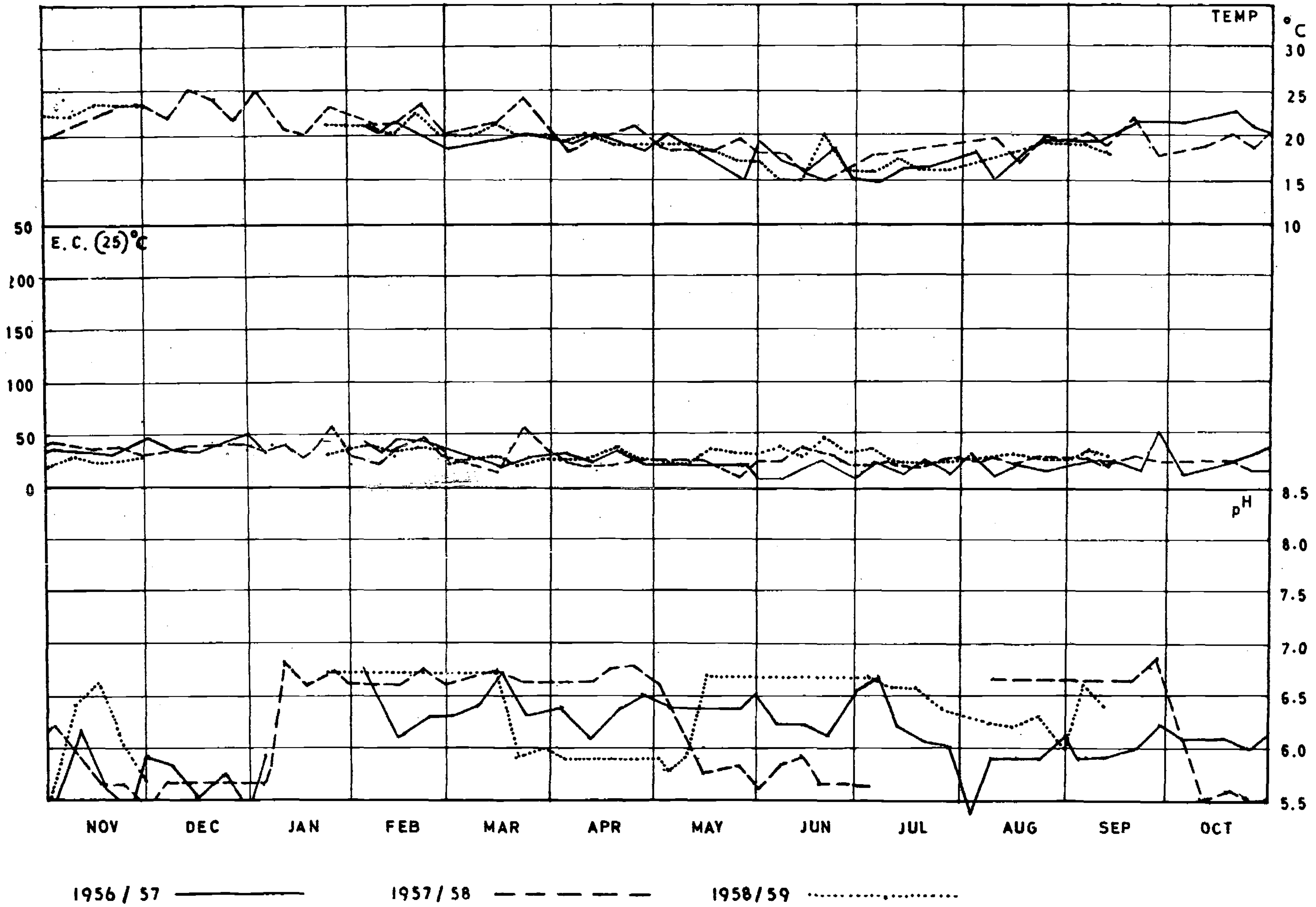
RIVER: CHIMALA STATION: CHIMALA NO: I.K.A. 7.



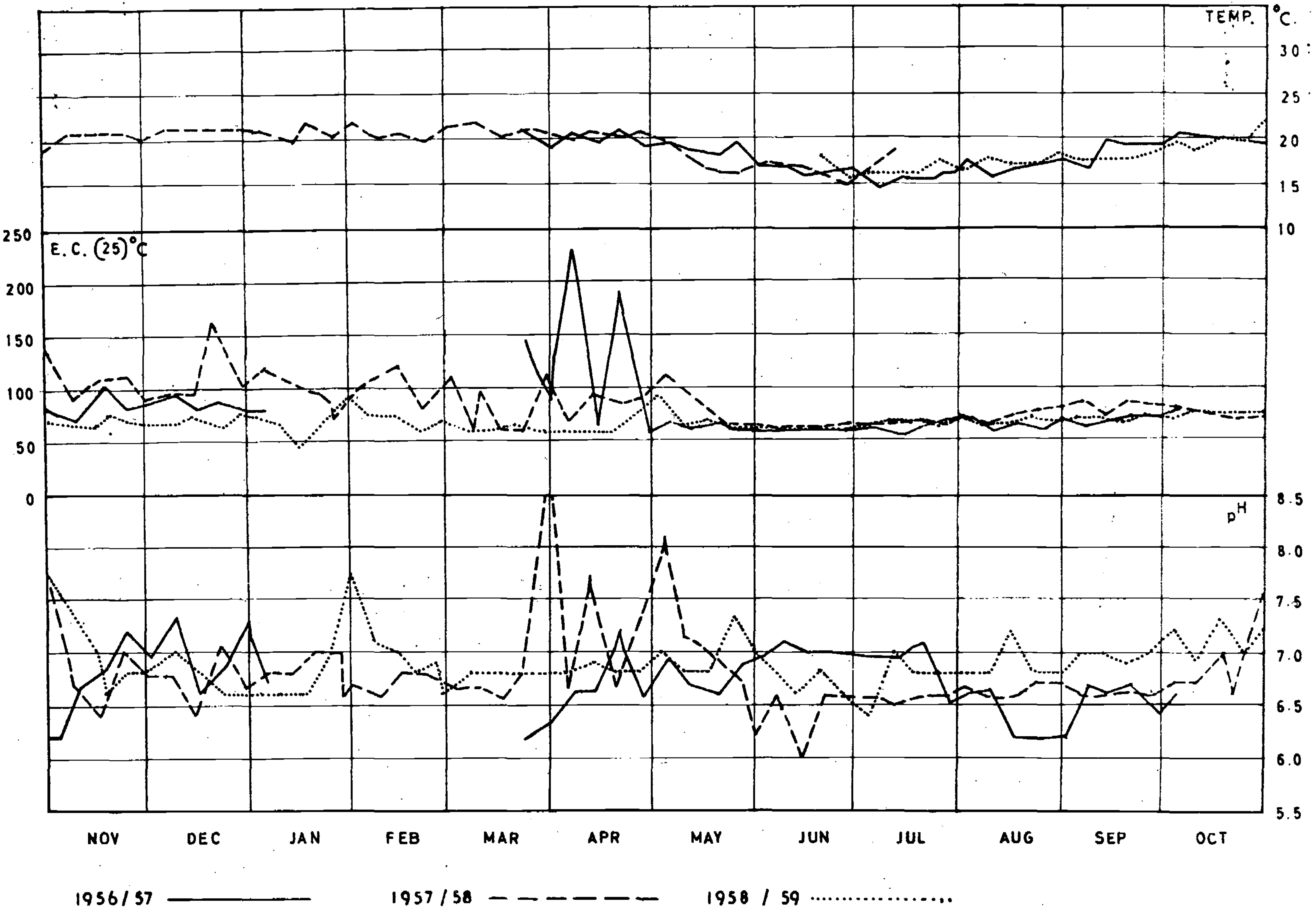
RIVER: GREAT RUAHA STATION: CHIMALA NO: IKA. 8.



RIVER : KIMANI   STATION : GREAT N. ROAD   No. IKA. 9.

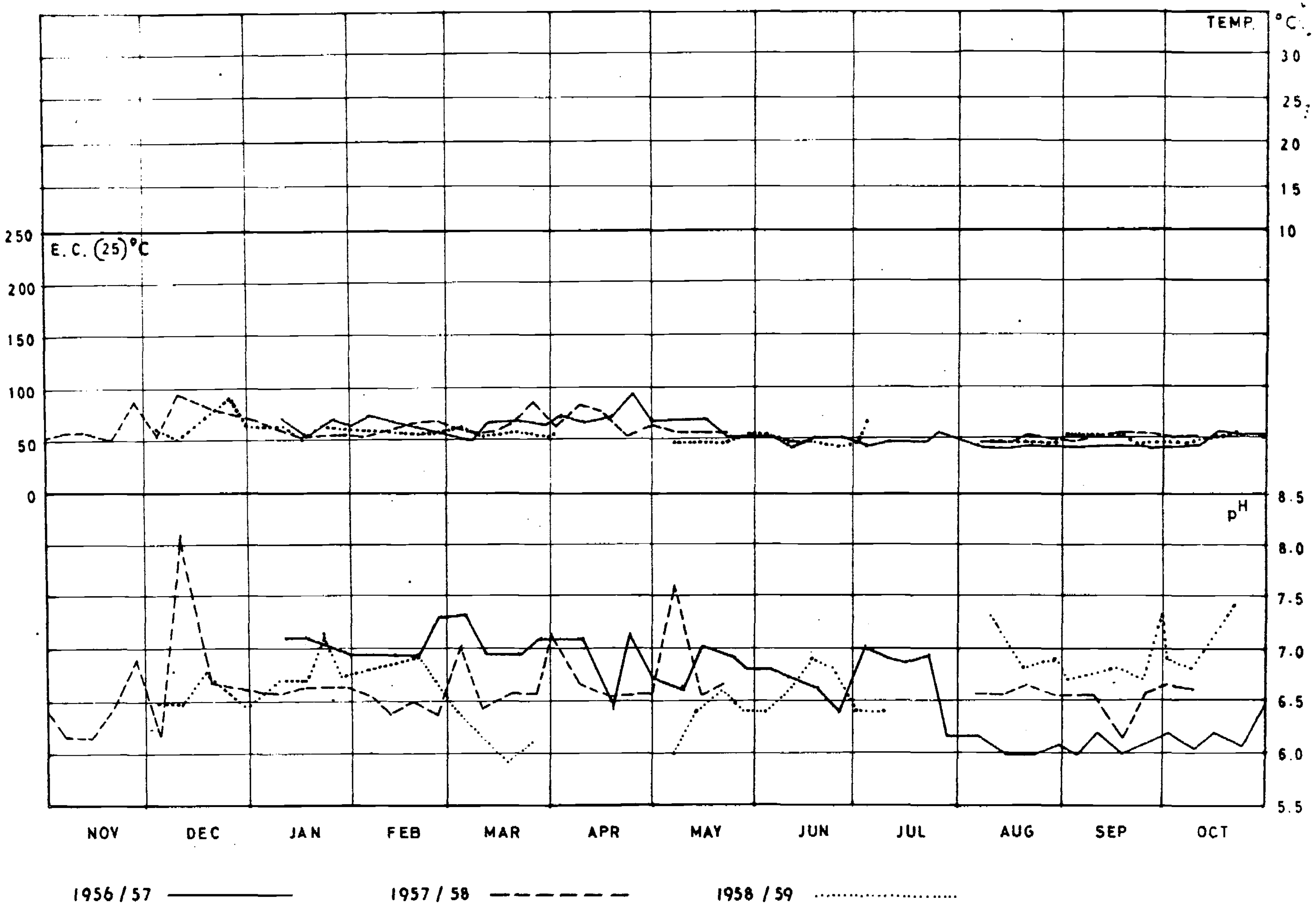


RIVER· MBARALI STATION. IGAWA No: IKA II

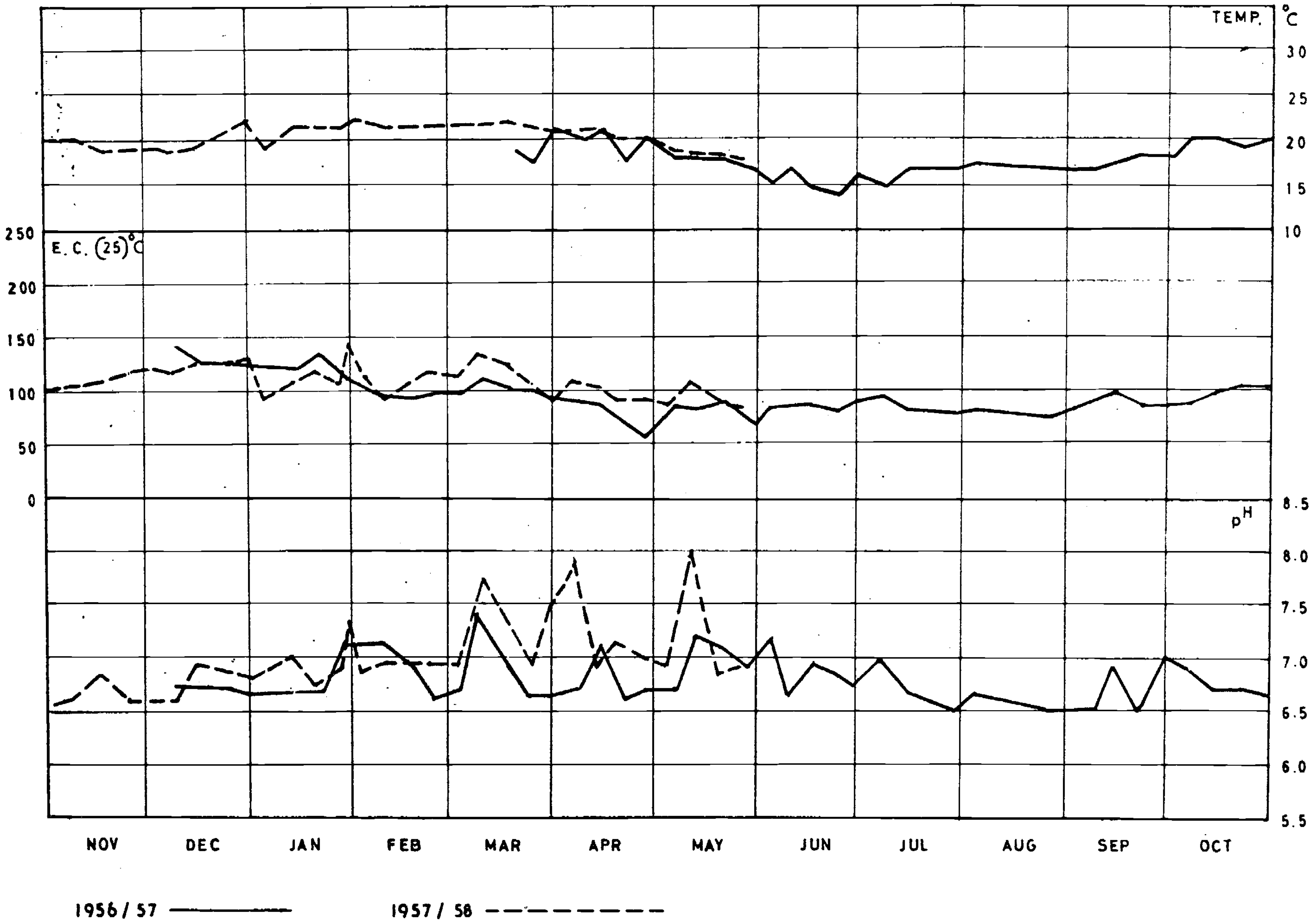


RIVER: HALALI STATION: IYAYI No: IKA 12

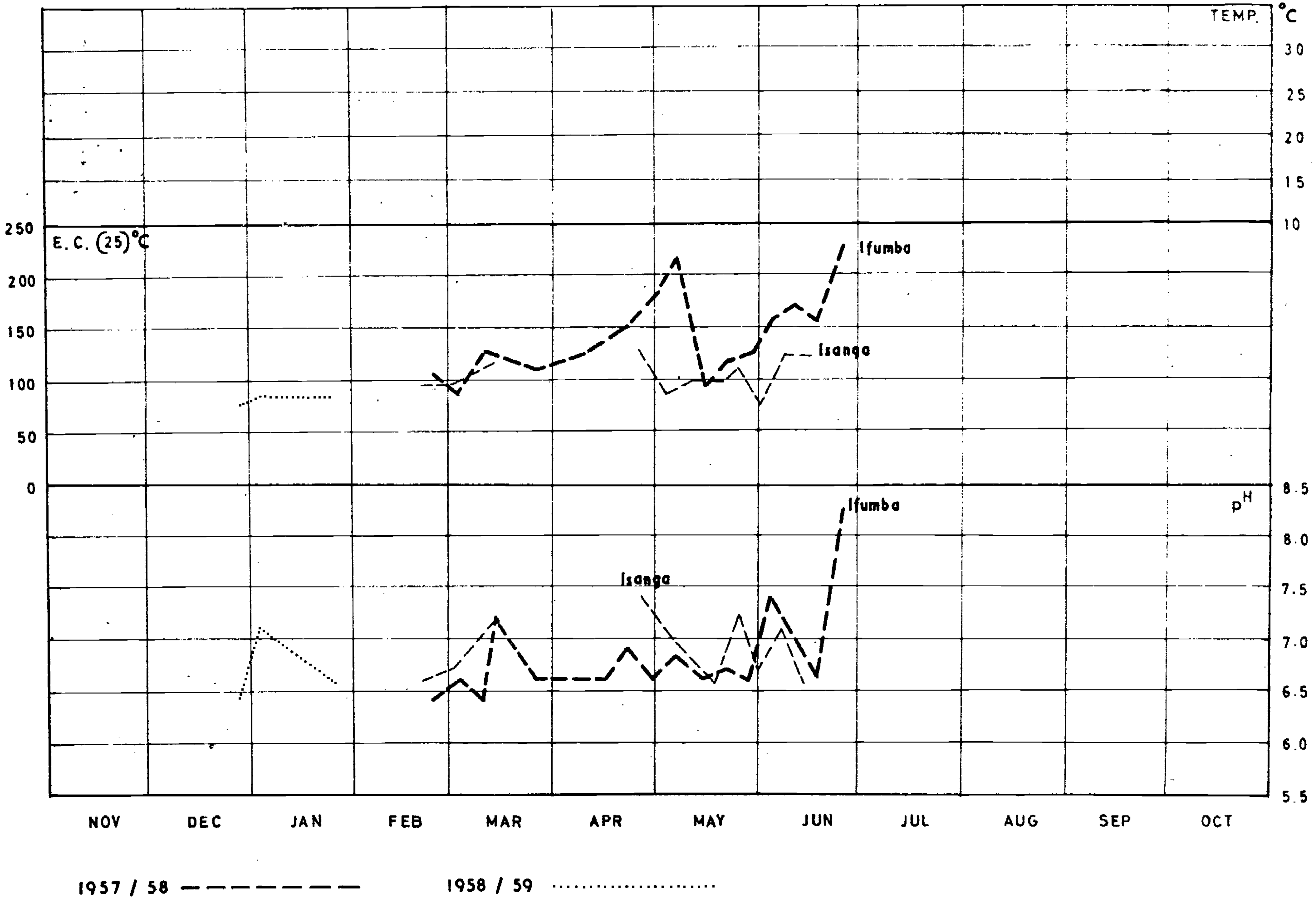
RIVER: LUKOSI **STATION: MBUYUNI (from 25.7.57 Mtandika).** **No. IKA 14**

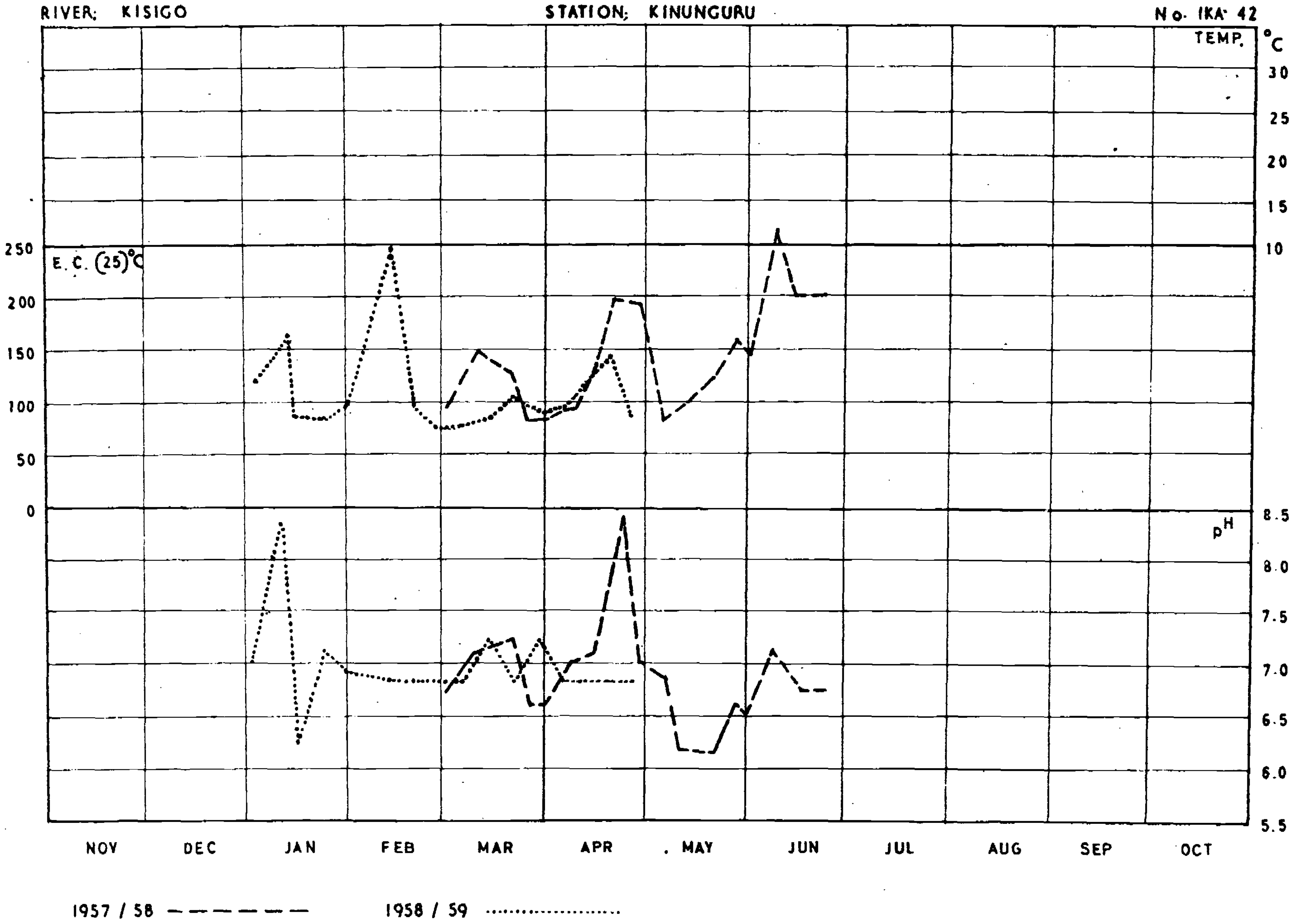


RIVER NDEMBERA STATION ILONGO No. IKA.15

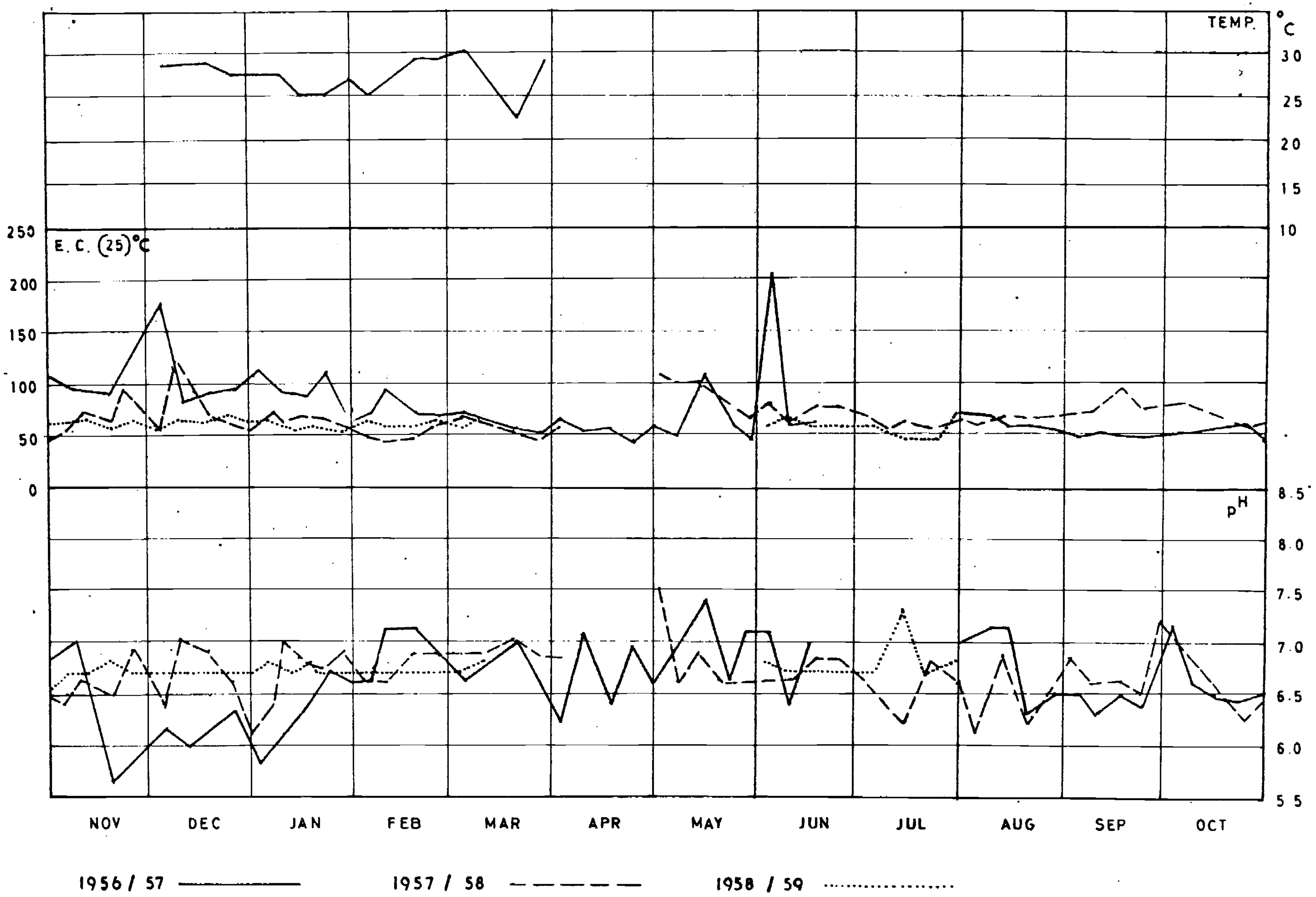


RIVER ; NJOMBE STATIONS; ISANGA & IFUMBA No's; IKA43. & IKA.29.

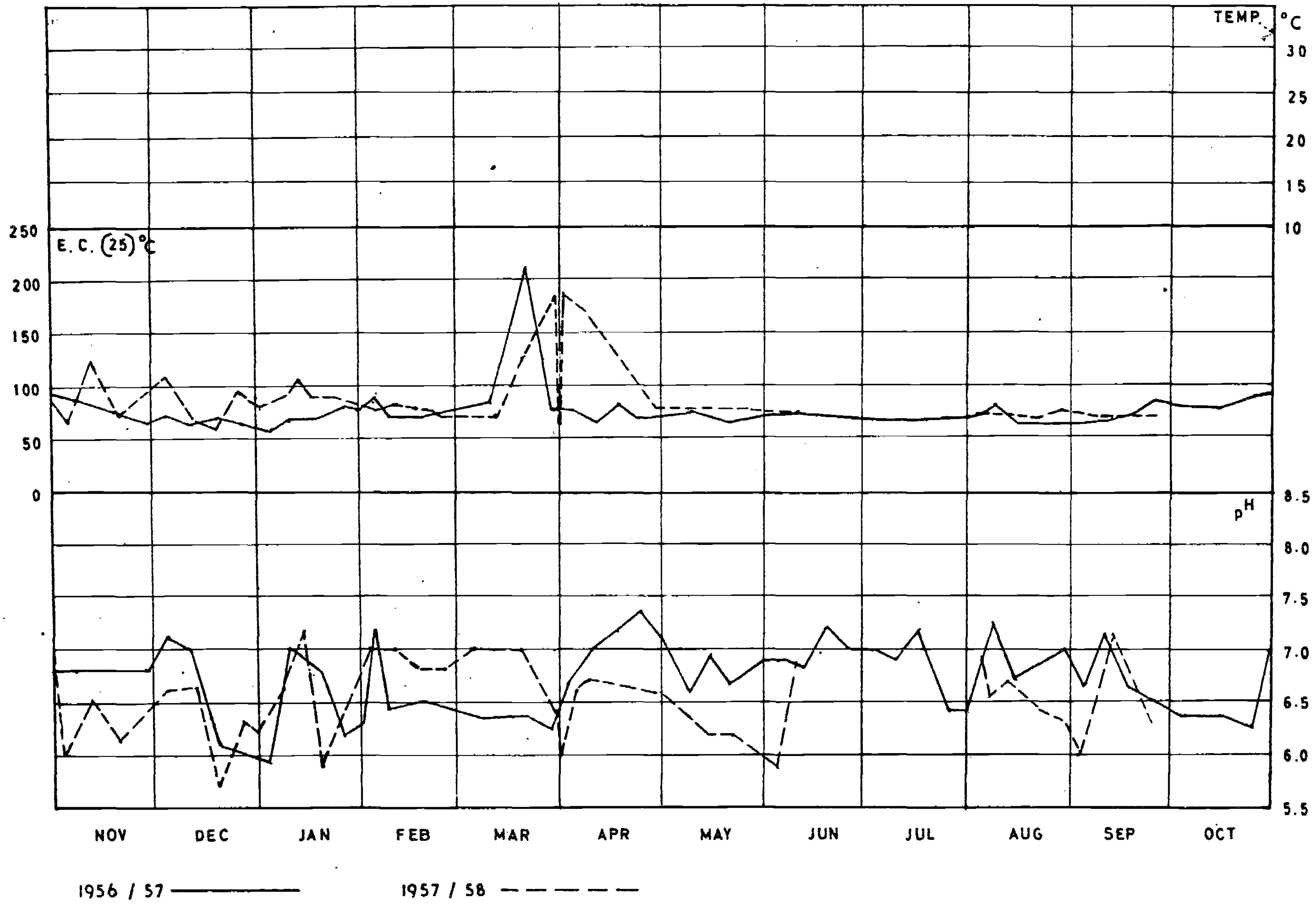



RIVER: KISIGO
STATION: KINUNGURU
No. IKA 42
TEMP. °C
30
25
20
15
10
250
200
150
100
50
0
E.C. (25)°C
8.5
8.0
7.5
7.0
6.5
6.0
5.5
pH
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
1957 / 58
1958 / 59

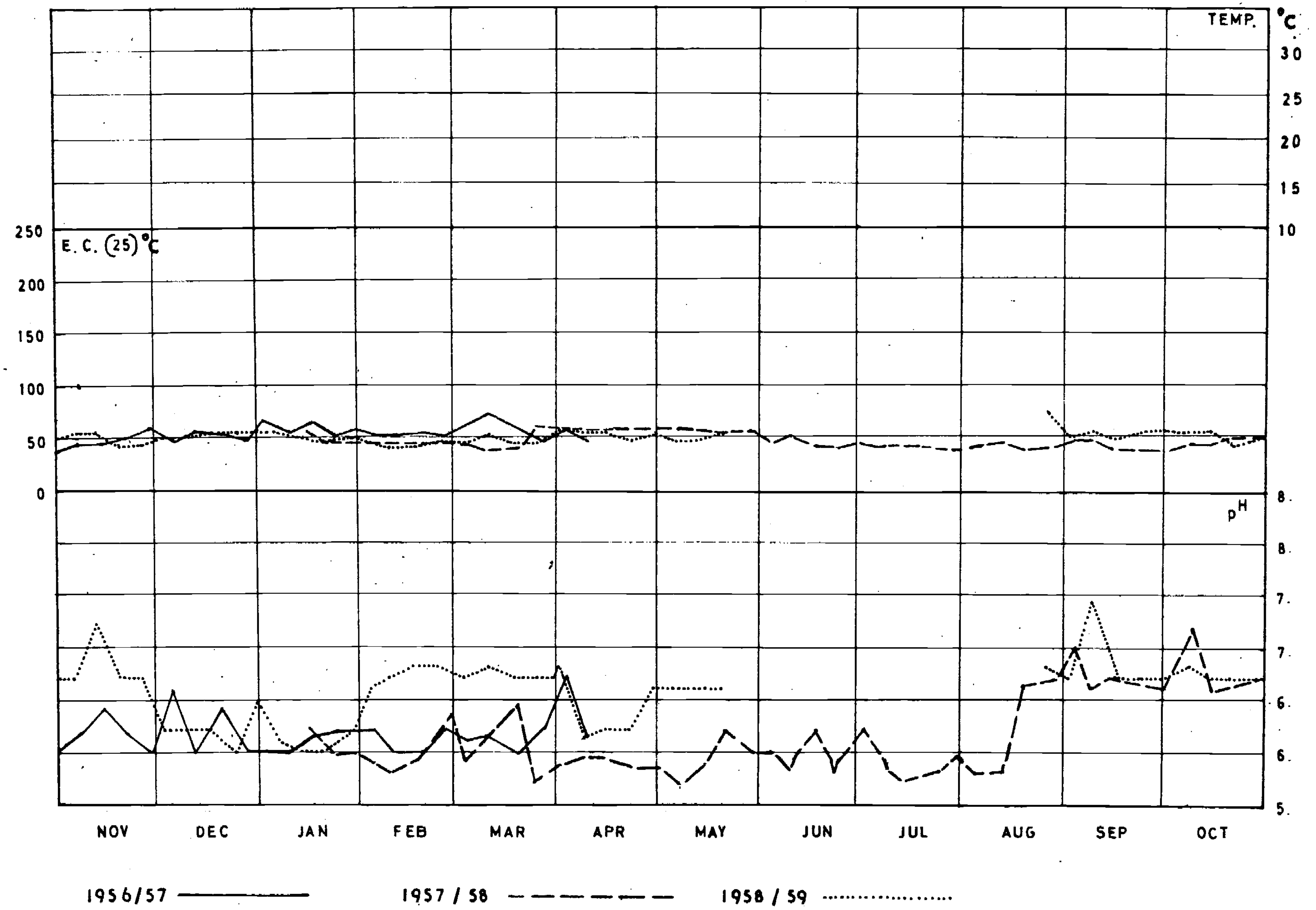
RIVER: KILOMBERO STATION IFAKARA No. IKB 2



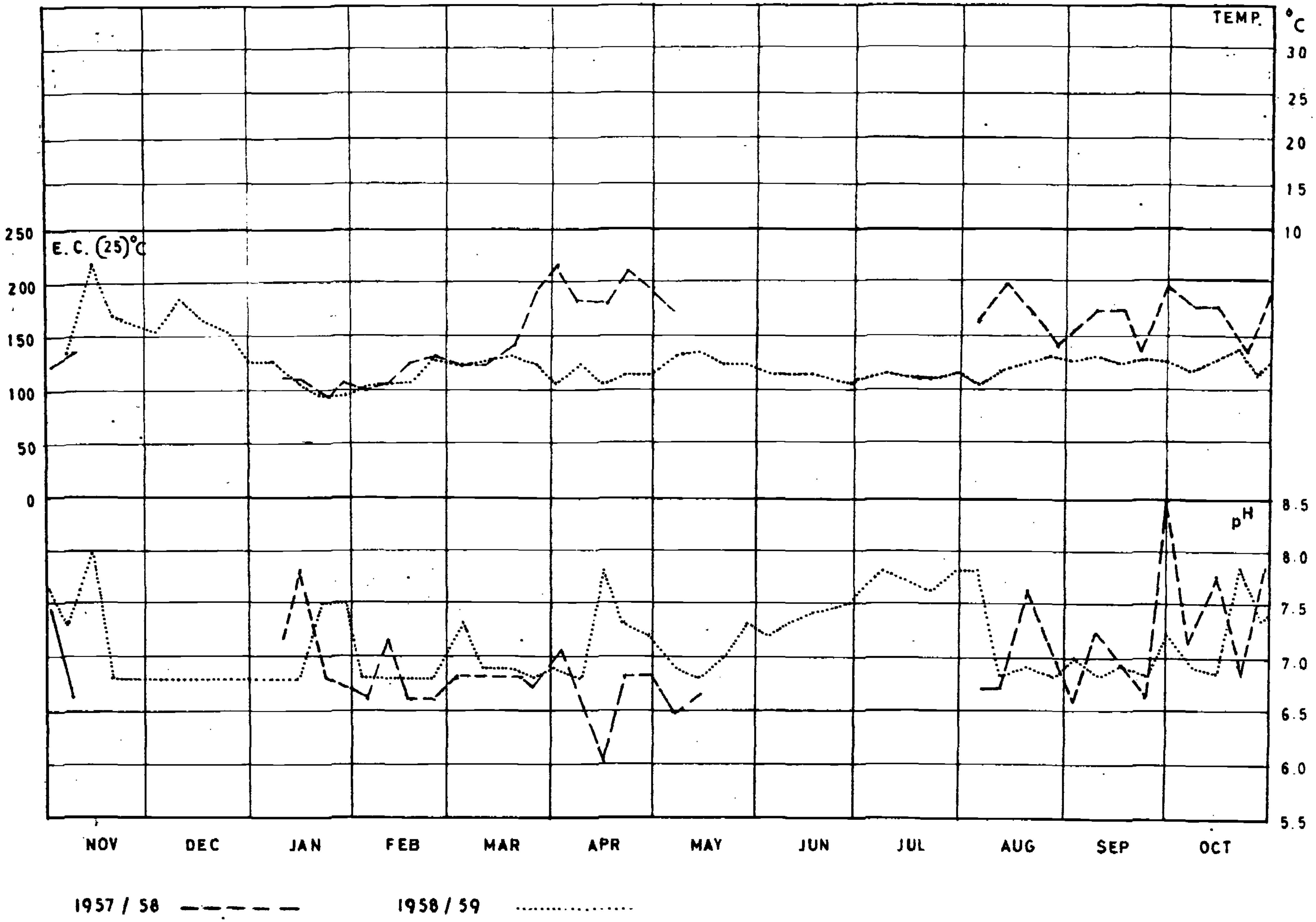
RIVER LUMEMO STATION IFAKARA No. IKB 3

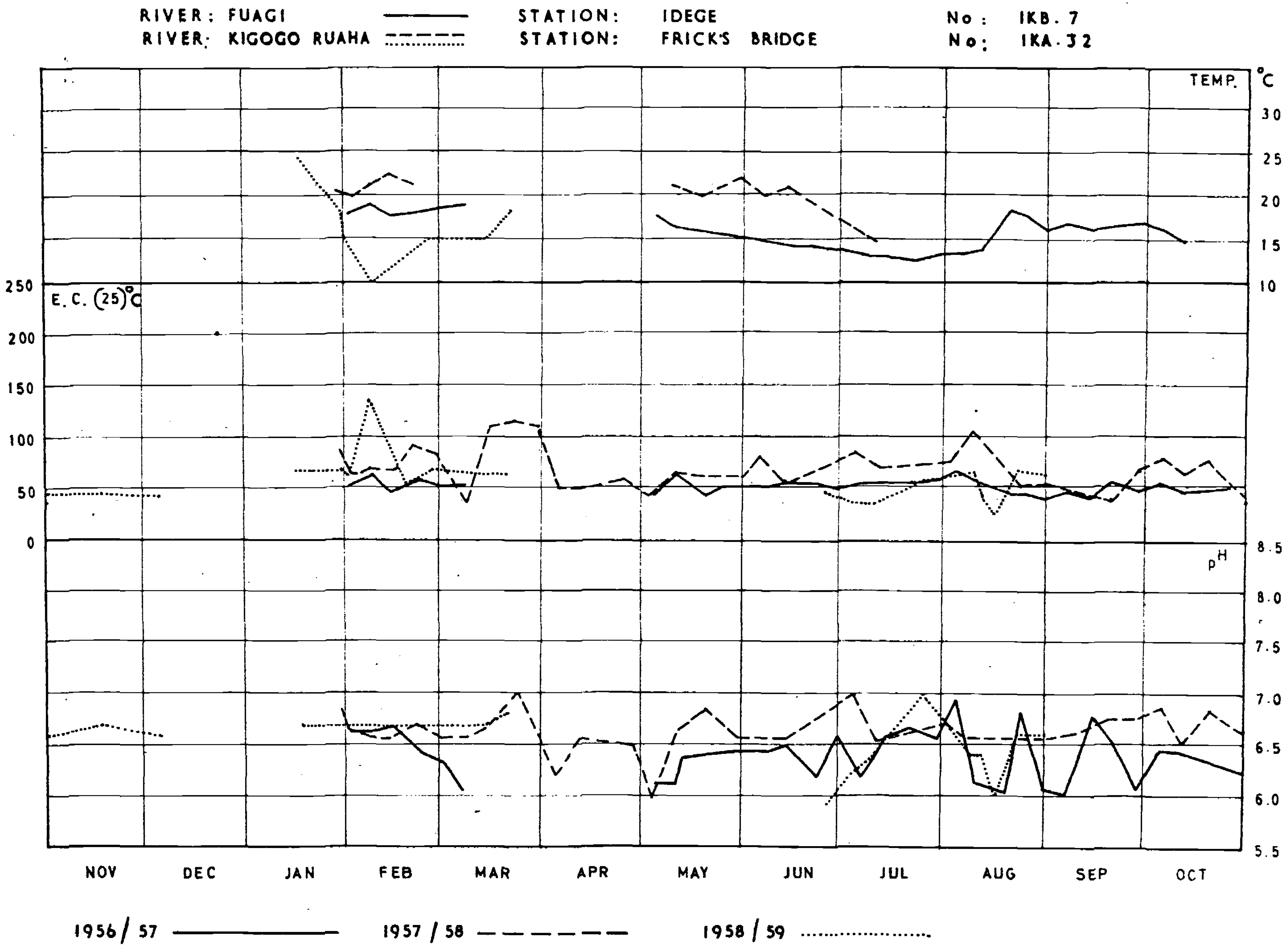


RIVER: KILOMBERO STATION: IFWEMA No: IKB 4

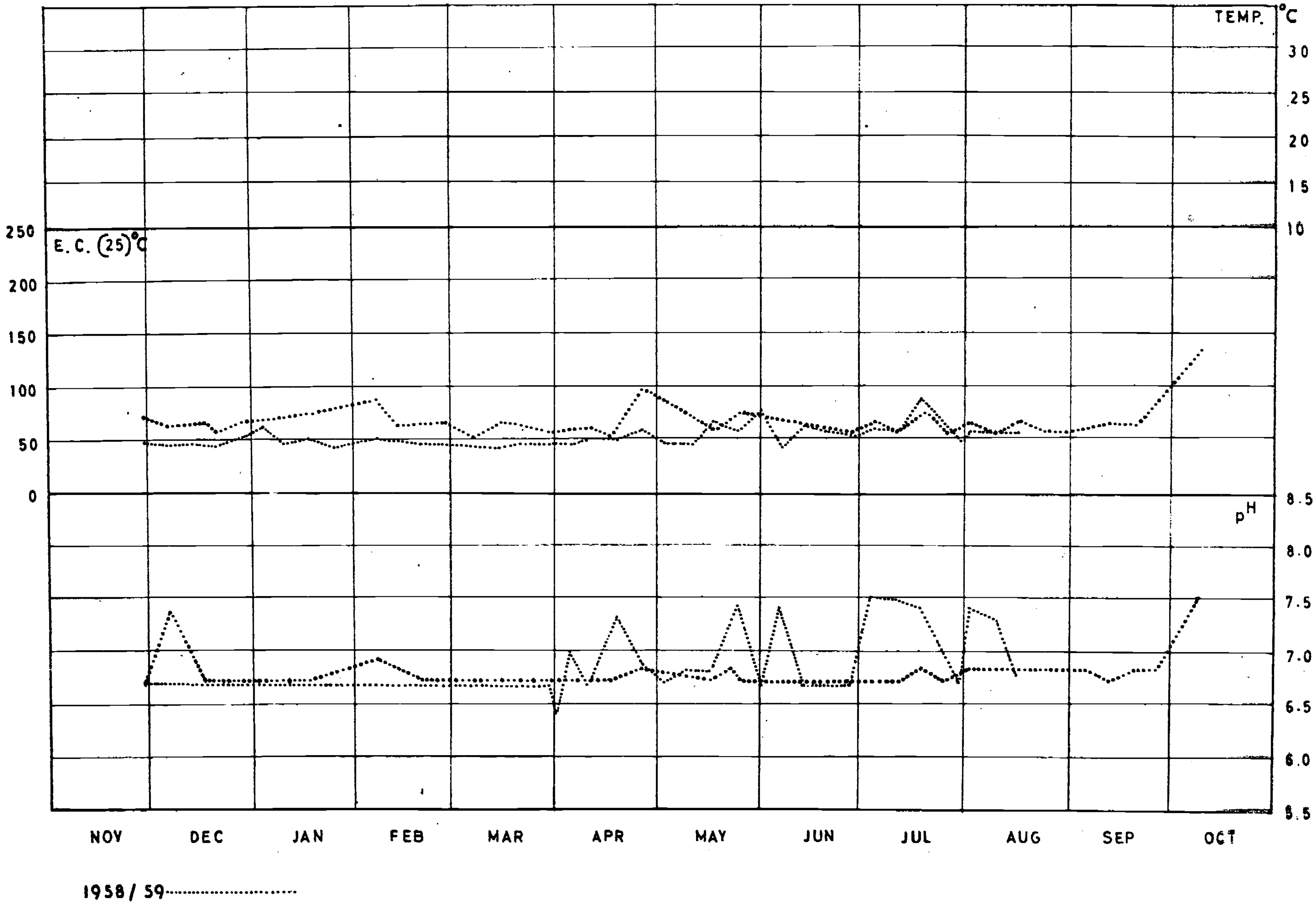


RIVER: LUHOMBERO STATION: ILONGA No. IKB 5

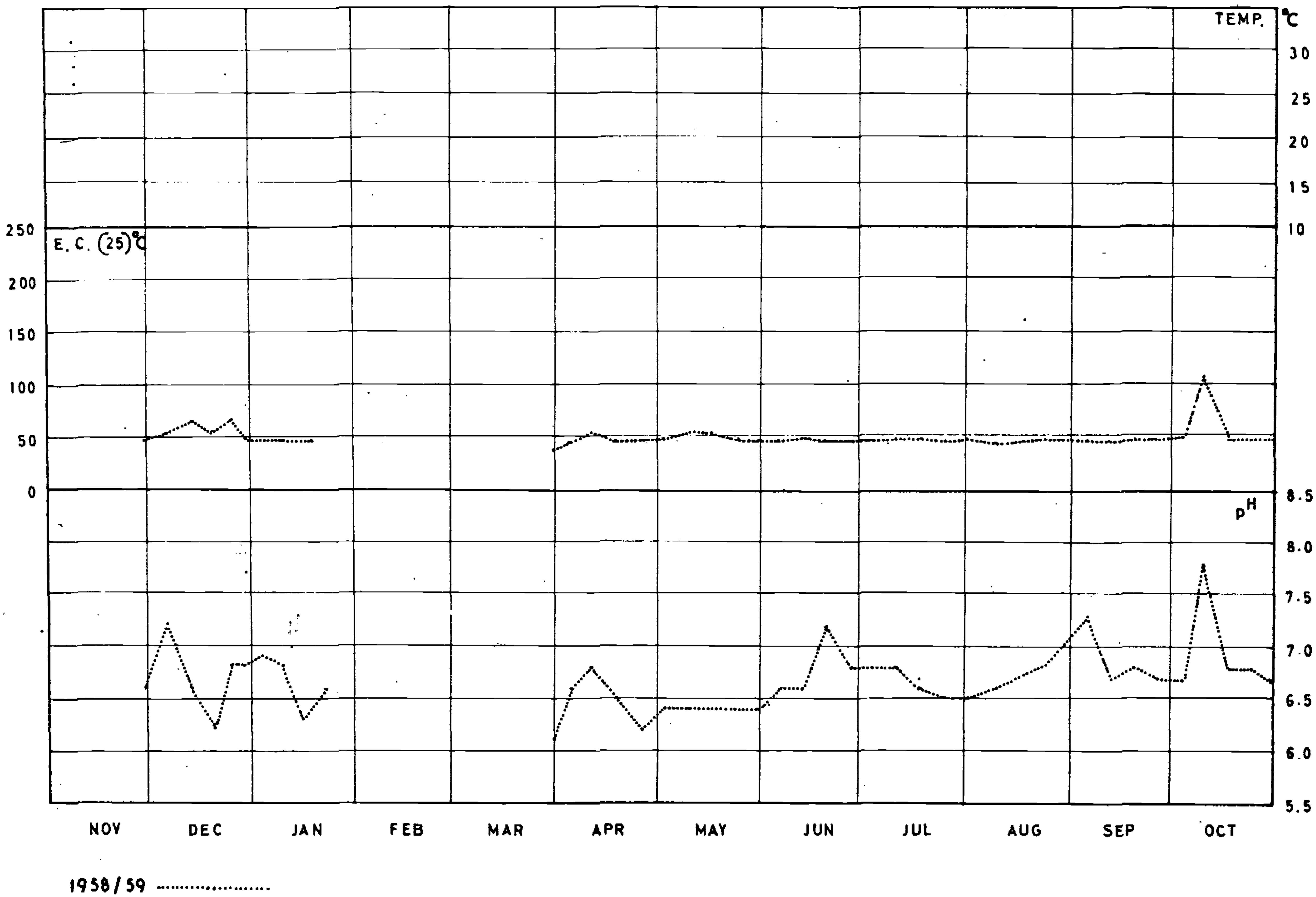



RIVER: FUAGI
STATION: IDEGE
No: IKB. 7
RIVER: KIGOGO RUAHA
STATION: FRICK'S BRIDGE
No: IKA. 32
TEMP. °C
30
25
20
15
10
E.C. (25)°C
250
200
150
100
50
0
pH
8.5
8.0
7.5
7.0
6.5
6.0
5.5
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
1956/57
1957/58
1958/59

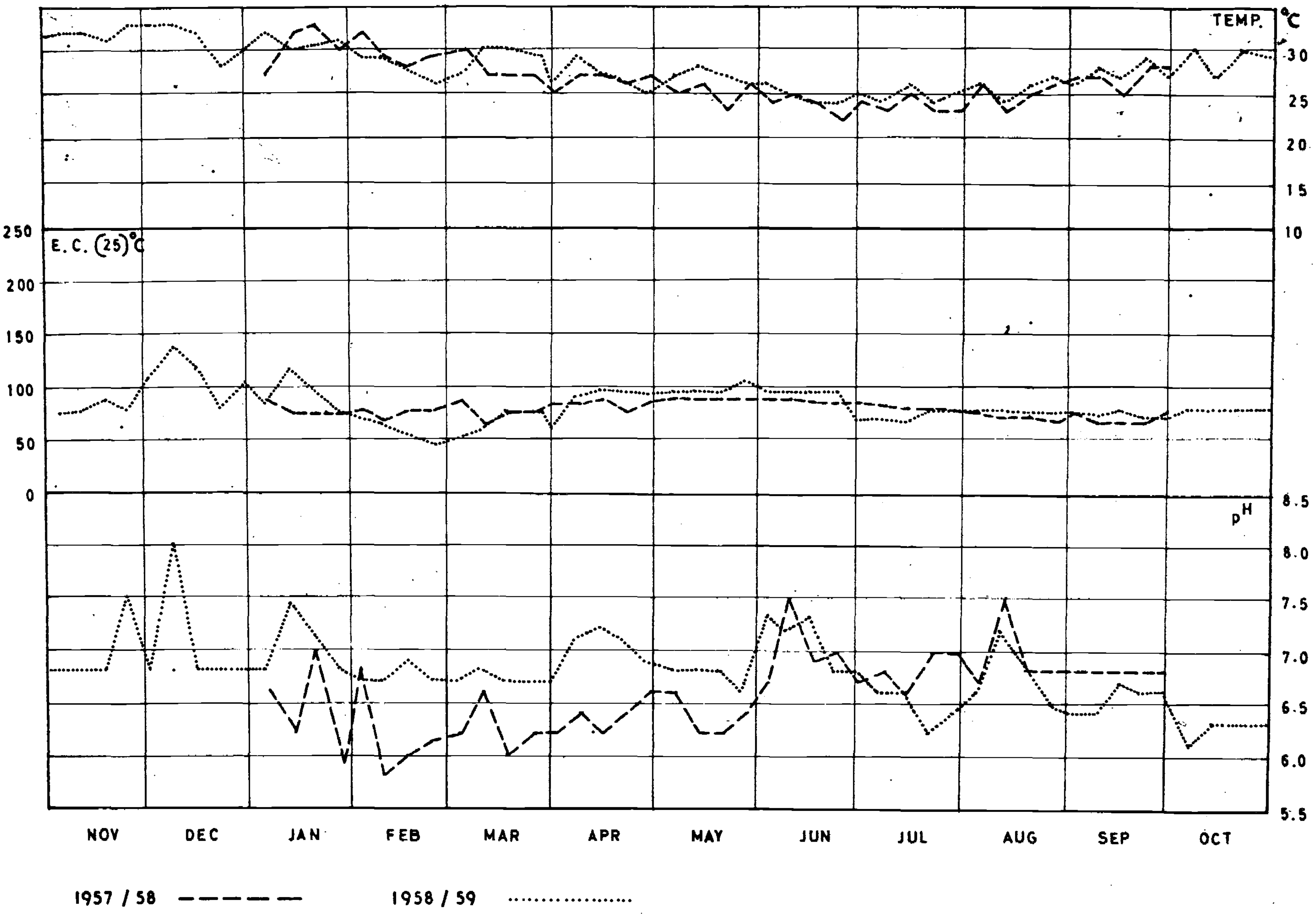
RIVER: MNEYRA ·········· STATION: TAVETA No: IKB .9.
RIVER: MPANGA ·········· STATION: MPANGA No: IKB .8.



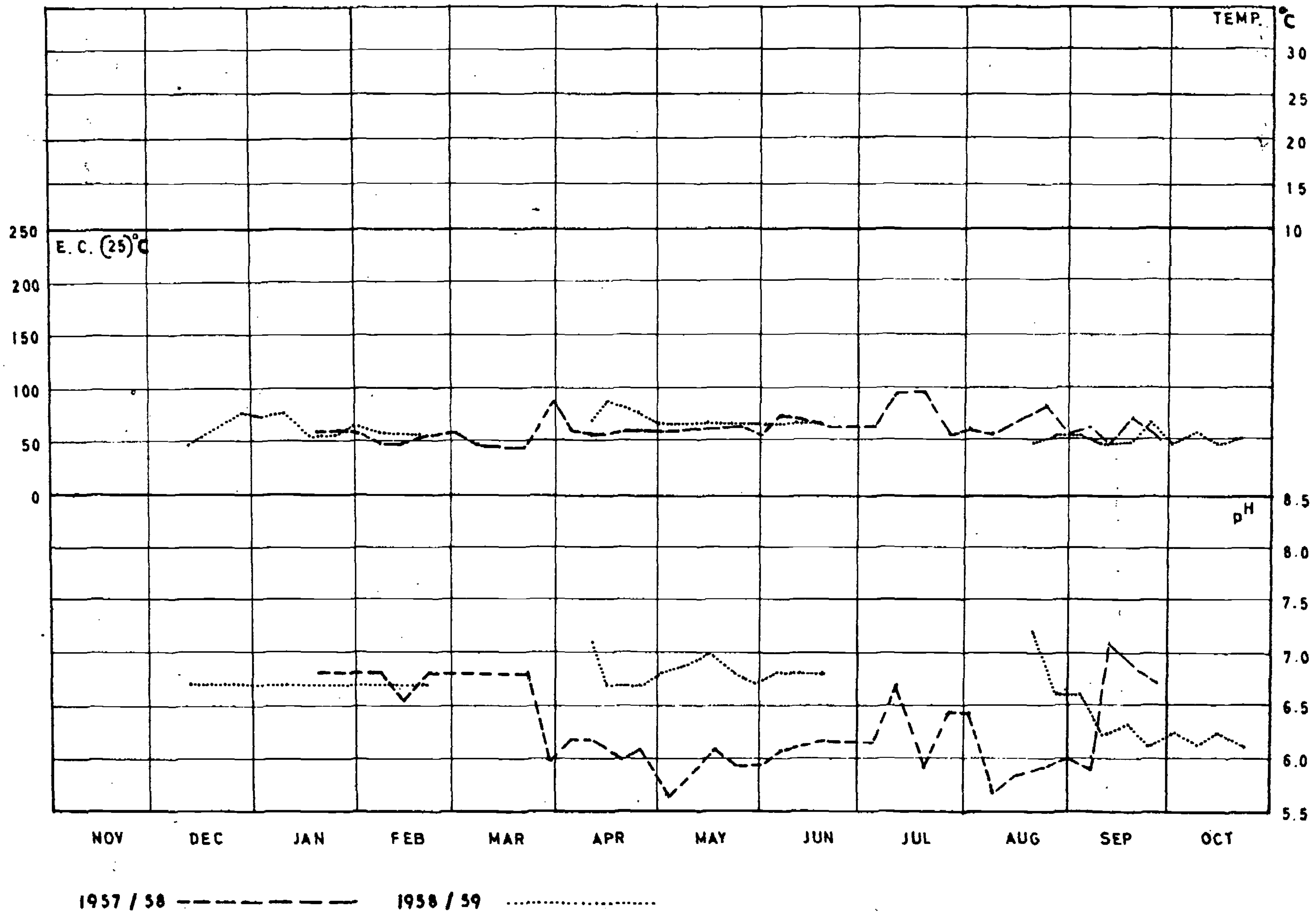
RIVER : RUHUJI STATION: MWAYAMLUNGU. No: IKB.IO.



RIVER: FURUA STATION: MALINYI No: IK B. 16



RIVER. KILOMBERO STATION. SWERO No. IKB 17



13. EVAPORATION FROM OPEN WATER

a. INTRODUCTION

Evaporation losses from a free water surface reach considerable heights in a tropical climate and are an important factor to consider for design and operation of future reservoirs. Evaporation, as met with in nature, is primarily a climatological phenomenon, but depends also on the configuration of the body of water from which the process takes place. The exact laws governing evaporation are not fully understood, and extensive research is in progress in different parts of the world to bring more light into the problem. Various formulae and methods exist for a practical evaluation of evaporation, and their accuracy invariably depends upon the extent to which implicit factors are and can be considered. In the Rufiji Basin, unfortunately, very few fragmental and often unreliable records are available on evaporation and in this chapter an attempt is made only to summarise information available in order to derive practical values for application in river regulation studies.

b. THE NATURAL LOSS OF WATER FROM CATCHMENT AREAS

The study of rainfall and runoff records in the Basin show that the greater proportion of the rain falling on a catchment area is lost by evaporation. The loss in different areas varies from a round 50% to 97% of the rainfall and is always restricted by the fact that water is not available for extensive evaporation at certain times of the year. The highest losses occur in areas with high rainfall and on eight investigated areas in the Kilombero sub-catchment the natural losses in a "wet year" is grouped around 54.5 inches with a range of dispersion from 59.5 inches to 47.2 inches. A "wet year" is the maximum rainfall year in the period 1940/41 to 1958/59, see chapter on Runoff.

A potential evapotranspiration, which is defined as the amount of water loss from an extensive vegetative-covered surface if there is at all times sufficient water for the use of the vegetation, will be greater than the figures indicated here. The evaporation from an open water surface will most likely also be higher, and according to this way of thinking it seems that the annual evaporation losses from future reservoirs in the Basin will be higher than 60 inches a year.

c. EVAPORATION PANS

The U.S. Weather Bureau Pan Class A is normally used for evaporation studies in East Africa, and pans of this type were installed at the Rujewa and the Mtanza Trial Farms and at Mtera and Igawa meteorological stations. Pan observations are also available for Dodoma, 1953 to 1959, Dar es Salaam 1958/59 and Nyamba ya Mungu on the Pangani River, 1958/59. At Rujewa three pans were installed in various ways to ascertain if some differences occur in the readings. Pan 1 is placed on a frame upon the ground. Pan 2 is dug into the ground with one inch rim above surface. Pan 3 is placed into the ground with air space around it.

Evaporation pans require especially reliable and accurate observers. Measurements on rainfall and of water added to and taken out of pan must be accurately recorded and furthermore the pan must be kept clean and watched for leakage. During wet season heavy showers may cause splash of water and in dry season, when water is scarce, a pan is often a resort for game and birds. Fences were made against game but birds and various smaller animals could not be prevented from dr drinking out of the pans. During the last few years work has been in progress by the East and Central African Territories on a design of a standard screening of evaporation pans. It is essential that such a standard screen be introduced in future pan observations.

Regardless of uncertain factors the losses from a small body of water in a pan can only be indicative on evaporation from an extensive storage. Certain coefficients must be applied for converting pan data into applicable data. Such a coefficient varies regionally and probably also seasonally. A coefficient of 0.7 has been recommended for the Class A pan, but values ranging from 0.6 to 0.8 or greater have been reported, (4, p. 163).

Results from pan observations in the Rufiji Basin are tabulated together with other evaporation records at the end of this chapter.

d. THE EVAPORATION FORMULA OF PENMAN

Penman has evolved a formula for calculating evaporation. The result of the computations are referred to as evaporation from open water and is generally applicable to smaller reservoirs. The East African Agricultural and Forestry Research Organisation has worked out modified values of various constants and coefficients to better suit the conditions in East Africa, and has kindly computed evaporation data using this method for some areas of the Rufiji Basin. The modified method is not yet published. The meteorological observations used have some deficiencies and are not up to scientific standard but the result is thought to be of great value for a preliminary estimate of evaporation.

e. PICHE ATMOMETER

The Piche Atmometer consists of a graduated glass tube with the top end closed and the bottom end flat, the flat end being covered by a standard circular piece of filter paper pressed against it by a disk. In use the tube is filled with distilled water, the paper and disk put on and the whole instrument inverted and exposed in a standard meteorological screen.

Records for a number of years are available for Piche Atmometer readings in East Africa, but the instrument has more and more gone out of use, because there is a great uncertainty if and how these records can be converted into applicable evaporation units. Records from 10 stations inside the "Tanganyika Forecast Area" are given for comparison in percentage values in a special table at the end of this chapter.

f. EVAPORATION FROM AFRICAN LAKES

The evaporation losses from the greater African Lakes have been discussed by various authors. Different methods for estimation are applied and the results also differ considerably. Information quoted is given below with source of reference.

In this respect it is of interest to mention a combination of some records from Lake Nyasa. The Water Development Department, Nyasaland, kindly supplied records from 29 evaporation pans in that country. These records are tabulated in a special way, table XVII. Ten of these pans are placed around and practically on the same level as Lake Nyasa and the median annual evaporation from them is 85.51 inches. As monthly cumulative percentages of the annual total, this evaporation can be expressed as follows:-

N	D	J	F	M	A	M	J	J	A	S	O
12.0	20.4	27.6	33.2	39.9	47.6	55.2	62.0	69.5	78.0	87.9	100.0

Mr. N.J. Cochrane (11, p. 379) gives a tentative evaporation of 31.5 inches from Lake Nyasa in the five driest months June to October. This is calculated from water budget as the average 1929-1953, the annual range being from 39.5 to 25.5 inches. During the dry season one can assume that evaporation can be fairly accurately computed this way. According to the above tabulation this evaporation corresponds to 44.8% of the annual total which consequently should be 70.3 inches. The pan factor is here assumed to be constant throughout the year and the median value is 70.3/85.51 = 0.82. The depth of evaporation from such large lakes is usually less than from smaller reservoirs. Some information on lake evaporation can be given as follows.

Lake Nyasa

61 inches, N.J. Cochrane; Lake Nyasa and the River Shire, Proc. Instn. Civ. Engrs. Vol. 8 Dec. 1957 (own formula) (11).

84 inches, F.E. Kanthak; The Fluctuations of Lake Nyasa. The Geogr. Journal, Vol. XCVIII No. 1, July 1941. (Own graphs) (1).

70.3 inches, J. Otnes; (A combination of water budget and pan observation) See above.

Lake Victoria

47.3 inches, H.E. Hurst; A short account of the Nile Basin, Phys. Dept. Paper No. 45. Cairo 1944 (Water budget, 120 cms.) (2).

60 inches, H.L. Penman 1954; Information given in Note below by H.O. Walker.

Proposed Lake Volta, Ghana

60-66 inches, H.O. Walker; Gold Coast Meteorological Dept. Departmental Note, 1955 (Various methods) (8).

Aswan Dam

110 inches, verbal information through W.N. Allan, Irrigation Consultant to the Republic of the Sudan (Deduced from a series of floating pans).

g. GENERAL CONSIDERATIONS

Dams are often built at the outlet of swamps where the natural evapotranspiration is comparatively high. This loss is automatically deducted in all downstream runoff records and under such circumstances the actual loss of water after construction of reservoir will be less than directly observed. A typical example of such a reservoir is proposed on the Ndembera River.

If a reservoir has a sufficient capacity to regulate the runoff from its catchment in such a way that no water goes to waste over the spillway, evaporation losses should be deducted for the whole year. Such a reservoir cannot always be found or built and for comparatively small reservoirs where water is ample and spills at the end of the filling period it is especially important to know what is lost by evaporation during the draw off season. This begins at the time when the reservoir is still at full supply level and lasts until the regulated flow equals the natural flow of the river.

For evaluation of monthly and seasonal evaporation, the observed data are expressed in percentage of the annual total and these percentages have been accumulated for the whole year. A summary of accumulative percentages are given at the end of this chapter and it will be seen that, with the exception of the Piche records, these figures coincide very well. If annual evaporation is estimated the seasonal distribution can be determined fairly accurately and it is recommended, until more information is available, that the more comprehensive Nyasaland records should be applied for this purpose.

h. CONCLUSIONS

From the rather fragmental records available it is not possible to give reliable evaluations on evaporation from future reservoirs in the Basin. The recommended pan coefficient of 0.7 was used for converting pan data, and together with theoretical values of the Penman formula, the results group around 80 inches of loss in a year. Even if the data varies a good deal, this is taken as the average loss which must be reckoned with. In the driest areas of the Great Ruaha sub-catchment the open water evaporation is assumed to be higher than this. The Mtera records show a very high evaporation (112.6 inches) which is of the same order as for the Aswan Dam in Egypt. At Dodoma, however, where the climate is also dry, the records show a suprisingly low evaporation (67.4 inches) and except for Dar es Salaam, in a humid climate on the Coast, this is the lowest recorded for the area. The reason for this is not understood. The climate at Mtera is hot and dry with a rainfall of less than 20 inches a year. The evaporation must be comparatively high and is set to 100 inches a year for the preliminary investigations of a reservoir at Mtera.

If reservoirs are to be built high up in the mountains and also very close to the Coast the evaporation will possibly be in the order of 60 to 70 inches or even less in a year. Until further information is compiled, which will bring more light into the problem, it can at present only be stated that the average evaporation losses from a future reservoir in the Basin most likely will be within a wide range of 60 to 100 inches a year with a probable average of 80 inches for the whole area.

i. FUTURE INVESTIGATIONS

So little is known on evaporation in Tanganyika and it is a necessity that extensive investigations should be introduced on this phenomenon.

If and when a suitable reservoir is built, measurements should be taken for accurate recordings of inflow, outflow and of water level variations in the reservoir itself and the loss computed from these data. Seepage is an implicit factor which is almost impossible to evaluate accurately, and especially in new reservoirs this factor might upset the whole equation, but as years go by the seepage has a tendency to diminish more and more and in certain reservoirs, especially in rocky valleys, it is often of a negligible order. It is important to get evaporation computed from water budget data and that a number of different pans are installed on the lake shore together with the usual meteorological instruments for a determination of pan coefficients and a comprehensive study of evaporation.

Standard screened pans should be installed together with the unscreened Class A pan and the necessary meteorological instruments at a number of places in the Basin. It is advisable that such stations are established at or near administrative centres where a close check can be maintained.

In the last years the Gun-Bellani Radiation Integrator has been introduced in evaporation studies in East Africa. It is of value that investigations continue with this instrument together with the other installations.

TABLE XV - EVAPORATION RECORDS IN THE RUFIJI BASIN

RUJEWA TRIAL FARM. Lat. S. $8^{o}37'$ - Long. E. $34^{o}16'$ - Alt. 3470 feet.

CLASS A.

PAN 1.	N	D	J	F	M	A	M	J	J	A	S	O	Inches Total
1956/57	-	-	7.1	5.9	7.3	6.7	8.3	9.0	9.6	11.2	12.5	13.7	-
1957/58	14.2	9.5	8.4	5.1	6.6	8.2	9.0	8.9	10.0	10.2	11.3	12.3	113.7
1958/59	12.3	10.3	10.5	10.1	9.9	11.4	11.9	10.7	12.3	11.7	14.1	12.7	137.9
1959/60	12.2	11.7	-	-	-	-	-	-	-	-	-	-	-
Average	12.9	10.5	8.7	7.0	7.9	8.8	9.7	9.5	10.6	11.0	12.7	12.9	122.2
%	10.6	8.6	7.1	5.7	6.5	7.2	7.9	7.8	8.7	9.0	10.4	10.5	-
% Cummulative	10.6	19.2	26.3	32.0	38.5	45.7	53.6	61.4	70.1	79.1	89.5	100.0	-
PAN 2. Pan sunk into ground, no airspace around, rim 1" above ground level.													
1956/57	-	-	7.8	5.3	6.9	5.5	7.0	7.9	8.4	9.5	9.5	11.9	-
1957/58	12.0	8.8	5.0	3.8	4.7	7.2	7.1	7.7	8.2	8.6	9.6	10.8	93.5
1958/59	11.6	8.9	8.7	9.0	8.0	9.7	10.1	7.9	8.9	8.1	10.4	10.2	111.5
1959/60	9.9	7.3	-	-	-	-	-	-	-	-	-	-	-
Average	11.2	8.3	7.2	6.0	6.5	7.5	8.1	7.8	8.5	8.7	9.8	11.0	100.6
%	11.1	8.2	7.2	6.0	6.5	7.5	8.1	7.8	8.4	8.6	9.7	10.9	-
% Cummulative	11.1	19.3	26.5	32.5	39.0	46.5	54.6	62.4	70.8	79.4	89.1	100.0	-
PAN 3. Pan sunk into ground, airspace around.													
1956/57	-	-	-	-	-	-	-	-	8.5	9.5	10.6	12.6	-
1957/58	12.5	9.3	5.2	3.7	3.0	7.2	6.7	7.8	8.4	9.9	11.0	11.1	95.8
1958/59	10.3	10.4	10.1	9.1	8.4	9.9	11.0	9.0	10.4	10.1	12.2	11.6	122.5
1959/60	11.3	8.0	-	-	-	-	-	-	-	-	-	-	-
2 years average	11.4	9.9	7.6	6.4	3.7	8.5	8.9	8.4	9.4	10.0	11.6	11.4	109.2
%	10.4	9.1	7.0	5.8	5.2	7.8	8.2	7.7	8.6	9.2	10.6	10.4	-
% Cummulative	10.4	19.5	26.5	32.3	37.5	45.3	53.5	61.2	69.8	79.0	89.6	100.0	-
Penman's Formula													
1956/57	9.7	8.6	7.0	5.2	6.8	5.5	5.5	5.5	5.7	7.2	8.5	7.8	83.0
1957/58	8.0	7.4	6.9	4.7	6.5	5.9	5.9	5.4	5.8	7.1	7.9	9.3	80.0
1958/59	9.2	7.0	6.9	5.6	5.8	6.3	6.4	5.5	5.5	6.4	7.7	8.1	80.4
Average	9.0	7.7	6.9	5.2	6.4	5.9	5.9	5.5	5.6	6.9	8.0	8.4	81.4
%	11.0	9.5	8.5	6.4	7.9	7.2	7.2	6.8	6.9	8.5	9.8	10.3	-
% Cummulative	11.0	20.5	29.0	35.4	43.3	50.5	57.7	64.5	71.4	79.9	89.7	100.0	-

TABLE XV - EVAPORATION RECORDS IN THE RUFIJI BASIN

RUJEWA TRIAL FARM. Lat. S. 8°37' - Long. E. 34°16' - Alt. 3470 feet.

Piche readings.	N	D	J	F	M	A	M	J	J	A	S	O	Inches Total
1956/57	17.3	11.8	4.5	3.1	4.9	4.6	8.0	9.9	11.1	13.1	15.0	16.7	120.0
1957/58	16.6	8.6	5.0	(4.0)	3.9	6.8	9.3	10.3	11.6	11.7	13.0	17.8	(118.6)
1958/59	16.4	8.3	6.9	4.3	4.1	6.4	8.5	10.2	12.8	14.0	14.1	13.9	119.9
Average	16.8	9.6	5.5	3.8	4.3	5.9	8.6	10.1	11.8	12.9	14.0	16.1	119.5
%	14.1	8.0	4.6	3.2	3.6	4.9	7.2	8.5	9.9	10.8	11.7	13.5	-
% Cummulative	14.1	22.1	26.7	29.9	33.5	38.4	45.6	59.1	64.0	74.8	86.5	100.0	-

IGAWA. Lat. S. 8°46' - Long. E. 34°22' - Alt. 3594 feet.

PAN CLASS A.

1957/58	13.3	11.8	10.0	8.0	13.0	9.4	8.6	9.7	10.2	11.7	12.7	13.7	132.1
1958/59	14.1	8.4	9.9	7.3	8.3	11.2	12.3	10.8	10.0	9.5	10.5	11.4	123.7
Average	13.7	10.1	10.0	7.6	10.6	10.3	10.5	10.2	10.1	10.6	11.6	12.6	127.9
%	10.7	7.9	7.8	5.9	8.3	8.1	8.2	8.0	7.9	8.3	9.1	7.8	-
% Cummulative	10.7	18.6	26.4	32.3	40.6	48.7	56.9	64.9	72.8	81.1	90.2	100.0	-

MTERA. Lat. S. 7°5' - Long. E. 35°59' - Alt. 2209 feet.

CLASS A.

1957/58	18.8	11.2	14.3	8.1	9.0	(9.5)	9.9	10.5	11.5	15.9	19.3	21.3	159.3
1958/59	23.2	17.5	9.8	7.1	7.7	12.0	11.5	10.7	11.3	13.6	17.8	20.2	162.4
Average	21.0	14.4	12.0	7.6	8.4	10.7	10.7	10.6	11.4	14.7	18.5	20.8	160.8
%	13.0	9.0	7.5	4.7	5.2	6.7	6.7	6.6	7.1	9.1	11.5	12.9	-
% cummulative	13.0	22.0	29.5	34.2	39.4	46.1	52.8	59.4	66.5	75.6	87.1	100.0	-

MTANZA TRIAL FARM. Lat. S. 7°52' - Long. E. 38°23' - Alt. 115 feet.

PAN CLASS A.

1956/57	-	-	9.3	7.9	9.1	5.8	9.2	10.2	10.5	12.7	14.2	13.5	(118.0)
1957/58	8.0	7.5	9.5	7.6	7.5	7.5	5.2	5.0	5.3	6.9	8.0	9.5	87.5

Penman's Formula

1956/57	8.7	8.0	6.1	5.9	6.5	5.8	5.3	5.0	5.0	6.0	7.1	8.0	77.4
1957/58	7.0	7.3	8.0	6.8	7.1	6.7	6.0	5.2	5.2	6.2	7.4	8.9	81.8
Average	7.8	7.6	7.1	6.4	6.8	6.2	5.7	5.1	5.1	6.1	7.2	8.5	79.6
%	9.8	9.6	8.9	8.0	8.5	7.8	7.2	6.4	6.4	7.7	9.0	10.7	-
% Cummulative	9.8	19.4	28.3	36.3	44.8	52.6	59.8	66.2	72.6	80.3	89.3	100.0	-

TABLE XVI - PAN EVAPORATION AT DODOMA

DODOMA. Lat. S. 6°11' - Long. E. 35°45' - Alt. 3305 feet.

	N	D	J	F	M	A	M	J	J	A	S	O	Inches Total
1953/54	12.6	9.3	6.2	7.6	9.0	7.5	7.4	7.2	7.8	8.7	9.6	11.8	104.7
1954/55	11.7	9.0	9.6	5.9	7.1	6.6	7.0	6.6	7.0	8.5	8.6	9.6	97.2
1955/56	9.0	(9.3)	(8.2)	5.5	8.2	5.0	7.3	6.3	7.6	7.8	9.3	9.2	92.7
1956/57	9.3	-	-	-	-	-	-	-	-	-	-	-	-
1957/58	10.4	9.5	8.7	6.6	4.8	6.6	6.4	7.4	7.8	8.0	8.5	11.8	96.5
1958/59	12.1	6.2	6.1	4.1	4.4	6.1	7.3	7.2	8.0	9.0	9.5	10.1	90.1
Average	11.2	8.7	7.8	5.8	6.7	6.4	7.1	6.9	7.6	8.4	9.1	10.5	96.3
%	11.6	9.0	8.1	6.0	7.0	6.7	7.4	7.2	7.9	8.7	9.5	10.9	-
% Cummulative	11.6	20.6	28.7	34.7	41.7	48.4	55.8	63.0	70.9	79.6	89.1	100.0	-

Data up to November 1956 are obtained from Geological Survey of Tanganyika. Observations are taken on the roof of the Geological Survey's Laboratories and it is reported that the pan was partly sheltered against wind. Observations after that date are obtained from the Provisional Engineer P.W.D. Dodoma and figures given are the averages from readings in two pans at Dodoma reservoir.

TABLE XVII

PAN EVAPORATION FOR VARIOUS STATIONS IN NYASALAND PROTECTORATE

Accumulated Monthly Average Evaporation Expressed as a Percentage of Annual Average
Percentages worked out from the Data kindly obtained from Director of Water Development-Nyasaland.

Station	Elevation. Feet	N	D	J	F	M	A	M	J	J	A	S	O	Years of obs.	Annual Total Inches.
Karongo	1575	12.5	21.3	28.3	35.2	42.5	49.7	56.9	63.6	70.3	78.7	82.2	100	6	78.65
Deep Bay	1560	12.1	21.7	29.2	34.8	42.3	48.7	55.6	61.9	69.2	77.9	87.7	100	6	85.21
Mzuzu	4160	13.5	22.0	29.4	35.4	42.8	49.2	55.4	60.5	66.6	74.9	85.0	100	7	58.39
Mkata Bay	1585	12.5	19.9	25.9	29.5	33.0	37.1	44.3	52.0	61.4	74.6	86.8	100	5	75.85
Chinteche	1560	9.4	17.4	23.8	29.4	36.1	42.4	50.6	58.7	67.9	78.1	88.1	100	5	67.15
Mzimba	4445	12.3	19.7	25.3	30.4	36.7	43.1	50.4	57.1	64.4	73.7	85.0	100	6	84.96
Likoma Island	1600	11.9	20.9	27.7	33.7	40.5	47.7	55.2	62.2	69.8	77.9	87.4	100	6	99.16
Kota Kota	1560	13.3	22.3	28.1	33.1	39.4	46.5	53.3	59.2	67.1	76.3	86.4	100	6	90.28
Salima	1675	12.8	20.7	27.5	32.5	39.2	46.1	53.1	58.7	66.0	75.4	86.1	100	5	75.43
Agr.Res.Stn.	3600	12.0	19.3	25.6	31.2	37.8	44.3	50.9	57.1	64.7	74.0	85.5	100	4	71.58
Lilongwe	3500	11.6	19.9	27.4	33.6	40.7	47.5	54.3	60.2	67.2	75.7	86.2	100	7	64.38
Chipoka	1570	11.4	19.2	25.6	31.7	39.4	47.5	55.1	62.1	69.8	78.6	88.2	100	6	85.81
Monkey Bay	1580	10.9	20.1	28.4	34.3	41.6	49.9	57.7	64.5	71.6	79.8	88.9	100	6	89.04
Chingoni	4500	16.9	23.2	29.7	35.0	42.0	48.1	55.2	60.2	67.0	74.8	86.6	100	1	68.27
Fort Johnson	1580	10.4	19.1	26.9	33.4	41.3	49.9	57.4	64.1	71.2	79.7	88.8	100	7	90.07
Zomba	3140	12.3	20.9	28.5	35.1	42.4	49.2	55.4	60.9	67.5	76.0	86.2	100	4	54.25
Matope	1525	11.1	18.7	26.0	32.6	39.9	47.2	54.2	60.2	67.2	75.8	86.3	100	4	84.06
Sombani	2000	10.8	18.3	25.7	33.2	41.9	50.1	58.1	65.6	73.9	81.0	89.3	100	3	93.44
Limbe	3600	10.6	18.8	27.7	35.5	42.0	48.9	55.2	60.3	66.8	75.6	85.9	100	5	73.83
Chileke	2527	12.3	19.9	26.9	32.8	40.1	46.7	53.3	59.1	66.5	75.2	86.2	100	4	98.24
Blantyre	3450	11.1	19.1	27.6	34.9	42.6	49.8	56.2	61.5	67.7	76.0	86.6	100	7	61.53
Mudi Dam	3500	11.3	19.9	27.0	34.4	41.7	48.6	54.8	60.7	67.7	76.2	86.8	100	3	65.98
Chisombesi	3500	15.6	25.2	33.7	41.3	48.4	55.7	61.5	66.0	73.4	79.7	87.7	100	2	67.91
Chikwawa	350	11.7	19.9	27.2	34.1	41.7	49.0	55.4	60.3	66.4	74.7	85.5	100	7	71.83
Naming'omba	3500	11.7	20.3	29.3	37.2	45.2	51.4	57.5	62.4	68.2	76.5	86.8	100	7	64.03
Swazi	2000	12.0	21.8	30.8	40.7	47.7	54.1	59.7	64.6	70.1	78.0	87.3	100	2	57.81
Alimenda	2000	9.6	20.3	27.8	35.7	43.7	50.8	57.7	62.6	67.9	76.0	85.7	100	2	83.08
Makanga	175	12.7	21.4	29.4	36.3	44.1	51.5	58.2	63.3	69.2	76.6	86.6	100	5	77.23
Port Herald	120	12.2	21.4	29.8	38.0	45.8	52.8	59.3	64.3	70.2	77.8	87.0	100	6	86.16

Maximum and minimum are underlined

Note: The pan used is the "Standard PWD Pan, Kenya". It is 4 feet in diameter and has a depth of 15 inches and water is maintained within 2 or 3 inches of the top. The pan is raised 4 inches above ground level.

TABLE XVIII - EVAPORATION FROM A PICHE ATMOMETER EXPRESSED IN MONTHLY PRECENTAGES OF THE ANNUAL AVERAGE

Calculated from records obtained from EAMD

STATION	N	D	J	F	M	A	M	J	J	A	S	O	No. of Years
Dodoma	12.2	8.6	5.9	5.3	5.4	5.6	7.1	7.7	8.6	9.6	11.1	12.9	9
Iringa	10.9	7.0	4.2	4.5	4.3	5.8	7.6	8.8	10.4	11.4	12.1	13.0	9
Kigoma	6.0	5.0	5.5	5.4	5.7	5.1	7.0	9.4	11.9	14.1	13.8	11.1	10
Kondoa	11.1	7.7	7.4	7.2	7.4	5.9	6.4	7.0	7.9	8.9	10.5	12.6	7
Lindi	9.3	7.8	6.1	5.9	5.8	5.6	8.7	10.2	10.9	10.5	9.6	9.6	10
Mbeya	12.4	8.0	5.6	5.2	5.2	4.7	5.3	7.1	8.6	10.0	12.7	15.2	9
Mpwapwa	11.9	9.2	6.6	4.4	4.7	4.9	7.3	8.8	9.1	9.8	11.0	12.3	5
Sao Hill	13.0	8.4	4.3	4.1	3.9	4.7	6.2	7.6	8.6	10.7	13.8	14.8	7
Songea	12.4	7.2	4.4	4.1	4.1	5.0	6.2	7.6	9.3	10.7	13.7	15.3	9
Tabora	9.2	5.4	4.9	4.6	4.5	4.8	6.4	9.1	10.9	12.0	13.4	14.8	10
Median	11.5	7.8	5.6	4.9	4.9	5.1	6.7	8.3	9.2	10.6	12.7	13.0	-
Accumulated	11.5	19.3	24.9	29.8	34.7	39.8	46.5	54.8	64.0	74.6	87.0	100.0	-

Note: The annual totals are not included in this tabulation as these may be confusing.

TABLE XIX - EVAPORATION

Summary of cummulative percentages

Area	Method	N	D	J	F	M	A	M	J	J	A	S	O	Remarks
"Tang. Forecast" Area	Piche	11.5	19.3	24.9	29.8	34.7	39.8	46.5	54.8	64.0	74.6	87.0	100	Median of 10 stations.
Dodoma	Pan	11.6	20.6	28.7	34.7	41.7	48.4	55.8	63.0	70.9	79.6	89.1	100	5 years average.
Mtera	Pan	13.0	22.0	29.5	34.2	39.4	46.1	52.8	59.4	66.5	75.6	87.1	100	2 years average.
Rujewa	Pan No.1	10.6	19.2	26.3	32.0	38.5	45.7	53.6	61.4	70.1	79.1	89.5	100	3 years average.
""	Pan No.2	11.1	19.3	26.5	32.5	39.0	46.5	54.6	62.4	70.8	79.4	89.1	100	3 years average.
""	Pan No.3	10.4	19.5	26.5	32.3	37.5	45.3	53.5	61.2	69.8	79.0	89.6	100	2 years average.
""	Penman	11.0	20.5	29.0	35.4	43.3	50.5	57.7	64.5	71.4	79.9	89.7	100	2 years average.
Mtanza	Penman	9.8	19.4	28.3	36.3	44.8	52.6	59.8	66.2	72.6	80.3	89.3	100	2 years average.
Lake Nyasa	Pan	12.0	20.4	27.6	33.2	39.9	47.6	55.2	62.0	69.5	78.0	87.9	100	Median of 10 pans on shore of lake.
Nyasaland	Pan	12.0	20.0	27.6	34.2	41.7	48.8	55.3	60.8	67.7	76.2	86.7	100	Median of 29 pans.

TABLE XX - SUMMARY OF ANNUAL VALUES

RUJEWA TRIAL FARM

Pan (122.2 x 0.7) inches = 85.5 inches

Penman = 81.4 inches

IGAWA METEOROLOGICAL STATION

Pan (160.8 x 0.7) inches = 112.6 inches

DODOMA

Pan (96.3 x 0.7) inches = 67.4 inches

LUMEMO TRIAL FARM

Penman = 81.6 inches

MTANZA TRIAL FARM

Pan (103.0 x 0.7) inches = 72.1 inches

Penman = 79.6 inches

DAR ES SALAAM (1 year 1958/59)

Pan (65.5 x 0.7) inches = 45.9 inches

MALINDI, COAST KENYA, (2 years 1956 and 1957)

Pan (65.4 x 0.7) inches = 45.9 inches

NYUMBA YA MUNGU, PANGANI RIVER, (1 year 1958/59)

Pan (107.3 x 0.7) inches = 75.1 inches

14. SUMMATION CURVE ANALYSES

a. INTRODUCTION

The River Flow Summation Curve, also termed the Mass Curve, is one of the most suitable methods for studying the effect of various Storage Capacities provided on a river and for the utilization of water in its practical aspects. This method has been used on river regulation studies in the Rufiji Basin and various data derived from such analyses are tabulated and also presented in graph form in this report. The establishment and application of Summation Curves are described by the Author in an article in "Water Power" (12) and for more detailed information of the method, reference is made to that source.

The actual summation curves, 28 in number, are not included in this report. They are drawn on rolls of transparent graph paper and have been handed over to the Director of Water Development and Irrigation Department. It is hoped, as new data are received from the field, that these discharges will be added to the previous totals and the curves extended. New curves should also be established for other important areas and as years pass by one will then get better material for river regulation evaluation on the Rufiji and its tributaries.

b. REGULATION CURVES

The annual regulation curves show the resultant regulated flow over the dry season for any effective reservoir capacity located upstream of the point under consideration. The regulated flow may be defined as the minimum flow in the regulation year when storage is utilised for obtaining a flow as even as possible at a given point. An annual regulation curve commences at the point of minimum discharge and ends at the point of average discharge over the total regulation year. In certain instances a regulation curve can be extended for regulation studies over more years. This has not been done in studies on the Rufiji. Very often the evaporation from a reservoir is so high that it is not economical to store water for extensive periods and furthermore the observation period is too short for reliable analyses on long time regulation.

The regulation curves for the stations analysed are given in table and graph form at the end of this chapter.

c. FLOOD REDUCTION CURVE

These curves relate the size of effective reservoir capacity on a river to the corresponding maximum flood obtained under regulated conditions. It is then assumed that all reservoir capacities are utilised for cutting the flood peaks off in such a way as to get the maximum flow as even and as small as possible at the station under consideration.

The flood reduction curves will only apply if the actual flood contribution from the partial unregulated subcatchment between the reservoir and the station does not exceed the computed regulated flood. For this purpose a reservoir can only contribute to the extent of regulation of its own catchment.

It can be mentioned that 1956 was a very heavy rainfall year for the whole south eastern part of Tanganyika. At many stations this is the maximum observed since 1940. The flood reduction curves this year can therefore be considered as very unfavourable and were applied on studies of flood control.

Flood regulation curves for the stations analysed are given in table and graph form at the end of this chapter.

d. FILLING AND TAPPING PERIODS

The lengths of filling and tapping periods are calculated and tabulated together with the other regulation and flood reduction data records. It is of interest to know how long a time it takes to fill different reservoirs and especially the length of the tapping period is important for studies on evaporation losses. In calculations of the duration of filling and tapping periods, it is assumed that water at all times is let out of reservoir so as to even out the river flow as much as possible at the stations to which the data apply.

e. PERCENTAGE CURVES

The regulation and flood reduction curves are expressed in percentage of average values. Storage capacity is calculated as a percentage of average annual runoff at the station. This figure is called the storage percentage and explains what portion of the average annual runoff can be held by the reservoir. The corresponding regulated flow over the dry season is expressed as a percentage of average rate of flow at the station. This figure is called the regulation percentage. If the regulation percentage is 100 it means that the dry season flow that year equals the long time average flow of the river provided the appropriate storage capacities were in existance. The corresponding regulated flood for each storage percentage is also calculated as a percentage of average annual rate of flow. This figure is called the flood regulation percentage.

Experience has proved that catchments of similar hydrological character produce nearly equivalent regulation curves when expressed in percentage values. This often permits the use of the curves in adjacent areas and for other points on the same river. Furthermore, it is possible to group the curves for the different stations according to relative storage requirements.

For stations where observations are available for 1956, the flood reduction curves are shown graphically in percentage values at the end of this chapter. Some percentage regulation curves are also shown graphically. A closer study of these curves is of interest, with regard to their particular application in the Rufiji Basin.

TABLE XXI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER RUFIJI STATION STIEGLER'S GORGE NO 1K 3 CATCHMENT AREA 61 106 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 18 050 000 ACRE FEET, OR 24 976 CUSECS.

STORAGE CAPACITY.	REGULATED FLOW DURING THE DRY SEASON, CUSECS.					LENGTH OF TAPPING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOW, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0	2 900	4 500	3 600	2 500	1 800	0	0	0	0	0	0	11.6	18.0	14.4	10.0	7.2
1 000 000	9 879	11 776	11 403	9 237	8 498	124	129	118	116	124	5.5	39.6	47.1	45.7	37.0	34.0
2 000 000	13 680	15 243	14 944	12 995	11 509	142	154	183	147	176	11.1	54.8	61.0	59.8	52.0	46.1
3 000 000	17 000	18 345	17 531	16 260	14 200	160	172	204	162	203	16.6	68.1	73.4	70.2	65.1	56.9
4 000 000	20 000	20 992	19 949	19 270	16 627	173	195	214	173	214	22.2	80.1	84.0	79.9	77.2	66.6
5 000 000	22 880	23 541	22 274	21 630		181	202	219	207		27.7	91.6	94.3	89.2	86.6	
6 000 000	25 631	26 051	24 532	23 920		187	211	227	231		33.2	102.6	104.3	98.2	95.8	
7 000 000		28 275					218				38.8		113.2			
8 000 000		30 571					222				44.3		122.4			
9 000 000		32 813					273				49.9		131.4			
10 000 000		34 657					276				55.4		138.8			
11 000 000		36 450					285				60.9		145.9			
12 000 000		38 218					287				66.5		153.0			

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 :6 600 000	27 268					191					36.6	109.2				
1956 12 500 000		39 184					287				69.3		156.9			
1957 :6 800 000			26 381					230			37.7			105.6		
1958 :7 200 000				26 390					242		39.9				105.7	
1959 :5 200 000					19 212					222	28.8					76.9

REMARKS

NOTE: SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXI

RUFIJI BASIN SURVEY – HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER LITTLE RUAHA STATION IRINGA NO 1KA 2 CATCHMENT AREA 1 127 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 444 000 ACRE FEET, OR 614 CUSECS.

STORAGE CAPACITY.	REGULATED FLOW DURING THE DRY SEASON, CUSECS.					LENGTH OF TAPPING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOW, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0	130	199	205	136	124	0	0	0	0	0	0	21.1	32.4	33.4	22.1	20.2
10 000	230	334	309	246	273	94	97	75	71	84	2.2	37.4	54.4	50.3	40.0	44.4
20 000	278	380	370	313	320	128	121	97	84	128	4.5	45.2	61.9	60.2	50.9	52.1
30 000	312	420	420	360	357	148	132	109	109	143	6.7	50.8	68.4	68.4	58.6	58.1
40 000	345	450	464	403	391	155	141	119	125	158	9.0	56.2	73.3	75.5	65.6	63.7
50 000	375	480	501	440	421	172	161	180	138	179	11.2	61.0	78.1	81.6	71.6	68.5
60 000		510	528	475	448		170	188	149	188	13.5		83.0	85.9	77.3	72.9
80 000		568	580	530	501		180	197	191	197	18.0		92.5	94.4	86.3	81.6
100 000		625	630	579			195	215	207		22.5		101.8	102.6	94.3	
120 000		680	675	626			199	226	215		27.0		110.7	109.9	101.9	
140 000		728	719				208	231			31.5		118.5	117.1		

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 : 62 000	428					203					13.9	69.7				
1956 : 168 000		798					219				37.8		130.0			
1957 : 158 000			760					237			35.6			123.8		
1958 : 147 000				685					260		33.1				111.5	
1959 : 99 000					545					235	22.3					88.7

REMARKS

NOTE: SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER GREAT RUAHA STATION KIDATU NO 1KA 3 CATCHMENT AREA 30 905 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 2 386 000 ACRE FEET, OR 3 302 CUSECS.

STORAGE CAPACITY.	REGULATED FLOW DURING THE DRY SEASON, CUSECS.					LENGTH OF TAPPING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY, %	REGULATED FLOW, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959		1955	1956	1957	1958	1959
0	484	484	454	454	398	0	0	0	0	0	0	14.7	14.7	13.7	13.7	12.1
100 000	1 095	1 152	1 170	1 119	1 096	127	126	146	118	118	4.2	33.2	34.9	35.4	33.9	33.2
200 000	1 450	1 520	1 492	1 498	1 482	155	145	165	146	142	8.4	43.9	46.0	45.2	45.4	44.9
300 000	1 774	-	1 770	1 831	1 792	158	-	186	157	187	12.6	53.7	-	53.6	55.5	54.3
400 000	2 080	2 142	2 035	2 078	2 058	171	192	198	213	198	16.8	63.0	64.9	61.6	62.9	62.3
500 000	2 361	-	2 285	2 311	-	181	-	204	221	-	21.0	71.5	-	69.2	70.0	-
600 000	2 642	2 648	2 528	2 537	2 540	188	207	213	227	213	25.1	80.0	80.2	76.6	76.8	76.9
700 000	2 907	-	2 762	2 757	-	192	-	220	231	-	29.3	88.0	-	83.6	83.5	-
800 000	3 170	3 128	2 988	2 940	3 007	195	215	225	252	224	33.5	96.0	94.7	90.5	89.0	91.1
1 000 000		3 590	3 434	3 363			221	229	257		41.9		108.7	104.0	101.8	
1 200 000		4 040	3 870	3 721			228	233	266		50.3		122.4	117.2	112.7	
1 400 000		4 480	4 295				231	240			58.7		135.7	130.1		
1 600 000		4 912	4 713				235	244			67.1		148.8	142.7		
1 800 000		5 340					239				75.4		161.7			
2 000 000		5 760					242				83.8		174.4			
2 200 000		6 175					245				92.2		187.0			

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 : 874 000	3 360					197					36.6	101.8				
1956 : 2 280 000		6 340					247				95.6		192.0			
1957 : 1 675 000			4 867					245			70.2			147.4		
1958 : 1 421 000				4 139					270		59.6				125.3	
1959 : 921 000					3 278					227	38.6					99.3

REMARKS

NOTE: SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER GREAT RUAHA STATION MBUYUNI NO 1KA 4 CATCHMENT AREA 28 774 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 1 712 000 ACRE FEET, OR 2 369 CUSECS.

STORAGE CAPACITY.	REGULATED FLOW DURING THE DRY SEASON, CUSECS.					LENGTH OF TAPPING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY, %	REGULATED FLOW, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0	54	100	115	103	80	0	0	0	0	0	0	2.3	4.2	4.9	4.3	3.4
100 000	511	-	-	-	-	145	-	-	-		5.8	21.6	-	-	-	-
200 000	836	985	1 047	1 051	945	182	158	170	154	154	11.7	35.3	41.6	44.2	44.3	39.9
300 000	1 110	-	-	-	-	189	-	-	-	-	17.5	46.9	-	-	-	-
400 000	1,371	1 564	1 580	1 637	1 527	198	187	211	231	213	23.3	57.9	66.0	66.7	69.1	64.5
500 000	1 620	-	-	-	-	210	-	-			29.2	68.4	-	-	-	-
600 000		2 063	2 040	2 064	1 985		216	226	242	224	35.0		87.1	86.1	87.1	83.8
800 000		2 521	2 481	2 452	2 428		225	233	265	231	46.7		106.4	104.7	103.5	102.5
1 000 000		2 963	2 909	2 839			232	238	270		58.4		125.1	122.8	119.8	
1 200 000		3 392	3 325				239	245			70.1		143.2	140.4		
1 400 000		3 811					242				81.8		160.9			
1 600 000		4 225					246				93.5		178.3			

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 : 553 400	1 747					213					32.3	73.7				
1956 :1 888 000		4 807					254				110.2		202.9			
1957 :1 355 000			3 628					249			79,1			153.1		
1958 :1 154 000				3 124					275		67.4				131.9	
1959 : 829 600					2 493					232	48.5					105.2

REMARKS

NOTE: SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER GREAT RUAHA STATION MTERA NO 1KA 5 CATCHMENT AREA 26 254 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 1 655 000 ACRE FEET, OR 2 290 CUSECS.

STORAGE CAPACITY.	REGULATED FLOW DURING THE DRY SEASON, CUSECS.					LENGTH OF TAPPING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOW, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0	37	129	110	88	76	0	0	0	0	0	0	1.6	5.6	4.8	3.8	3.3
100 000	615	650	718	675	654	142	149	126	132	127	6.0	26.9	28.4	31.4	29.5	28.6
200 000	942	971	1 043	1 026	1 027	169	170	174	154	142	12.1	41.1	42.4	45.5	44.8	44.8
300 000	1 202	1 258	1 323	1 339	1 345	205	183	185	168	191	18.1	52.5	54.9	57.8	58.5	58.7
400 000	1 443	1 527	1 582	1 628	1 602	212	191	206	227	200	24.2	63.0	66.7	69.1	71.1	70.0
500 000		1 786	1 822	1 846	1 842		198	214	235	214	30.2		78.0	79.6	80.6	80.4
600 000		2 036	2 053	2 058	2 075		219	220	249	219	36.3		88.9	89.7	89.9	90.6
700 000		2 263	2 280	2 258	2 304		225	225	258	223	42.3		97.6	99.7	98.6	100.6
800 000		2 485	2 503	2 452			229	229	262		48.3		108.5	109.3	107.1	
900 000		2 705	2 722	2 643			232	231	266		54.4		118.1	118.9	115.4	
1 000 000		2 921	2 935				235	235			60.4		127.5	128.2		
1 200 000		3 345	3 356				240	243			72.5		146.1	146.5		
1 400 000		3 760					245				84.6		164.2			
1 600 000		4 168					248				96.7		182.0			

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 : 470 000	1 616					218					28.4	70.6				
1956 : 1 742 000		4 454					251				105.3		194.5			
1957 : 1 300 000			3 560					245			78.5			155.5		
1958 : 1 058 000				2 940					272		63.9				128.4	
1959 : 831 000					2 598					227	50.2					113.4

REMARKS

NOTE: SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER CHIMALA STATION CHIMALA NO 1KA 7 CATCHMENT AREA 85 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 76 000 ACRE FEET, OR 105 CUSECS.

STORAGE CAPACITY.	REGULATED FLOW DURING THE DRY SEASON, CUSECS.					LENGTH OF TAPPING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOW, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0	23	21	18	14	19	0	0	0	0	0	0	21.9	20.0	17.1	13.3	18.1
5 000	41	46	45	44	43	163	166	159	173	155	6.5	39.0	43.8	42.8	41.9	40.9
10 000	55	60	59	57	59	186	190	182	197	175	13.1	52.4	57.1	56.2	54.3	56.2
15 000	68	73	71	70	72	197	198	246	206	187	19.7	64.7	69.5	67.6	66.6	68.5
20 000	81	85	81		85	202	206	274		194	26.3	77.1	80.9	77.1		80.9
25 000		97	90		96		219	278		239	32.9		92.4	85.7		91.4
30 000		109	99		107		242	287		240	39.4		103.8	94.3		101.9
35 000		120	108		117		245	290		240	46.0		114.3	102.8		111.4
40 000			116		128			294		247	52.6			110.4		121.9
45 000					138					250	59.2					131.4

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 : 21 300	84					204					28.0	80.0				
1956 : 36 000		121					245				47.3		115.2			
1957 : 41 500			120					298			54.6			114.3		
1958 : 20 400				82					214		26.8				78.1	
1959 : 47 600					143					250	62.6					136.2

REMARKS

NOTE: SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXI

RUFIJI BASIN SURVEY – HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER GREAT RUAHA STATION GT.N.RD.CHIMALA NO 1KA 8 CATCHMENT AREA 328 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 – 54/55) 238 000 ACRE FEET, OR 329 CUSECS.

STORAGE CAPACITY.	REGULATED FLOW DURING THE DRY SEASON, CUSECS.					LENGTH OF TAPPING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOW, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0	49	57	62	58	165	0	0	0	0	0	0	14.9	17.3	18.8	17.6	50.1
10 000	107					150					4.2	32.5				
20 000	138	153	168	157	282	170	182	158	160	156	8.4	41.9	46.5	51.0	47.7	85.7
30 000	167					183					12.6	50.7				
40 000	194	205	228	214	338	192	198	188	189	189	16.8	58.9	62.3	69.3	65.0	102.7
50 000	220					201					21.0	66.8				
60 000	245	255	280	266	390	203	214	200	200	203	25.2	74.4	77.5	85.1	80.8	118.5
70 000	269					208					29.4	81.7				
80 000	294	300	329	315	439	214	235	207	207	212	33.6	89.3	91.2	100.0	95.7	133.4
90 000	317					216					37.8	96.3				
100 000		343	373	363	481		239	252	212	246	42.0		104.2	113.4	110.3	146.2
120 000		385	413	407	521		241	257	242	251	50.4		117.0	125.5	123.7	158.3
140 000		427	452	450	562		244	260	244	253	58.8		129.8	137.4	136.8	170.8
160 000		468	491		601		245	262		255	67.2		142.2	149.2		182.7
180 000		509					247				75.6		154.7			

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 : 107 600	358					230					45.2	108.8				
1956 : 197 700		545					248				83.0		165.6			
1957 : 171 600			513					271			72.1			155.9		
1958 : 147 400				464					246		61.9				141.0	
1959 : 180 700					642					258	75.9					195.1

REMARKS

NOTE: SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER KIMANI STATION GT. NORTH ROAD NO 1KA 9 CATCHMENT AREA 173 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 134 000 ACRE FEET, OR 185 CUSECS.

STORAGE CAPACITY.	REGULATED FLOW DURING THE DRY SEASON, CUSECS.					LENGTH OF TAPPING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOW, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0	14	15	14	13	14	0	0	0	0	0	0	7.6	8.1	7.6	7.0	7.6
10 000	60	60	67	57	62	163	181	153	170	157	7.5	32.4	32.4	36.2	30.8	33.5
20 000	89	86	97	85	92	190	203	180	216	189	14.9	48.1	46.5	52.4	45.9	49.7
30 000	114	111	124	107	118	202	216	195	228	198	22.4	61.6	60.0	67.0	57.8	63.8
40 000	139	133	150	129	143	210	223	205	237	206	29.9	75.1	71.9	81.1	69.7	77.3
50 000	164	153	172	149	167	218	244	219	242	210	37.3	88.6	82.7	93.0	80.5	90.2
60 000	186	173	192	170	191	221	250	261	245	213	44.8	100.5	93.5	103.8	91.9	103.2
70 000	209	193	210	191	215	224	252	262	250	216	52.2	113.0	104.3	113.5	103.2	116.2
80 000	231	213	228		236	225	256	265		253	59.7	124.9	115.1	123.2		127.6
90 000		233	247				259	267			67.2		125.9	133.5		
100 000		252					261				74.6		136.2			
110 000		271					262				82.1		146.5			
120 000		289					267				89.6		156.2			

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 : 83 000	235					245					61.9	127.0				
1956 : 143 000		331					273				106.7		178.9			
1957 : 98 000			263					272			73.1			142.2		
1958 : 80 000				212					253		59.7				114.6	
1959 : 85 000					246					254	63.4					133.0

REMARKS

NOTE: SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER MBARALI STATION IGAWA NO 1KA 11 CATCHMENT AREA 619 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 357 000 ACRE FEET, OR 494 CUSECS.

STORAGE CAPACITY.	REGULATED FLOW DURING THE DRY SEASON, CUSECS.					LENGTH OF TAPPING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOW, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0	68	105	115	110	131	0	0	0	0	0	0	13.7	21.2	23.2	22.2	26.5
5 000	133	185	179	169	190	69	76	78	93	91	1.4	26.9	37.4	36.2	34.2	38.4
10 000	168	212	208	194	214	76	93	98	107	121	2.8	34.0	42.9	42.1	39.2	43.3
15 000	199	237	232	215	234	95	105	113	133	139	4.2	40.3	47.9	46,9	43.5	47.3
20 000	222	263	253	232	253	102	126	128	154	144	5.6	44.9	53.2	51.2	46.9	51.2
30 000	274	294	288	264	285	116	168	152	171	169	8.4	55.4	59.5	58.3	53.4	57.7
40 000	302	323	320	292	314	152	183	167	183	181	11.2	61.1	65.4	64,7	59.1	63.5
60 000	363	377	376	344	366	164	191	194	223	201	16.8	73.5	76.3	76.1	69.6	74.1
80 000	423	424	426	387	415	169	216	203	241	209	22.4	85.6	85.8	86.2	78.3	84.0
100 000	477	471	473	428	463	191	221	247	248	215	28.0	96.5	95.3	95.7	86.6	
120 000		515	514				227	251			33.6		104.2	104.0		
140 000		553	553				242	257			39.2		111.9	111.9		
160 000		596					248				44.8		120.6			

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 : 102 000	482					191					28.6	97.5				
1956 : 196 000		670					253				54.9		135.6			
1957 : 146 700			567					257			41.1			114.7		
1958 : 112 600				454					250		31.5				91.9	
1959 : 111 000					488					216	31.1					98.8

REMARKS

NOTE: SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER HALALI D/S STATION IYAYI NO 1KA 12 CATCHMENT AREA 302 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 76 000 ACRE FEET, OR 105 CUSECS.

STORAGE CAPACITY.	REGULATED FLOW DURING THE DRY SEASON, CUSECS.					LENGTH OF TAPPING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY, %	REGULATED FLOW, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959		1955	1956	1957	1958	1959
0		0.4	1	3	8	0	0	0	0	0	0		0.4	0.9	2.8	7.6
5 000		22	23	28	30		196	167	208	173	6.5		20.9	21.9	26.6	28.5
10 000		34	36	40	43		216	189	224	204	13.1		32.4	34.3	38.1	40.9
15 000		45	49	51	56		223	205	238	208	19.7		42.8	46.6	48.5	53.3
20 000		57	62	61	67		232	212	256	225	26.3		54.3	59.0	58.1	63.8
25 000		68	74	71	78		241	216	261	229	32.9		64.7	70.4	67.6	74.3
30 000		78	85	80	89		244	221	275	238	39.4		74.3	80.9	76.2	84.7
35 000		88		89			246		276		46.0		83.8		84.7	
40 000		98		98			246		280		52.6		93.3		93.3	
45 000		109		107			247		282		59.2		103.8		101.9	
50 000		119					250				65.8		113.3			
55 000		130					251				72.3		123.8			
60 000		139					253				78.9		132.4			

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 :																
1956 : 65 500		150					264				86.1		142.8			
1957 : 34 600			94					258			45.5			89.5		
1958 : 51 600				119					288		67.9				113.3	
1959 : 35 900					102					244	47.2					97.1

REMARKS

NOTE: SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER NDEMBERA STATION ILONGO NO 1KA 15 CATCHMENT AREA 404 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 95 000 ACRE FEET, OR 131 CUSECS.

STORAGE CAPACITY.	REGULATED FLOW DURING THE DRY SEASON, CUSECS.					LENGTH OF TAPPING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY, %	REGULATED FLOW, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0		4	4	2	5	0	0	0	0	0	0		3.0	3.0	1.5	3.8
5 000		26	-	24	25		145	-	170	177	5.3		19.8	-	18.3	19.1
10 000		42	44	38	40		169	175	192	185	10.5		32.0	33.6	29.0	30.5
20 000		68	71	63	66		203	193	205	195	21.0		51.9	54.2	48.1	50.4
30 000		93	97	88	92		212	202	214	202	31.6		71.0	74.0	67.1	70.2
40 000		117	117		115		219	245		243	42.1		89.3	89.3		87.8
50 000		138	138				228	249			52.6		105.3	105.3		
60 000		160	158				245	254			63.1		122.1	120.6		
70 000		181	177				246	262			73.7		138.1	135.1		

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 :																
1956 : 79 500		202					248				83.7		154.2			
1957 : 75 800			188					261			79.8			143.5		
1958 : 38 300				107					216		40.3				81.6	
1959 : 44 500					125					243	46.8					95.4

REMARKS

NOTE: SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER LITTLE RUAHA STATION TOSAMAGANGA NO 1KA 20 CATCHMENT AREA 1 273 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 439 000 ACRE FEET, OR 607 CUSECS.

STORAGE CAPACITY.	REGULATED FLOW DURING THE DRY SEASON, CUSECS.					LENGTH OF TAPPING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOW, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0		159	117	117	159	0	0	0	0	0	0		26.2	19.2	19.2	26.2
20 000		308	289	301	341		115	99	85	117	4.5		50.7	47.6	49.6	56.1
40 000		392	385	395	417		126	110	136	147	9.1		64.5	63.4	65.0	68.7
60 000		454	459	464	480		169	175	176	171	13.6		74.8	75.6	76.4	79.0
80 000		509	515	521			181	191	193		18.2		83.8	84.8	85.8	
100 000		565	565	570			191	208	207		22.7		93.1	93.1	93.9	
120 000		617	611	617			198	222	224		27.3		101.6	100.6	101.6	
140 000		661	656				208	224			31.9		108.9	108.0		
160 000		708	698				219	237			36.4		116.6	115.0		
180 000		754					223				41.0		124.2			

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 :																
1956 : 193 500		783					236				44.0		129.0			
1957 : 187 000			753					244			42.6			124.0		
1958 : 148 000				672					240		33.7				110.7	
1959 : 82 400					537					222	18.7					88.4

REMARKS

NOTE: SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER LITTLE RUAHA STATION IHIMBU NO 1KA 21 CATCHMENT AREA 957 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 394 000 ACRE FEET, OR 545 CUSECS.

STORAGE CAPACITY.	REGULATED FLOW DURING THE DRY SEASON, CUSECS.					LENGTH OF TAPPING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOW, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0			145	145	129	0	0	0	0	0	0			26.6	26.6	23.6
20 000			318	302	285			94	100	122	5.0			58.3	55.4	33.9
40 000			413	390	359			120	127	150	10.1			75.7	71.5	65.8
60 000			488	456	419			181	180	187	15.2			89.5	83.6	76.9
80 000			532	510				202	194		20.3			97.6	93.5	
100 000			582	560				223	210		25.4			106.8	102.7	
120 000			626					229			30.4			114.8		

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 :																
1956 :																
1957 :128 800			643					235			32.7			118.0		
1958 :126 000				611					259		31.9				112.1	
1959 : 82 000					477					198	20.8					87.5

REMARKS

NOTE: SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER MTITU STATION MTITU BRIDGE NO 1KA 22 CATCHMENT AREA 172 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 82 000 ACRE FEET, OR 113 CUSECS.

STORAGE CAPACITY.	REGULATED FLOW DURING THE DRY SEASON, CUSECS.					LENGTH OF TAPPING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOW, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0			50	50	40	0	0	0	0	0	0			44.2	44.2	35.4
2 500			80	72	68			90	78	96	3.0			70.8	63.7	60.1
5 000			92	87	78			110	102	149	6.1			81.4	77.0	69.0
7 500			103	98	85			129	146	198	9.1			91.1	86.7	75.2
10 000			111	106	92			224	182	200	12.2			98.2	93.8	81.4
12 500			116	113	98			235	199	204	15.2			102.6	100.0	86.7
15 000			121	119				240	207		18.3			107.0	105.3	
17 500				125					224		21.3				110.6	
20 000				131					237		24.4				115.9	

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 :																
1956 :																
1957 : 18 400			128					245			22.4			113.2		
1958 : 21 300				133					237		25.9				117.7	
1959 : 14 500					103					204	17.7					91.1

REMARKS

NOTE: SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXI

RUFIJI BASIN SURVEY – HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER GREAT RUAHA STATION MKUPULE NO 1KA 27 CATCHMENT AREA 7 700 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 1 346 000 ACRE FEET, OR 1 862 CUSECS.

STORAGE CAPACITY.	REGULATED FLOW DURING THE DRY SEASON, CUSECS.					LENGTH OF TAPPING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY, %	REGULATED FLOW, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959		1955	1956	1957	1958	1959
0			108	90		0	0	0	0	0	0			5.8	4.8	
100 000			547	515				166	179		7.4			29.4	27.7	
200 000			825	781				195	201		14.9			44.3	41.9	
300 000			1 069	1 020				218	217		22.3			57.4	54.8	
400 000			1 294	1 269				230	233		29.7			69.5	68.2	
500 000			1 510	1 431				237	242		37.1			81.1	76.9	
600 000			1 718	1 662				246	261		44.6			92.3	89.3	
700 000			1 920					253			52.0			103.1		
800 000			2 116					261			59.4			113.6		

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 :																
1956 :																
1957 : 920 000			2 320					269			68.4			124.6		
1958 : 660 000				1 786					268		49.0				95.9	
1959 :																

REMARKS Records from the last part of 1959 were not received in time and analyses from this year is therefore not included in this tabulation.

NOTE: SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXI

RUFIJI BASIN SURVEY – HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER LITTLE RUAHA STATION MAWANDE NO 1KA 31 CATCHMENT AREA 2005 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 465 000 ACRE FEET, OR 643 CUSECS.

STORAGE CAPACITY.	REGULATED FLOW DURING THE DRY SEASON, CUSECS.					LENGTH OF TAPPING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOW, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0			136	109		0	0	0	0	0	0			21.2	17.0	
20 000			334	278				80	96		4.3			51.9	43.2	
40 000			433	367				121	128		8.6			67.3	57.1	
60 000			504	435				187	170		12.9			78.4	67.7	
80 000			555	491				210	187		17.2			86.3	76.4	
100 000			602	541				222	208		21.5			93.6	84.1	
120 000			647	588				228	219		25.8			100.6	91.4	
140 000			691	632				233	228		30.1			107.5	98.3	
160 000			734					238			34.4			114.2		

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 :																
1956 :																
1957 : 178 000			770					243			38.3			119.8		
1958 : 156 000				670					235		33.5				104.2	
1959 :																

REMARKS

NOTE: SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXI

RUFIJI BASIN SURVEY – HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER LITTLE RUAHA STATION S. H. CLUB NO 1KA 32 CATCHMENT AREA 293 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 116 000 ACRE FEET, OR 161 CUSECS.

STORAGE CAPACITY.	REGULATED FLOW DURING THE DRY SEASON, CUSECS.					LENGTH OF TAPPING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOW, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0			23	21	12	0	0	0	0	0	0			14.3	13.0	7.4
5 000			72	65	57			75	87	97	4.3			44.7	40.3	35.4
10 000			104	90	78			96	107	134	8.6			64.6	55.9	48.4
15 000			129	112	96			113	128	151	12.9			80.1	69.5	59.6
20 000			149	127	111			126	182	183	17.2			92.5	78.9	68.9
25 000			169	141				187	193		21.5			104.9	87.5	
30 000			182	154				195	201		25.8			113.0	95.6	
35 000			194	166				209	209		30.1			120.5	103.1	
40 000			205					213			34.5			127.3		
45 000																
50 000																

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 :																
1956 :																
1957 :47 000			221					223			40.5			137.2		
1958 :42 000				180					239		36.2				111.8	
1959 :25 000					123					205	21.5					76.4

REMARKS

NOTE: SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER NDEMBERA STATION MADIBIRA NO 1KA 33 CATCHMENT AREA 707 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 147 000 ACRE FEET, OR 203 CUSECS.

STORAGE CAPACITY.	REGULATED FLOW DURING THE DRY SEASON, CUSECS.					LENGTH OF TAPPING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY, %	REGULATED FLOW, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959		1955	1956	1957	1958	1959
0			15	16		0	0	0	0	0	0			7.4	7.9	
10 000			55	63				172	177		6.8			27.1	31.0	
20 000			84	90				188	190		13.6			41.2	44.3	
30 000			109	116				208	196		20.4			53.7	57.1	
40 000			133	142				211	208		27.2			65.5	70.0	
50 000			157	165				221	220		34.0			77.3	81.3	
60 000			180	186				226	225		40.8			88.7	91.6	
70 000			203	210				231	226		47.6			100.0	103.4	
80 000				233					228		54.4				114.8	
90 000				255					228		61.2				125.6	

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 :																
1956 :																
1957 : 82 700			228					237			56.3			112.3		
1958 : 97 500				271					228		66.3				133.5	
1959 :																

REMARKS

NOTE: SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXI

RUFIJI BASIN SURVEY – HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER LITTLE RUAHA STATION IWAWA NO. 1KA 39 CATCHMENT AREA 645 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 265 000 ACRE FEET. OR 367 CUSECS.

STORAGE CAPACITY.	REGULATED FLOW DURING THE DRY SEASON, CUSECS.					LENGTH OF TAPPING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOW, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0			71	61	51	0	0	0	0	0	0			19.3	16.6	13.9
10 000					150					89	3.7					40.8
20 000			222	211	198			111	115	121	7.5			60.5	57.5	53.9
30 000					235					140	11.3					64.0
40 000			300	289	269			144	161	167	15.1			81.7	78.7	73.3
50 000					295					184	18.8					80.4
60 000			354	345				201	188		22.6			96.4	94.0	
80 000			404	391				220	244		30.2			110.1	106.5	
100 000			445					227			37.7			121.2		

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 :																
1956 :																
1957 : 111 400			472					236			42.0			128.6		
1958 : 96 000				424					259		36.2				115.5	
1959 : 61 100					326					221	23.0					88.8

REMARKS

NOTE: SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER KILOMBERO STATION IFAKARA NO 1KB 2 CATCHMENT AREA 12 063 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 10 560 000 ACRE FEET, OR 14 612 CUSECS.

STORAGE CAPACITY.	REGULATED FLOW DURING THE DRY SEASON, CUSECS.					LENGTH OF TAPPING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOW, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0	3 290	4 430	4 260	4 430	3 010	0	0	0	0	0	0	22.5	30.3	29.2	30.3	20.6
250 000	5 500	6 800	6 300	-	-	113	108	99	-	-	2.7	37.6	46.5	43.1	-	-
500 000	6 500	7 700	7 400	7 203	5 798	152	134	164	168	169	4.7	44.5	52.7	50.6	49.3	39.7
1 000 000	8 000	9 300	8 800	8 640	7 070	176	163	187	190	220	9.5	54.7	63.6	60.2	59.1	48.4
1 500 000	9 400	10 800	10 100	9 858	8 180	192	204	213	210	236	14.2	64.3	73.9	69.1	67.5	56.0
2 000 000	10 600	12 000	11 200	11 000		200	217	234	245		18.9	72.5	82.1	76.6	75.3	
2 500 000	11 800	13 000	12 200	12 017		205	259	243	251		23.7	80.7	89.0	83.5	82.2	
3 000 000	13 000	13 900	13 200	13 009		210	264	249	257		28.4	89.0	95.1	90.3	89.0	
3 500 000	14 100	14 800	14 100	13 970		214	270	255	269		33.1	96.5	101.3	96.5	95.6	
4 000 000		15 700	15 100	14 904			274	258	273		37.9		107.4	103.3	102.0	
4 500 000		16 600	16 100	15 825			277	264	276		42.6		113.6	110.2	108.3	
5 000 000		17 400	17 000				282	269			47.3		119.1	116.3		
6 000 000		19 200					288				56.8		131.4			
7 000 000		21 000					294				66.3		143.7			

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 : 3 650 000	14 500					216					34.6	99.2				
1956 : 7 200 000		21 300					294				68.2		145.8			
1957 : 5 450 000			17 900					272			51.6			122.5		
1958 : 5 069 000				16 856					279		48.0				115.4	
1959 : 1 977 000					9 194					239	18.7					62.9

REMARKS

NOTE: SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXI

RUFIJI BASIN SURVEY – HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER KILOMBERO STATION IFWEMA NO 1KB 4 CATCHMENT AREA 7048 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 5 235 000 ACRE FEET, OR 7 244 CUSECS.

STORAGE CAPACITY.	REGULATED FLOW DURING THE DRY SEASON, CUSECS.					LENGTH OF TAPPING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOW, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0	2 430	3 230	2 760	2 760	2 470	0	0	0	0	0	0	33.5	44.6	38.1	38.1	34.1
200 000	4 008	5 074	4 700	4 320	3 760	110	103	99	104	125	3.8	55.2	70.0	64.9	59.6	51.9
400 000	4 802	5 922	5 600	5 120	4 530	146	130	110	153	147	7.6	66.3	81.8	77.3	70.7	62.5
600 000	5 430	6 652	6 350	5 770	5 100	183	157	151	160	204	11.5	75.0	91.8	87.7	79.7	70.4
800 000	5 970	7 270	6 950	6 380	5 580	188	166	158	178	219	15.3	82.4	100.4	95.9	88.1	77.0
1 000 000	6 500	7 811	7 500	6 850	6 020	194	186	214	211	227	19.1	87.7	107.8	103.5	94.6	83.1
1 200 000		8 309	7 950	7 350			209	228	215		22.9		114.7	109.7	101.5	
1 400 000		8 776					222				26.7		121.1			
1 600 000		9 225					226				30.6		127.3			

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 : 1 102 000	6 760					198					21.1	93.3				
1956 : 1 776 000		9 616					235				33.9		132.7			
1957 : 1 360 000			8 400					244			26.0			116.0		
1958 : 1 275 000				7 500					216		24.4				103.5	
1959 : 1 040 000					6 230					228	19.9					84.6

REMARKS

NOTE: SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXI

RUFIJI BASIN SURVEY – HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER LUHOMBERO STATION ILONGA NO 1KB 5 CATCHMENT AREA 395 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 – 54/55) 182 000 ACRE FEET, OR 252 CUSECS.

STORAGE CAPACITY.	REGULATED FLOW DURING THE DRY SEASON, CUSECS.					LENGTH OF TAPPING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOW, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0	40	99	88	44	12	0	0	0	0	0	0	15.9	39.3	34.9	17.5	4.8
20 000	110	172	175	152	99	179	194	226	146	209	11.0	43.7	68.3	69.4	60.3	39.3
40 000	164	219	215	207		200	225	233	204		22.0	65.1	86.9	85.3	82.1	
60 000	214	263	258	256		205	233	216	216		33.0	84.9	104.4	102.4	101.6	
80 000	263	305		299		205	251		274		44.0	104.4	121.0		118.7	
100 000		341					307				55.0		135.3			
120 000		374					309				65.9		148.4			
140 000		407					310				76.9		161.5			
160 000		438					319				87.9		173.8			
180 000		469					324				98.9		186.1			

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 : 109 000	333					208					59.9	132.1				
1956 : 193 000		490					326				106.1		194.4			
1957 : 83 200			305					256			45.7			121.0		
1958 : 89 100				316					275		49.0				125.4	
1959 : 36 900					137					240	20.3					54.4

REMARKS

NOTE: SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER KIGOGO-RUAHA STATION FRICKS BRIDGE NO 1KB 6 CATCHMENT AREA 511 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 284 000 ACRE FEET, OR 393 CUSECS.

STORAGE CAPACITY.	REGULATED FLOW DURING THE DRY SEASON, CUSECS.					LENGTH OF TAPPING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOW, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0		81	82	93		0	0	0	0	0	0		20.6	20.9	23.7	
10 000		-	172	197			-	93	82		3.5		-	43.8	50.1	
20 000		205	214	250			155	132	108		7.0		52.2	54.5	63.6	
30 000		-	250	291			-	146	129		10.6		-	63.6	74.0	
40 000		266	283	326			179	173	188		14.1		67.7	72.0	83.0	
60 000		320	336	376			194	199	231		21.1		81.4	85.5	95.7	
80 000		371	386	419			205	207	242		28.2		94.4	98.2	106.6	
100 000		419		460			217		251		35.2		106.6		117.0	
120 000		465					221				42.3		118.3			
140 000		510					234				49.3		129.8			
160 000		552					239				56.3		140.5			
180 000		595					243				63.4		151.4			
200 000		635					251				70.4		161.6			
220 000		675					257				77.5		171.8			
240 000		711					322				84.5		180.9			
260 000		742					324				91.5		188.8			
280 000		773					327				98.6		196.7			
300 000		804					328				105.6		204.6			

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 :																
1956 : 342 000		865					329				120.4		220.1			
1957 : 98 000			429					213			34.5			109.1		
1958 : 123 000				505					259		43.3				128.5	
1959 :																

REMARKS

NOTE: SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER MPANGA STATION MPANGA NO 1KB 8 CATCHMENT AREA 937 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 869 000 ACRE FEET, OR 1 202 CUSECS.

STORAGE CAPACITY.	REGULATED FLOW DURING THE DRY SEASON, CUSECS.					LENGTH OF TAPPING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOW, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0			570	544	435	0	0	0	0	0	0			47.4	45.3	36.2
25 000			783	786	714			97	98	128	2.9			65.1	65.4	59.4
50 000			896	892	800			128	149	182	5.8			74.5	74.2	66.6
75 000			978	968	863			203	166	217	8.6			81.4	80.5	71.8
100 000			1 046	1 040	920			215	179	232	11.5			87.0	86.5	76.5
125 000			1 107	1 110				226	184		14.3			92.1	92.3	
150 000			1 162	1 165				235	256		17.3			96.7		

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 :																
1956 :																
1957 : 175 000			1 210					248			20.1			100.7		
1958 : 175 000				1 215					269		20.1				101.1	
1959 : 120 000					964					234	13.8					80.2

REMARKS

NOTE: SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER MNYERA STATION TAVETA NO 1KB 9 CATCHMENT AREA 1 950 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 1 694 000 ACRE FEET, OR 2 344 CUSECS.

STORAGE CAPACITY.	REGULATED FLOW DURING THE DRY SEASON, CUSECS.					LENGTH OF TAPPING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOW, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0			785	915	766	0	0	0	0	0	0			33.5	39.0	32.7
50 000			1 228	1 339	1 224			105	104	136	3.0			52.4	57.1	52.2
100 000			1 453	1 537	1 395			127	148	156	5.9			62.0	65.6	59.5
150 000			1 631	1 701	1 525			167	160	229	8.9			69.6	72.6	65.1
200 000			1 776	1 850	1 634			180	177	235	11.8			75.8	78.9	69.7
250 000			1 910	1 989	1 740			198	186	239	14.8			81.5	84.9	74.2
300 000			2 036	2 104				203	220		17.7			86.9	89.8	
350 000				2 215					234		20.7				94.5	

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 :																
1956 :																
1957 : 385 300			2 214					250			22.7			94,5		
1958 : 399 600				2 321					239		23,6				99.0	
1959 : 304 800					1 856					243	18.0					79.2

REMARKS

NOTE: SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER RUHUJI STATION MWAYAMALUNGU NO 1KB 10 CATCHMENT AREA 3 294 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 2 257 000 ACRE FEET, OR 3 123 CUSECS.

STORAGE CAPACITY.	REGULATED FLOW DURING THE DRY SEASON, CUSECS.					LENGTH OF TAPPING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOW, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0			1 134	1 134	826	0	0	0	0	0	0			36.3	36.3	26.4
100 000			1 996	1 814	1 510			109	125	132	4.4			63.9	58.1	48.4
200 000			2 415	2 174	1 860			134	154	163	8.8			77.3	69.6	59.5
300 000			2 765	2 492	2 126			159	166	221	13.3			88.5	79.8	68.1
400 000			3 073	2 782	2 350			170	180	230	17.7			98.4	89.1	75.2
500 000			3 366	3 032	2 566			232	216	238	22.1			107.8	97.1	82.1
600 000			3 582	3 261				239	222		26.6			114.7	104.4	
700 000			3 791	3 483				243	231		31.0			121.4	111.5	
800 000			3 995					249			35.4			127.9		

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 :																
1956 :																
1957 : 895 000			4 187					251			39.6			134.0		
1958 : 777 000				3 650					233		34.4				116.9	
1959 : 550 000					2 672					241	24.3					85.5

REMARKS

NOTE: SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXI

RUFIJI BASIN SURVEY – HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER LUMEMO STATION IFAKARA AND KIB-AONI. NO 1KB3 and 1KB 14. CATCHMENT AREA 165 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 312 000 ACRE FEET, OR 432 CUSECS.

STORAGE CAPACITY.	REGULATED FLOW DURING THE DRY SEASON, CUSECS.					LENGTH OF TAPPING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY, %	REGULATED FLOW, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959		1955	1956	1957	1958	1959
0		85	113	101	70	0	0	0	0	0	0		19.7	26.1	23.4	16.2
10 000		179	189	175	123		102	165	152	174	3.2		41.4	43.7	40.5	28.5
20 000		221	218	205	151		135	183	190	229	6.4		51.2	50.5	47.5	35.0
30 000		257	245	230			166	195	201		9.6		59.5	56.7	53.2	
40 000		288	270	251			169	201	209		12.8		66.7	62.5	58.1	
50 000		309	295	269			222	205	214		16.0		71.5	68.3	62.3	
60 000		331	320	287			244	214	283		19.2		76.6	74.1	66.4	
70 000			343	304				223	289		22.4			79.4	70.4	
80 000		371	364	321			259	238	297		25.6		85.9	84.3	74.3	
90 000			385	337				240	301		28.8			89.1	78.0	
100 000		410		353			264		301		32.1		94.9		81.7	
110 000				368					301		35.3				85.2	

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 :																
1956 : 116 400		440					278				37.3		101.9			
1957 : 103 400			413					251			33.1			95.6		
1958 : 120 000				383					304		38.5				88.7	
1959 : 26 500					165					289	8.5					38.2

REMARKS

NOTE: SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXI

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER KILOMBERO STATION SWERO NO 1KB 17 CATCHMENT AREA 12 915 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 11 092 000 ACRE FEET, OR 15 348 CUSECS.

STORAGE CAPACITY.	REGULATED FLOW DURING THE DRY SEASON, CUSECS.					LENGTH OF TAPPING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY, %	REGULATED FLOW, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959		1955	1956	1957	1958	1959
0				3 455	2 825	0	0	0	0	0	0				22.5	18.4
250 000				5 544	4 900				105	117	2.3				36.1	31.9
500 000				6 568	5 753				136	180	4.5				43.0	37.5
750 000				7 422	6 432				170	193	6.8				48.4	41.9
1 000 000				8 143	7 084				180	217	9.0				53.1	46.2
1 250 000				8 809	-				197	-	11.3				57.4	-
1 500 000				9 438	8 170				206	234	13.5				61.5	53.2
1 750 000				10 044					214		15.8				65.4	
2 000 000				10 630					217		18.0				69.3	
2 250 000				11 182					243		20.3				72.9	
2 500 000				11 698					247		22.5				76.2	
3 000 000				12 712					251		27.0				82.8	
3 500 000				13 700					258		31.6				89.3	
4 000 000				14 660					271		36.1				95.5	

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 :																
1956 :																
1957 :																
1958 : 4 500 000				15 590					275		40.6				101.6	
1959 : 2 020 000					9 279					238	18.2					60.5

REMARKS

NOTE: SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXII

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER RUFIJI STATION STIEGLER'S GORGE NO 1K 3 CATCHMENT AREA 61 106 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 18 050 000 ACRE FEET, OR 24 976 CUSECS.

STORAGE CAPACITY.	MAXIMUM FLOOD REDUCED TO, CUSECS.					LENGTH OF FILLING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOOD, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0	94 000	252 000	106 000	119 000	60 000	0	0	0	0	0	0	376	1 009	424	476	240
1 000 000	56 340	109 030	70 041	68 430	39 172	49	23	37	44	80	5.5	226	437	280	274	157
2 000 000	47 846	91 799	57 210	58 050	33 200	65	32	42	54	90	11.1	192	367	229	232	133
3 000 000	41 398	77 641	46 823	49 330	28 082	117	41	53	70	107	16.6	166	311	187	198	112
4 000 000	37 196	72 206	39 213	42 510	23 477	123	116	76	78	112	22.2	149	289	157	170	94
5 000 000	33 279	67 923	33 017	36 830		132	119	90	90		27.7	133	271	132	147	
6 000 000	29 528	63 725	29 305	31 540		137	122	142	116		33.2	118	255	117	126	
7 000 000		59 710					129				38.8		239			
8 000 000		55 833					131				44.3		224			
9 000 000		52 027					134				49.9		208			
10 000 000		48 300					137				55.4		193			
11 000 000		44 665					140				60.9		179			
12 000 000		41 102					144				66.5		165			

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 : 6 600 000	27 268					146					36.6	109.2				
1956 : 12 500 000		39 184					146				69.3		156.9			
1957 : 6 800 000			26 381					147			37.7			105.6		
1958 : 7 200 00				26 390					125		39.9				105.7	
1959 : 5 200 000					19 212					173	28.8					76.7

REMARKS

NOTE : SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXII

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER LITTLE RUAHA STATION IRINGA NO 1KA 2 CATCHMENT AREA 1 127 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 444 000 ACRE FEET, OR 614 CUSECS.

STORAGE CAPACITY.	MAXIMUM FLOOD REDUCED TO, CUSECS.					LENGTH OF FILLING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOOD, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0	1 300	2 600	5 200	3 500	2 500	0	0	0	0	0	0	212	423	847	570	407
10 000	797	1 509	2 823	2 489	1 468	26	84	8	16	13	2.2	130	246	460	405	239
20 000	652	1 438	2 339	2 182	1 167	68	103	12	18	20	4.5	106	234	381	355	190
30 000	578	1 375	1 950	1 917	982	97	104	14	21	44	6.7	94	224	317	312	160
40 000	523	1 323	1 640	1 683	880	104	107	28	22	59	9.0	85	215	267	274	143
50 000	475	1 275	1 487	1 480	802	108	108	39	27	67	11.2	77	208	242	241	131
60 000		1 225	1 316	1 313	730		108	46	47	71	13.5		199	214	214	119
80 000		1 140	1 152	1 111	621		111	52	52	123	18.0		186	188	181	101
100 000		1 050	991	932			116	123	67		22.5		171	161	152	
120 000		971	910	820			127	134	95		27.0		158	148	133	
140 000		892	832				136	147			31.5		145	135		

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 : 62 000	428					128					13.9	69.5				
1956 : 168 000		798					151				37.8		130.0			
1957 : 158 000			760					151			35.6			123.8		
1958 : 147 000				685					116		33.1				111.5	
1959 : 99 000					545					128	22.3					88.7

REMARKS

NOTE : SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXII

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER GREAT RUAHA STATION KIDATU NO 1KA 3 CATCHMENT AREA 30 905 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 2 386 000 ACRE FEET, OR 3 302 CUSECS.

STORAGE CAPACITY.	MAXIMUM FLOOD REDUCED TO, CUSECS.					LENGTH OF FILLING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOOD, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0	14 300	27 500	35 800	23 300	23 000	0	0	0	0	0	0	433	833	1 084	706	697
100 000	7 812	19 340	20 950	15 488	13 858	41	15	9	13	9	4.2	237	586	634	469	420
200 000	6 941	16 744	16 235	14 044	9 771	75	45	13	41	16	8.4	210	507	492	425	296
300 000	6 271	-	13 720	12 853	8 018	77	-	25	45	44	12.6	190	-	416	389	243
400 000	5 627	14 510	11 903	11 754	6 928	81	54	34	47	51	16.8	170	439	360	356	210
500 000	5 081	-	10 490	10 694	-	100	-	38	48	-	21.0	154	-	318	324	-
600 000	4 589	13 430	9 325	9 642	5 226	105	106	112	49	73	25.1	139	407	282	292	158
700 000	4 114	-	8 877	8 681	-	108	-	114	53	-	29.3	125	-	269	263	-
800 000	3 670	12 480	8 370	7 741	3 940	121	106	115	55	87	33.5	111	378	253	234	119
1 000 000		11 536	7 574	6 190			108	120	96		41.9		349	229	187	
1 200 000		10 610	6 743	5 167			111	124	99		50.3		321	204	156	
1 400 000		9 708	5 940				114	127			58.7		294	180		
1 600 000		8 880	5 094				128	132			67.1		269	154		
1 800 000		8 137					132				75.4		246			
2 000 000		7 346					138				83.8		222			
2 200 000		6 625					143				92.2		201			

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 : 874 000	3 360					125					36.6	101.8				
1956 : 2 280 000		6 340					145				95.6		192.0			
1957 : 1 675 000			4 867					134			70.2			147.4		
1958 : 1 421 000				4 139					115		59.6				125.3	
1959 : 921 000					3 278					98	38.6					99.3

REMARKS

NOTE : SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXII

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER GREAT RUAHA STATION MBUYUNI NO 1KA 4 CATCHMENT AREA 28 774 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 1 712 000 ACRE FEET, OR 2 369 CUSECS.

STORAGE CAPACITY.	MAXIMUM FLOOD REDUCED TO, CUSECS.					LENGTH OF FILLING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOOD, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0	11 008	28 560	35 655	21 139	23 000	0	0	0	0	0	0	465	1 206	1 505	892	971
100 000	4 432					58	-	-	-	-	5.8	187	-		-	-
200 000	3 707	14 019	13 380	10 944	8 047	79	45	10	38	13	11.7	156	592	564	462	340
300 000	3 078					83	-	-	-	-	17.5	130	—	-	-	-
400 000	2 493	11 830	7 893	8 515	5 359	90	47	36	47	63	23.3	105	499	333	359	226
500 000	1 994					107	-	-	-	-	29.2	84	-	-	-	-
600 000		10 402	6 764	6 454	3 890		91	113	52	77	35.0		439	286	272	164
800 000		9 391	5 881	4 988	2 658		105	116	98	88	46.7		396	248	211	112
1 000 000		8 430	5 023	3 909			107	120	100		58.4		356	212	165	
1 200 000		7 513	4 206				121	126			70.1		317	178		
1 400 000		6 693					125				81.8		282			
1 600 000		5 898					129				93.5		250			

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 : 553 400	1 747					111					32.3	73.7				
1956 :1 888 000		4 807					138				110.2		202,9			
1957 :1 355 000			3 628					130			79.1			153.1		
1958 :1 154 000				3 124					107		67.4				131.9	
1959 : 829 600					2 493					93	48.5					105.2

REMARKS

NOTE : SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXII

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER GREAT RUAHA STATION MTERA NO 1KA 5 CATCHMENT AREA 26 254 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 1 655 000 ACRE FEET, OR 2 290 CUSECS.

STORAGE CAPACITY.	MAXIMUM FLOOD REDUCED TO, CUSECS.					LENGTH OF FILLING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY, %	REGULATED FLOOD, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959		1955	1956	1957	1958	1959
0	10 340	25 411	31 069	17 450	22 000	0	0	0	0	0	0	452	1 110	1 356	762	960
100 000	4 124	13 820	15 255	10 879	11 506	48	15	9	29	9	6.0	180	603	666	475	502
200 000	3 230	11 960	10 199	9 360	7 636	70	45	13	38	37	12.1	141	522	445	409	333
300 000	2 559	10 862	7 922	8 126	6 402	83	49	36	45	44	18.1	112	474	346	355	280
400 000	1 991	10 265	7 273	7 030	5 410	94	90	111	49	64	24.2	87	448	318	307	236
500 000		9 706	6 821	6 048	4 647		91	113	53	69	30.2		424	298	264	203
600 000		9 183	6 378	5 295	3 962		101	116	90	77	36.3		401	279	231	173
700 000		8 687	5 945	4 744	3 335		104	118	93	85	42.3		379	260	207	145
800 000		8 194	5 519	4 210			105	120	97		48.3		358	241	184	
900 000		7 732	5 107	3 699			108	124	101		54.4		338	223	162	
1 000 000		7 326	4 704				122	126			60.4		320	205		
1 200 000		6 513	3 922				126	132			72.5		284	171		
1 400 000		5 723					131				84.6		250			
1 600 000		4 970					137				96.7		217			

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 : 470 300	1 616					106					28.4	70.6				
1956 :1 742 000		4 454					141				105.3		194.5			
1957 :1 300 000			3 560					135			78.5			155.5		
1958 :1 058 000				2 940					109		63.9				128.4	
1959 : 831 000					2 596					97	50.2					113.4

REMARKS

NOTE : SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXII

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER CHIMALA STATION CHIMALA NO 1KA 7 CATCHMENT AREA 85 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 76 000 ACRE FEET, OR 105 CUSECS.

STORAGE CAPACITY.	MAXIMUM FLOOD REDUCED TO, CUSECS.					LENGTH OF FILLING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOOD, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0	800	1 600	3 200	650	2 000	0	0	0	0	0	0	762	1 524	3 048	619	1 905
5 000	184	322	452	288	911	71	20	21	19	5	6.5	175	307	430	274	868
10 000	150	266	352	174	571	77	46	26	27	10	13.1	143	253	335	166	544
15 000	118	212	266	122	392	88	50	34	59	32	19.7	112	202	253	116	373
20 000	90	182	244		321	94	122	91		43	26.3	86	173	232		306
25 000		162	198		281		128	95		68	32.9		154	188		268
30 000		142	173		244		136	100		69	39.4		135	165		232
35 000		125	148		208		143	111		72	46.0		119	141		198
40 000			126		180			117		98	52.6			120		171
45 000					156					104	59.2					148

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 : 21 300	84					97					28.0	80.0				
1956 : 36 000		121					144				47.3		115.2			
1957 : 41 500			120					118			54.6			114.3		
1958 : 20 400				82					97		26.8				78.1	
1959 : 47 600					143					104	62.6					136.2

REMARKS

NOTE : SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXII

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER GREAT RUAHA STATION GT.N.RD.CHIMALA NO 1KA 8 CATCHMENT AREA 328 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 238 000 ACRE FEET, OR 329 CUSECS.

STORAGE CAPACITY.	MAXIMUM FLOOD REDUCED TO, CUSECS.					LENGTH OF FILLING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOOD, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0	3 600	5 300	7 200	7 500	20 000	0	0	0	0	0	0	1 094	1 611	2 188	2 280	6 079
10 000	1 171					17					4.2	356				
20 000	971	1 650	1 902	2 441	5 023	54	36	8	12	2	8.4	295	501	578	742	1 530
30 000	878					55					12.6	267				
40 000	788	1 385	1 286	1 718	2 627	57	46	32	16	6	16.8	239	421	391	522	798
50 000	703					65					21.0	214				
60 000	626	1 181	1 096	1 190	1 825	65	83	85	23	30	25.2	190	359	333	362	555
70 000	548					66					29.4	166				
80 000	490	1 073	979	890	1 496	104	104	88	56	32	33.6	149	326	297	270	455
90 000	441					105					37.8	134				
100 000		977	866	730	1 217		106	93	83	41	42.0		297	263	222	370
120 000		881	760	620	1 042		108	98	87	66	50.4		268	231	188	317
140 000		791	660	505	895		111	101	90	72	58.8		240	201	153	272
160 000		700	566		761		113	111		85	67.2		213	172		231
180 000		614					136				75.6		187			

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 : 107 600	358					108					45.2	108.8				
1956 : 197 700		545					139				83.0		165.6			
1957 : 171 600			513					112			72.1			155.9		
1958 : 147 400				464					92		61.9				141.0	
1959 : 180 700					642					91	75.9					195.1

REMARKS

NOTE : SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXII

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER KIMANI STATION GT. NORTH ROAD NO 1KA 9 CATCHMENT AREA 173 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 134 000 ACRE FEET, OR 185 CUSECS.

STORAGE CAPACITY.	MAXIMUM FLOOD REDUCED TO, CUSECS.					LENGTH OF FILLING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOOD, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0	1 510	3 960	2 340	3 200	8 400	0	0	0	0	0	0	816	2 140	1 265	1 729	4 541
10 000	770	1 348	770	1 238	1 403	18	36	32	13	6	7.5	416	728	416	669	758
20 000	676	1 223	698	922	940	58	43	81	20	13	14.9	365	661	377	498	508
30 000	590	1 107	637	690	759	62	43	82	23	31	22.4	319	598	344	373	410
40 000	510	986	576	503	604	63	43	84	23	35	29.9	276	532	311	272	326
50 000	430	877	514	422	480	68	49	89	64	48	37.3	232	474	277	228	259
60 000	363	795	460	345	388	89	82	90	71	57	44.8	196	430	249	186	210
70 000	307	733	406	276	323	92	84	94	80	89	52.2	166	396	219	149	175
80 000	253	674	353		268	97	84	95		106	59.7	137	364	191		145
90 000		612	302				85	104			67.2		331	163		
100 000		552					89				74.6		298			
110 000		495					89				82.1		268			
120 000		440					94				89.6		238			

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 : 83 000	235					100					61.9	127.0				
1956 : 143 000		331					103				106.7		178.9			
1957 : 98 000			263					106			73.1			142.2		
1958 : 80 000				212					85		59.7				114.6	
1959 : 85 000					246					108	63.4					133.0

REMARKS

NOTE : SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXII

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER MBARALI STATION IGAWA NO 1KA 11 CATCHMENT AREA 619 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 357 000 ACRE FEET, OR 494 CUSECS.

STORAGE CAPACITY.	MAXIMUM FLOOD REDUCED TO, CUSECS.					LENGTH OF FILLING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOOD, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0	3 100	9 300	7 000	7 500	18 000	0	0	0	0	0	0	627	1 882	1 417	1 518	3 644
10 000	1 085	1 910	1 592	2 245	2 345	9	4	26	9	9	2.8	220	387	322	454	475
20 000	840	1 700	1 410	1 740	1 818	58	27	28	14	10	5.6	170	344	285	352	368
30 000	775	15540	1 240	1 435	1 377	82	81	31	19	13	8.4	157	312	251	290	279
40 000	730	1 470	1 112	1 172	1 125	109	81	84	20	34	11.2	148	297	225	237	228
60 000	640	1 350	997	834	856	121	83	90	35	47	16.8	129	273	202	169	173
80 000	560	1 230	886	647	667	131	84	92	67	60	22.4	113	249	179	131	135
100 000		1 120	784	522	540		97	101	86	107	28.0		227	159	106	109
120 000		1 020	687				104	107			33.6		206	139		
140 000		920	595				107	112			39.2		186	120		
160 000		830					112				44.8		168			

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 : 102 000	482					158					28.6	97.5				
1956 : 196 000		670					119				54.9		135.6			
1957 : 146 700			567					125			41.1			114.7		
1958 : 112 600				454					130		31.5				91.9	
1959 : 111 000					488					112	31.1					98.8

REMARKS

NOTE : SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXII

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER HALALI D/S STATION IYAYI NO 1KA 12 CATCHMENT AREA 302 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 76 000 ACRE FEET, OR 105 CUSECS.

STORAGE CAPACITY.	MAXIMUM FLOOD REDUCED TO, CUSECS.					LENGTH OF FILLING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOOD, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0		3 300	2 000	1 900	4 900	0	0	0	0	0	0		3 143	1 905	1 809	4 667
5 000		937	264	907	737		6	76	11	8	6.5		892	251	864	702
10 000		565	231	696	478		10	80	12	14	13.1		538	220	663	455
15 000		432	200	525	317		79	83	16	18	19.7		411	190	500	302
20 000		400	170	404	218		79	86	27	56	26.3		381	162	385	208
25 000		368	141	316	175		85	95	29	67	32.9		350	134	301	167
30 000		339	116	240	140		86	103	63	72	39.4		323	110	228	133
35 000		310		202			86		97		46.0		295		192	
40 000		280		176			86		98		52.6		267		168	
45 000		252		151			91		102		59.2		240		144	
50 000		224					95				65.8		213			
55 000		198					99				72.3		188			
60 000		174					110				78.9		166			

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 :																
1956 : 65 500		150					117				86.1		142.8			
1957 : 34 600			94					106			45.5			89.5		
1958 : 51 600				119					103		67.9				113.3	
1959 : 35 900					102					83	47.2					97.1

REMARKS

NOTE : SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXII

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER NDEMBERA STATION ILONGO NO 1KA 15 CATCHMENT AREA 404 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 95 000 ACRE FEET, OR 131 CUSECS.

STORAGE CAPACITY.	MAXIMUM FLOOD REDUCED TO, CUSECS.					LENGTH OF FILLING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOOD, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0		948	5 530	594	506	0	0	0	0	0	0		724	4 221	453	386
5 000		634	-	393	345		33	-	24	46	5.3		484	-	300	263
10 000		568	2 450	298	292		47	4	29	52	10.5		434	1 870	227	223
20 000		474	1 215	206	232		69	5	85	99	21.0		362	927	157	177
30 000		415	571	150	182		98	23	95	104	31.6		317	436	115	139
40 000		368	406		141		110	36		138	42.1		281	310		108
50 000		322	298				117	100			52.6		246	227		
60 000		280	253				122	118			63.1		214	193		
70 000		240	211				127	126			73.7		183	161		

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 :																
1956 : 79 500		202					131				83.7		154.2			
1957 : 75 800			188					131			79.8			143.5		
1958 : 38 300				107					103		40.3				81.6	
1959 : 44 500					125					140	46.8					95.4

REMARKS

NOTE : SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXII

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER LITTLE RUAHA STATION TOSAMAGANGA NO 1KA 20 CATCHMENT AREA 1 273 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 439 000 ACRE FEET, OR 607 CUSECS.

STORAGE CAPACITY.	MAXIMUM FLOOD REDUCED TO, CUSECS.					LENGTH OF FILLING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOOD, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0		3 500	5 500	3 400	1 900	0	0	0	0	0	0		577	906	560	313
20 000		1 603	2 570	2 179	968		53	10	19	42	4.5		264	423	359	159
40 000		1 473	1 758	1 696	748		83	30	22	62	9.1		243	290	279	123
60 000		1 321	1 443	1 295	630		85	36	30	106	13.6		218	238	213	104
80 000		1 246	1 256	1 077			108	58	55		18.2		205	207	177	
100 000		1 155	1 090	913			113	64	87		22.7		190	180	150	
120 000		1 066	992	801			115	126	95		27.3		176	163	132	
140 000		982	912				126	132			31.9		162	150		
160 000		904	837				132	139			36.4		149	138		
180 000		828					134				41.0		136			

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 :																
1956 : 193 500		783					146				44.0		129.0			
1957 : 187 000			753					155			42.6			124.0		
1958 : 148 000				672					113		33.7				110.7	
1959 · 82 400					537					140	18.7					88.4

REMARKS

NOTE : SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXII

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER LITTLE RUAHA STATION IHIMBU NO 1KA 21 CATCHMENT AREA 957 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 394 000 ACRE FEET, OR 545 CUSECS.

STORAGE CAPACITY.	MAXIMUM FLOOD REDUCED TO, CUSECS.					LENGTH OF FILLING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOOD, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0				3 000	4 000	0	0	0	0	0	0				550	734
20 000			1 381	1 753	864			27	19	44	5.0			253	322	158
40 000			1 119	1 289	687			42	26	68	10.1			205	236	126
60 000			913	1 013	565			57	52	121	15.2			167	186	104
80 000			809	837				125	89		20.3			148	153	
100 000			734	728				149	100		25.4			135	133	
120 000			668					158			30.4			122		

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 :																
1956 :																
1957 : 128 800			643					163			32.7			118.0		
1958 : 126 000				611					122		31.9				112.1	
1959 : 82 000					477					131	20.8					87.5

REMARKS

NOTE : SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXII

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER MTITU STATION MTITU BRIDGE NO 1KA 22 CATCHMENT AREA 172 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 82 000 ACRE FEET, OR 113 CUSECS.

STORAGE CAPACITY.	MAXIMUM FLOOD REDUCED TO, CUSECS.					LENGTH OF FILLING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOOD, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0				900	300	0	0	0	0	0	0				796	265
2 500			244	398	169			32	11	40	3.0			216	352	150
5 000			206	298	146			38	18	95	6.1			182	264	129
7 500			179	225	132			49	22	96	9.1			158	199	117
10 000			159	200	120			57	62	119	12.2			141	177	106
12 500			148	179	110			118	86	137	15.2			131	158	97
15 000			138	165				121	89		18.3			122	146	
17 500				151					91		21.3				134	
20 000				137					94		24.4				121	

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 :																
1956 :																
1957 : 18 400			128					149			22.4			113.2		
1958 : 21 300				133					96		25.9				117.7	
1959 : 14 500					103					151	17.7					91.1

REMARKS

NOTE : SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXII

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER GREAT RUAHA STATION MKUPULE NO 1KA 27 CATCHMENT AREA 7 700 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 1 346 000 ACRE FEET, OR 1 862 CUSECS.

STORAGE CAPACITY.	MAXIMUM FLOOD REDUCED TO, CUSECS.					LENGTH OF FILLING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOOD, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0			10 900	11 380		0	0	0	0	0	0			585	611	
100 000			7 859	7 932				29	23		7.4			422	426	
200 000			6 334	5 838				35	30		14.9			340	314	
300 000			5 083	4 498				99	47		22.3			273	242	
400 000			4 583	3 556				104	60		29.7			246	191	
500 000			4 108	2 781				108	71		37.1			221	149	
600 000			3 649	2 138				112	90		44.6			196	115	
700 000			3 207					117			52.0			172		
800 000			2 786					122			59.4			150		

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 :																
1956 :																
1957 : 920 000			2 320					125			68.4			124.6		
1958 : 660 000				1 786					99		49.0				95.9	
1959 :																

REMARKS

NOTE : SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXII

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER LITTLE RUAHA STATION MAWANDE NO 1KA 31 CATCHMENT AREA 2 005 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 465 000 ACRE FEET, OR 643 CUSECS.

STORAGE CAPACITY.	MAXIMUM FLOOD REDUCED TO, CUSECS.					LENGTH OF FILLING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOOD, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0			5 740	5 530		0	0	0	0	0	0			893	860	
20 000			2 542	2 330				11	15		4.3			395	362	
40 000			1 747	1 781				17	21		8.6			272	277	
60 000			1 388	1 376				44	46		12.9			216	214	
80 000			1 183	1 167				110	51		17.2			184	181	
100 000			1 091	966				110	69		21.5			170	150	
120 000			1 001	825				115	83		25.8			156	128	
140 000			915	744				121	110		30.1			142	116	
160 000			834					129			34.4			130		

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 :																
1956 :																
1957 : 178 000			770					145			38.3			119.8		
1958 : 660 000				670					124		33.5				104.2	
1959 :																

REMARKS Records from the last part of 1959 were not received in time and analyses from this year is therefore not included in this tabulation.

NOTE : SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXII

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER LITTLE RUAHA STATION S. H. CLUB NO 1KA 32 CATCHMENT AREA 293 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 116 000 ACRE FEET, OR 161 CUSECS.

STORAGE CAPACITY.	MAXIMUM FLOOD REDUCED TO, CUSECS.					LENGTH OF FILLING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOOD, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0				650	480	0	0	0	0	0	0				404	298
5 000			444	444	270			28	30	22	4.3			276	276	168
10 000			381	372	207			46	52	65	8.6			237	231	129
15 000			334	326	171			62	57	80	12.9			207	202	106
20 000			313	284	145			126	65	110	17.2			194	176	90
25 000			291	252				136	98		21.5			181	157	
30 000			274	228				142	111		25.8			170	142	
35 000			255	207				160	125		30.1			158	129	
40 000			240					168			34.5			149		
45 000																
50 000																

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 :																
1956 :																
1957 :47 000			221					175			40.5			137.2		
1958 :42 000				180					139		36.2				111.8	
1959 :25 000					123					121	21.5					76.4

REMARKS

NOTE : SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXII

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER NDEMBERA STATION MADIBIRA NO 1KA 33 CATCHMENT AREA 707 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 147 000 ACRE FEET, OR 203 CUSECS.

STORAGE CAPACITY.	MAXIMUM FLOOD REDUCED TO, CUSECS.					LENGTH OF FILLING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOOD, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0			3 600	3 400	1 700	0	0	0	0	0	0			1 773	1 675	837
10 000			1 834	1 287	982			5	22	24	6.8			903	634	484
20 000			1 015	1 113	779			8	28	25	13.6			500	548	384
30 000			674	932	585			21	28	31	20.4			332	459	288
40 000			451	758	480			25	29	98	27.2			222	373	236
50 000			376	610	430			89	35	100	34.0			185	300	212
60 000			323	500	380			97	73	104	40.8			159	246	187
70 000			278	434	331			127	77	106	47.6			137	214	163
80 000				371	285				84	135	54.4				183	140
90 000				314					89		61.2				155	

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 :																
1956 :																
1957 : 82 700			228					129			56.3			112.3		
1958 : 97 500				271					91		66.3				133.5	
1959 :																

REMARKS

NOTE : SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXII

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER LITTLE RUAHA STATION IWAWA NO 1KA 39 CATCHMENT AREA 645 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 265 000 ACRE FEET, OR 367 CUSECS.

STORAGE CAPACITY.	MAXIMUM FLOOD REDUCED TO, CUSECS.					LENGTH OF FILLING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOOD, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0				2 100	1 700	0	0	0	0	0	0				572	463
10 000					912					16	3.7					248
20 000			1 067	1 114	652			28	25	25	7.5			291	303	178
30 000					515					57	11.3					140
40 000			817	804	432			53	47	72	15.1			223	219	118
50 000					370					91	18.8					101
60 000			657	619				125	61		22.6			179	169	
80 000			578	497				133	104		30.2			157	135	
100 000			509					147			37.7			139		

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 :																
1956 :																
1957 : 111 400			472					150			42.0			128.6		
1958 : 96 000				424					123		36.2				115.5	
1959 : 61 100					326					136	23.0					88.8

REMARKS

NOTE : SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXII

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER KILOMBERO STATION IFAKARA NO 1KB 2 CATCHMENT AREA 12 063 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 10 560 000 ACRE FEET, OR 14 612 CUSECS.

STORAGE CAPACITY.	MAXIMUM FLOOD REDUCED TO, CUSECS.					LENGTH OF FILLING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOOD, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0	63 000	90 000	98 000	74 000	28 000	0	0	0	0	0	0	431	616	671	506	192
500 000	44 100	-	-	56 000	17 966	27	-	-	27	65	4.7	302	-	-	388	123
1 000 000	36 600	-	-	49 730	14 307	41	-	-	50	74	9.5	250	-	-	340	98
1 500 000	31 000	-	54 800	44 802	11 326	49	-	30	53	93	14.2	212	-	375	307	78
2 000 000	26 300	51 700	48 800	40 170		55	45	43	56		18.9	180	354	334	275	
2 500 000	22 100	46 400	43 100	35 862		62	60	47	61		23.7	151	318	295	245	
3 000 000	18 400	42 100	38 000	31 798		76	64	51	63		28.4	126	288	260	218	
3 500 000	15 200	38 500	33 100	27 843		85	66	54	65		33.1	104	264	227	191	
4 000 000		35 300	28 600	24 057			71	57	69		37.9		242	196	165	
4 500 000		32 700	24 400	20 502			112	62	74		42.6		224	167	140	
5 000 000		30 500	20 500				115	68			47.3		209	140		
6 000 000		26 100					122				56.8		179			
7 000 000		22 000					132				66.3		151			

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 :3 650 000	14 500					89					34.6	99.2				
1956 :7 200 000		21 300					133				68.2		145.8			
1957 :5 450 000			17 900					77			51.6			122.5		
1958 :5 069 000				16 856					87		48.0				115.4	
1959 :1 977 000					9 194					126	18.7					62.9

REMARKS

NOTE : SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXII

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER KILOMBERO STATION IFWEMA NO 1KB 4 CATCHMENT AREA 7 048 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 5 235 000 ACRE FEET, OR 7 244 CUSECS.

STORAGE CAPACITY.	MAXIMUM FLOOD REDUCED TO, CUSECS.					LENGTH OF FILLING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOOD, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0	19 000	29 000	26 000	24 000	18 000	0	0	0	0	0	0	262	400	359	331	248
200 000	12 870	16 165	15 700	14 700	10 500	27	39	33	53	68	3.8	178	223	217	203	145
400 000	10 048	15 135	13 500	12 950	9 050	84	116	56	62	75	7.6	138	209	186	179	125
600 000	8 944	14 268	11 900	11 300	7 860	111	117	64	65	120	11.5	123	197	164	156	109
800 000	8 050	13 412	10 600	9 900	7 050	114	119	117	72	127	15.3	111	185	146	137	97
1 000 000	7 160	12 570	9 700	8 700	6 250	128	121	123	105	138	19.1	99	174	134	120	86
1 200 000		11 761	8 900	7 800			132	132	118		22.9		162	123	108	
1 400 000		11 003					134				26.7		152			
1 600 000		10 256					136				30.6		142			

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 :1 102 000	6 760					131					21.1	93.3				
1956 :1 776 000		9 616					142				33.9		132.7			
1957 :1 360 000			8 400					140			26.0			116.0		
1958 :1 275 000				7 500					123		24.4				103.5	
1959 :1 040 000					6 130					141	19.9					84.6

REMARKS

NOTE : SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXII

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER LUHOMBERO STATION ILONGA NO 1KB 5 CATCHMENT AREA 395 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 182 000 ACRE FEET, OR 252 CUSECS.

STORAGE CAPACITY.	MAXIMUM FLOOD REDUCED TO, CUSECS.					LENGTH OF FILLING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOOD, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0			4 400	5 000	3 400	0	0	0	0	0	0	-	-	1 746	1 984	1 349
20 000	844	2 569	1 410	895	208	17	11	18	41	82	11.0	335	1 019	560	355	83
40 000	587	1 727	860	656		94	14	22	44		22.0	233	685	341	260	
60 000	500	1 404	560	467		147	27	34	89		33.0	198	557	222	185	
80 000	432	1 086		359		148	39		102		44.0	171	431		142	
100 000		947					95				55.0		376			
120 000		841					96				65.9		334			
140 000		740					99				76.9		294			
160 000		638					104				87.9		253			
180 000		545					114				98.9		216			

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 : 109 000	333					149					59.9	132.1				
1956 : 193 000		490					118				106.1		184.4			
1957 : 83 200			305					105			45.7			121.0		
1958 : 89 100				316					108		49.0				125.4	
1959 : 36 900					137					147	20.3					54.4

REMARKS

NOTE : SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXII

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER KICOGO-RUAHA STATION FRICKS BRIDGE NO 1KB 6 CATCHMENT AREA 511 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 284 000 ACRE FEET, OR 393 CUSECS.

STORAGE CAPACITY.	MAXIMUM FLOOD REDUCED TO, CUSECS.					LENGTH OF FILLING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOOD, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0		-	-	2 248	1 868	0	0	0	0	0	0		-	-	572	475
10 000		-	1 070	1 435	1 078		-	31	20	12	3.5		-	272	365	274
20 000		3 457	911	1 244	740		20	32	33	18	7.0		880	232	317	188
30 000		-	728	1 104	640		-	37	40	68	10.6		-	185	281	163
40 000		2 990	666	989	568		55	97	61	71	14.1		761	169	252	145
60 000		2 812	568	834	431		58	110	68	81	21.1		716	145	212	110
80 000		2 664	492	701			64	139	99		28.2		678	125	178	
100 000		2 536		603			67		108		35.2		645		153	
120 000		2 389					71				42.3		608			
140 000		2 248					72				49.3		572			
160 000		2 108					72				56.3		536			
180 000		1 968					72				63.4		501			
200 000		1 827					72				70.4		465			
220 000		1 687					72				77.5		429			
240 000		1 547					73				84.5		394			
260 000		1 408					73				91.5		358			
280 000		1 271					74				98.6		323			
300 000		1 136					75				105.6		289			

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 :																
1956 : 342 000		865					75				120.4		220.1			
1957 : 98 000			429					148			34.5			109.1		
1958 : 123 000				505					147		43.3				128.5	
1959 :																

REMARKS

NOTE: SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXII

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER MPANGA STATION MPANGA NO 1KB 8 CATCHMENT AREA 937 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 869 000 ACRE FEET, OR 1 202 CUSECS.

STORAGE CAPACITY.	MAXIMUM FLOOD REDUCED TO, CUSECS.					LENGTH OF FILLING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOOD, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0			5 300	5 800	3 600	0	0	0	0	0	0			441	483	300
25 000			2 660	2 720	1 425			25	37	71	2.9			221	225	119
50 000			2 170	2 380	1 240			28	39	76	5.8			180	198	103
75 000			1 860	2 070	1 110			56	41	144	8.6			154	172	92
100 000			1 630	1 790	1 030			60	53	148	11.5			135	150	86
125 000			1 430	1 550				62	65		14.3			118	129	
150 000			1 290	1 380				157	74		17.3			107	115	

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 :																
1956 :																
1957 : 175 000			1 210					158			20.1			100.7		
1958 : 175 000				1 215					106		20.1				101.1	
1959 : 120 000					964					154	13.8					80.2

REMARKS

NOTE : SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXII

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER MNYERA STATION TAVETA NO 1KB 9 CATCHMENT AREA 1 950 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 1 694 000 ACRE FEET, OR 2 344 CUSECS.

STORAGE CAPACITY.	MAXIMUM FLOOD REDUCED TO, CUSECS.					LENGTH OF FILLING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOOD, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0			8 700	14 000	7 000	0	0	0	0	0	0			371	597	299
50 000			5 427	5 384	3 445			11	43	39	3.0			232	230	147
100 000			4 109	4 826	2 884			31	46	64	5.9			175	206	123
150 000			3 490	4 294	2 530			45	48	101	8.9			145	183	108
200 000			2 978	3 784	2 288			53	51	107	11.8			127	161	98
250 000			2 758	3 299	2 059			121	53	116	14.8			118	141	88
300 000			2 550	2 904				122	80		17.7			109	124	
350 000				2 595					85		20.7				111	

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 :																
1956 :																
1957 : 385 300			2 214					129			22.7			94.5		
1958 : 399 600				2 321					111		23.6				99.0	
1959 : 304 800					1 856					150	18.0					79.2

REMARKS

NOTE : SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXII

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER RUHUJI STATION MWAYAMALUNGU NO 1KB 10 CATCHMENT AREA 3 294 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 2 257 000 ACRE FEET, OR 3 123 CUSECS.

STORAGE CAPACITY.	MAXIMUM FLOOD REDUCED TO, CUSECS.					LENGTH OF FILLING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOOD, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0			15 000	14 000	13 000	0	0	0	0	0	0			480	448	416
100 000			11 410	8 771	5 128			28	52	41	4.4			365	281	164
200 000			9 714	7 811	4 198			30	54	72	8.8			311	250	134
300 000			8 418	7 023	3 695			52	60	115	13.3			269	225	118
400 000			7 492	6 190	3 257			58	61	117	17.7			240	198	104
500 000			6 645	5 420	2 838			62	64	123	22.1			213	173	91
600 000			5 855	4 587				66	90		26.6			187	147	
700 000			5 121	4 040				73	95		31.0			164	129	
800 000			4 563					126			35.4			146		

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 :																
1956 :																
1957 : 895 000			4 187					130			39.6			134.0		
1958 : 777 000				3 650					104		34.4				116.9	
1959 : 550 000					2 672					151	24.3					85.5

REMARKS

NOTE : SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXII

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER LUMEMO STATION IFAKARA AND KIBAONI. NO 1KB3 and 1KB14. CATCHMENT AREA 165 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 312 000 ACRE FEET, OR 432 CUSECS.

STORAGE CAPACITY.	MAXIMUM FLOOD REDUCED TO, CUSECS.					LENGTH OF FILLING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOOD, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0		3 000	3 100	6 300	1 600	0	0	0	0	0	0		694..	718	1 458	370
10 000		1 388	1 318	3 500	250		15	25	3	119	3.2		321	305	810	58
20 000		1 155	1 126	1 270	190		30	28	40	126	6.4		267	261	294	44
30 000		996	964	1 150			33	39	41		9.6		231	223	266	
40 000		851	856	1 030			40	50	43		12.8		197	198	238	
50 000		728	760	920			46	56	46		16.0		169	176	213	
60 000		683	682	815			94	66	50		19.2		158	158	189	
70 000		-	609	725			-	73	57		22.4		-	141	168	
80 000		587	544	650			119	82	57		25.6		136	126	150	
90 000		-	485	575			-	88	65		28.8		-	112	133	
100 000		503		505			124		75		32.1		116			
110 000				440					86		35.3				102	

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 :																
1956 : 116 400		440					157				37.3		101.9			
1957 : 103 400			413					106			33.1			95.6		
1958 : 120 000				383					91		38.5				88.7	
1959 : 26 500					165					136	8.5					38.2

REMARKS

NOTE : SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

TABLE XXII

RUFIJI BASIN SURVEY — HYDROLOGICAL SECTION

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

RIVER KILOMBERO STATION SWERO NO 1KB 17 CATCHMENT AREA 12 915 SQ. MILES.

AVERAGE YEARLY RUNOFF (SYNTHETIC 1940/41 — 54/55) 11 092 000 ACRE FEET, OR 15 348 CUSECS.

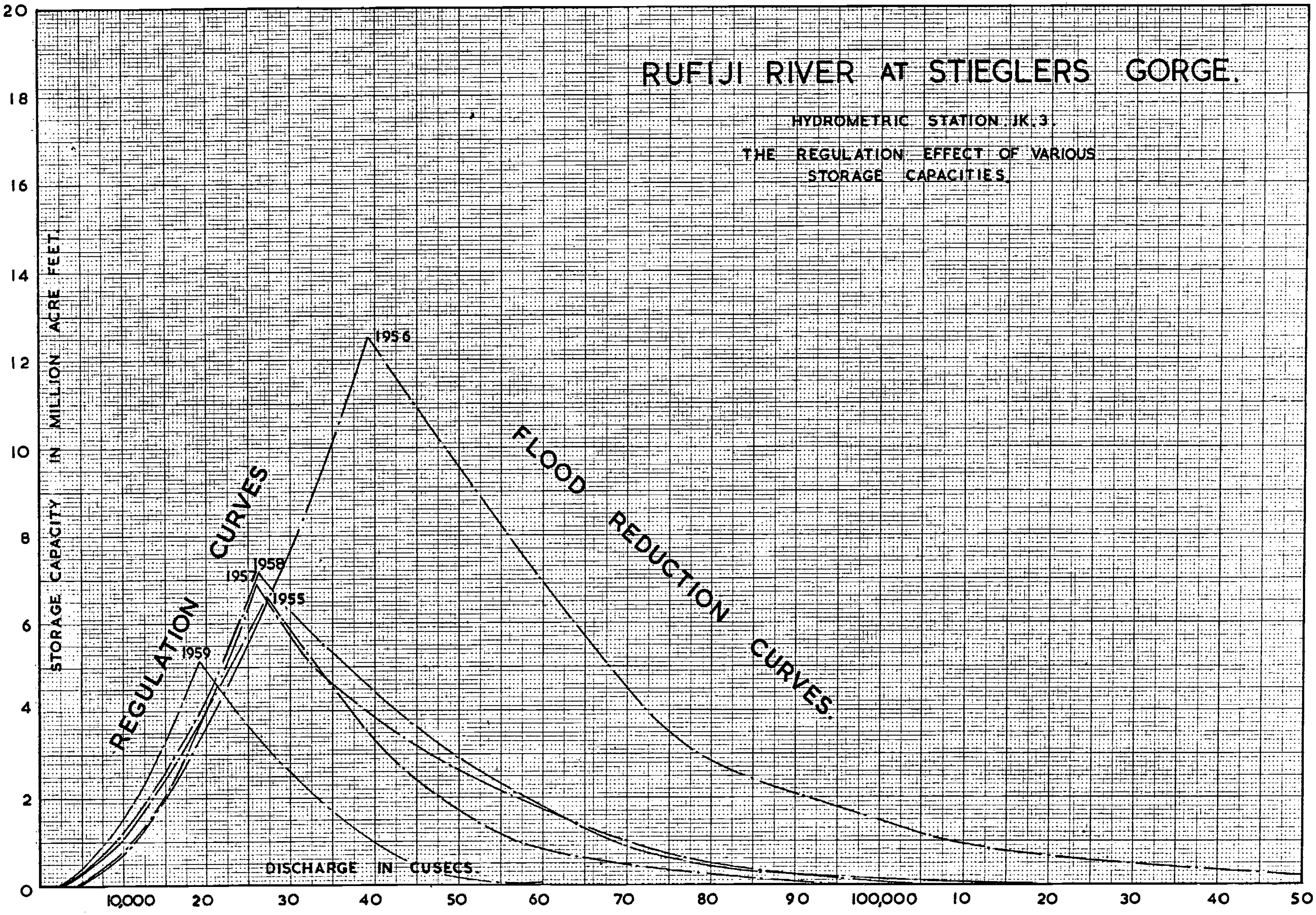
STORAGE CAPACITY.	MAXIMUM FLOOD REDUCED TO, CUSECS.					LENGTH OF FILLING PERIOD IN DAYS.					PERCENTAGES OF AVERAGES					
											STORAGE CAPACITY,	REGULATED FLOOD, %				
ACREFEET	1955	1956	1957	1958	1959	1955	1956	1957	1958	1959	%	1955	1956	1957	1958	1959
0				66 000	28 000	0	0	0	0	0	0				430	182
250 000				52 920	19 907				15	62	2.3				345	130
500 000				46 960	17 956				27	67	4.5				306	117
750 000				43 246	15 864				55	71	6.8				282	103
1 000 000				40 976	14 400				56	76	9.0				267	94
1 250 000				38 794	-				59	93	11.3				253	75
1 500 000				36 675	11 564				60		13.5				239	
1 750 000				34 632					63		15.8				226	
2 000 000				32 638					65		18.0				213	
2 250 000				30 708					66		20.3				200	
2 250 000				28 821					68		22.5				188	
3 000 000				25 172					70		27.0				164	
3 500 000				21 680					75		31.6				141	
4 000 000				18 458					85		36.1				120	

RESERVOIR CAPACITIES REQUIRED TO KEEP A REGULATED FLOW THROUGHOUT THE YEAR.

1955 :																
1956 :																
1957 :																
1958 :4 500 000				15 590					93		40.6				101.6	
1959 : 2 020 000					9 279					126	18.2					60.5

REMARKS

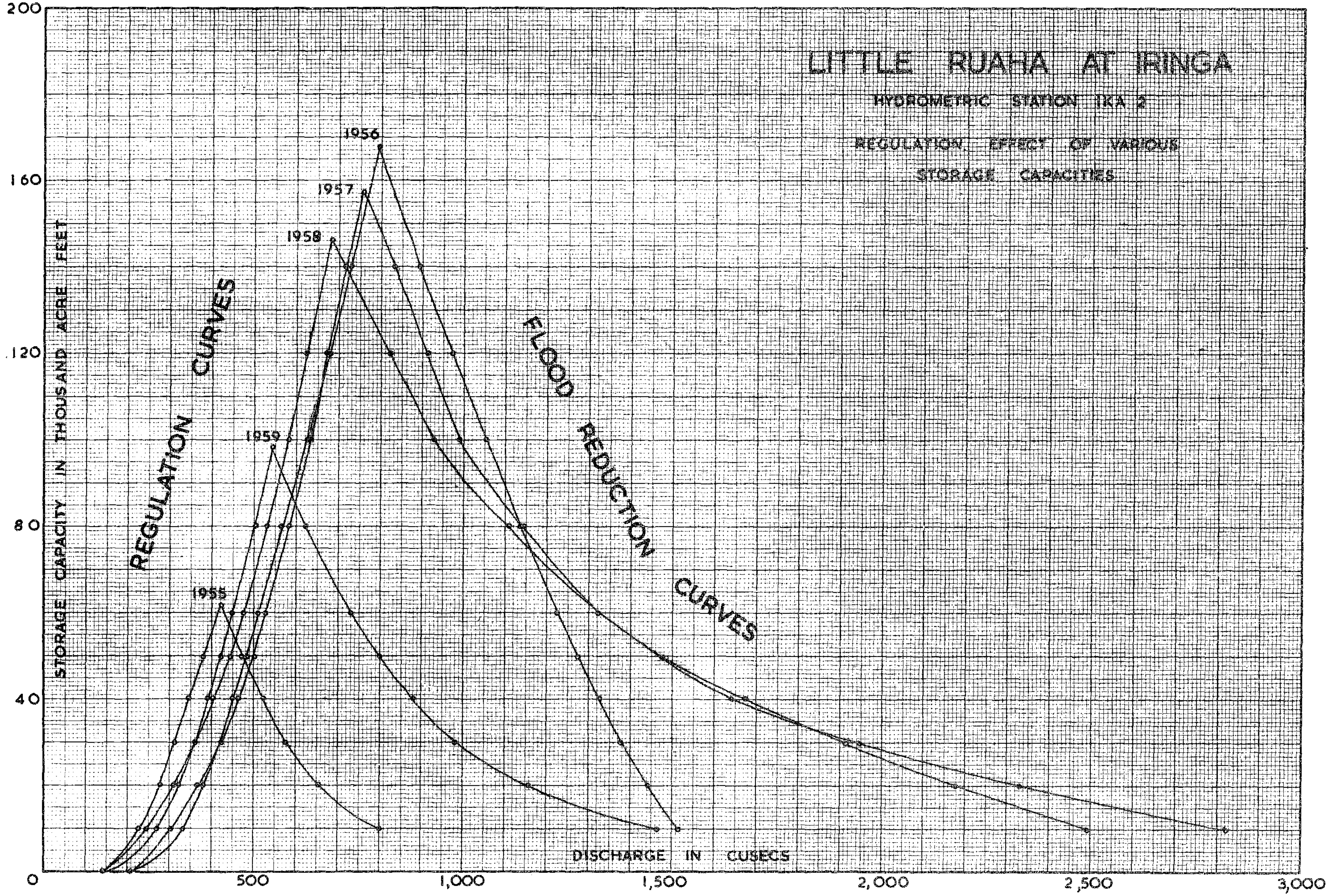
NOTE: SURFACE EVAPORATION FROM RESERVOIRS HAS NOT BEEN TAKEN INTO ACCOUNT IN THESE COMPUTATIONS.

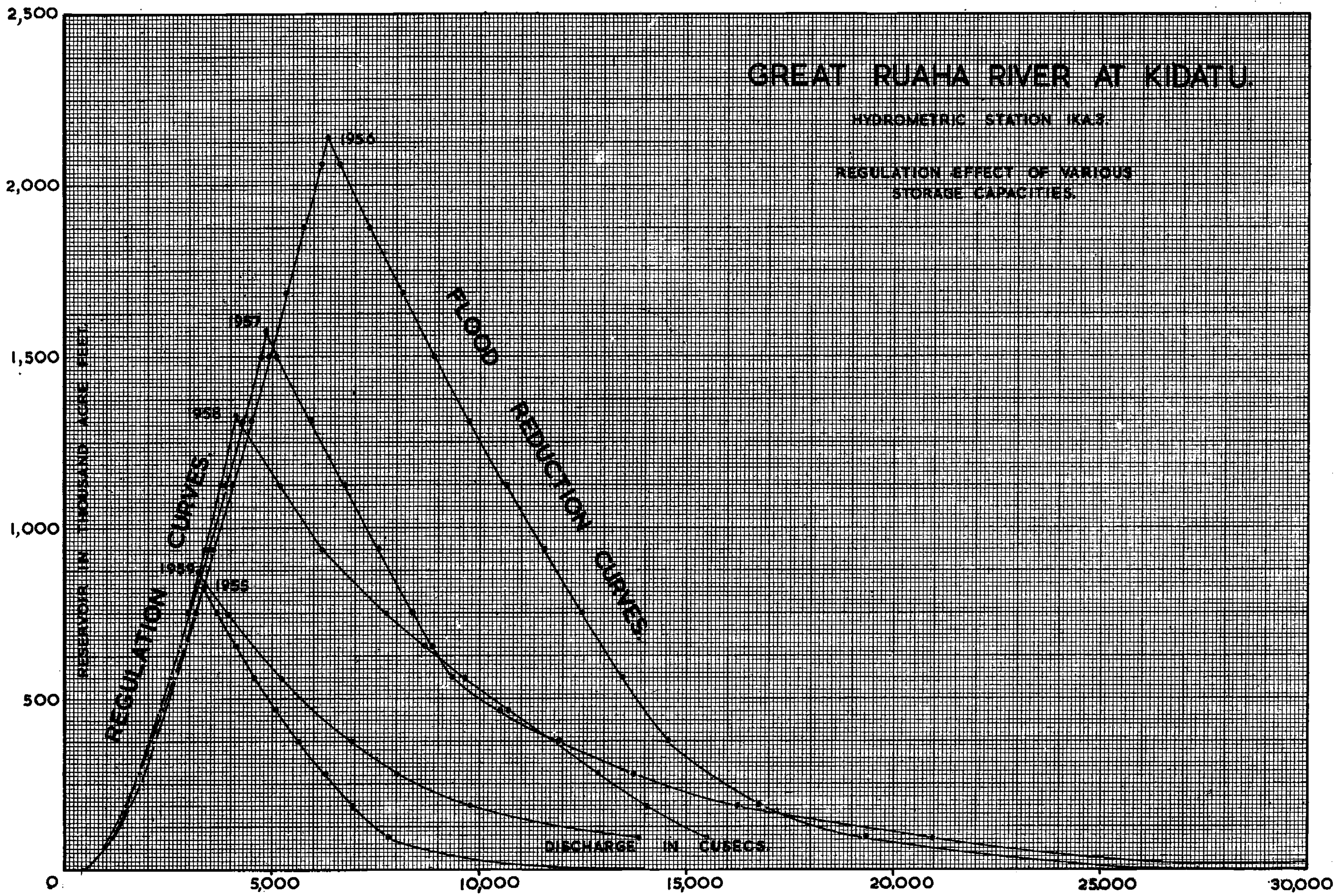


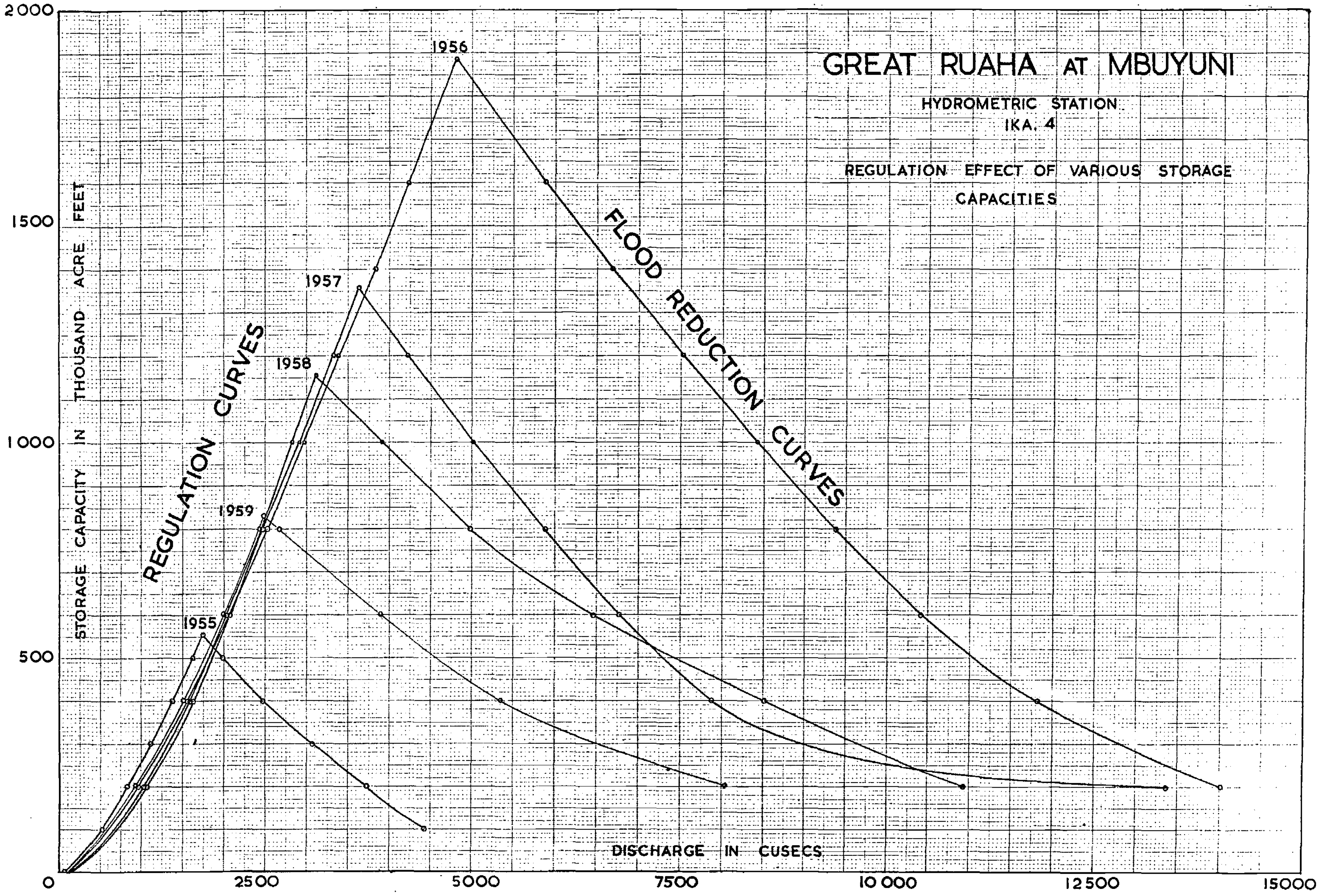
RUFIJI RIVER AT STIEGLERS GORGE.

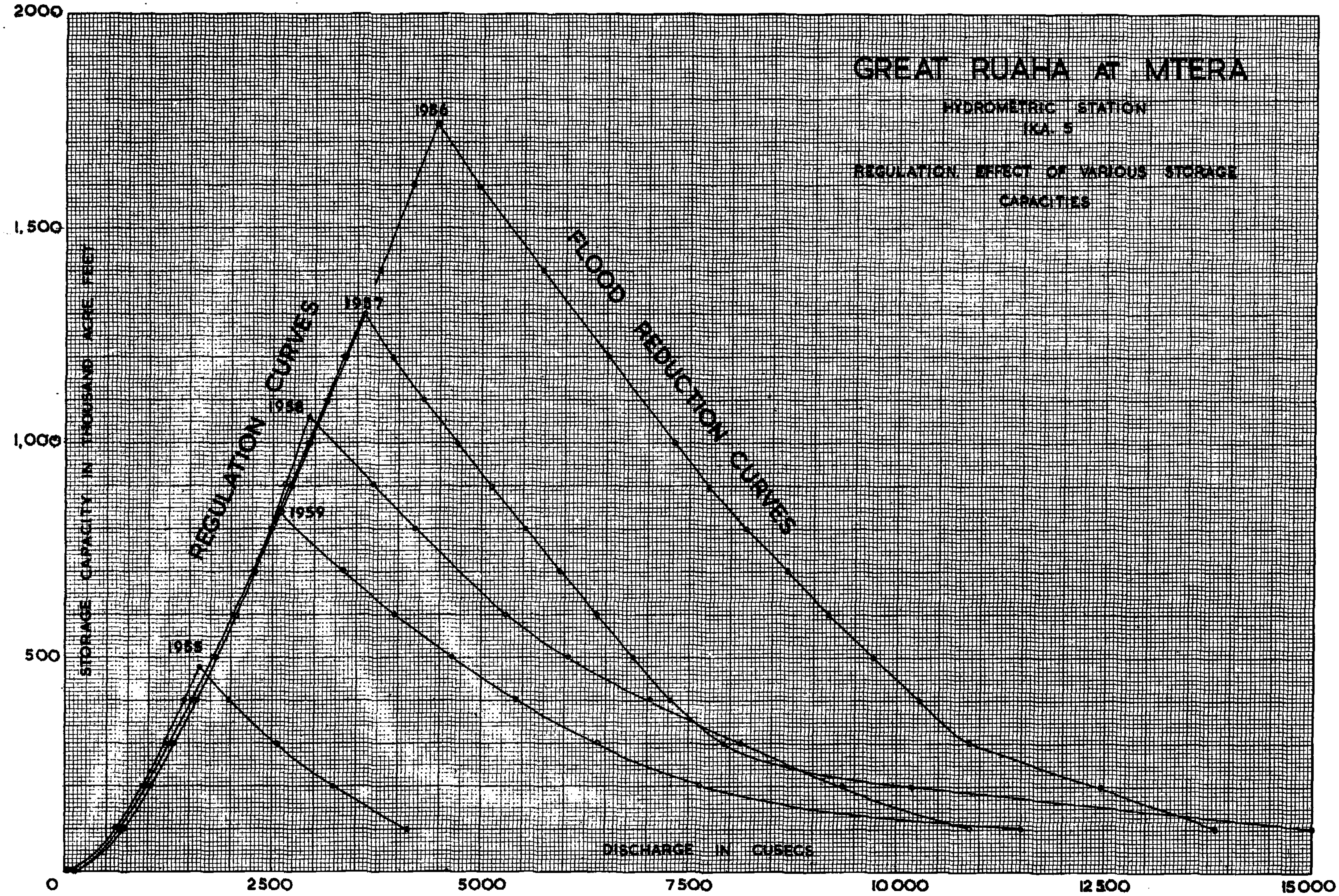
HYDROMETRIC STATION JK. 3.

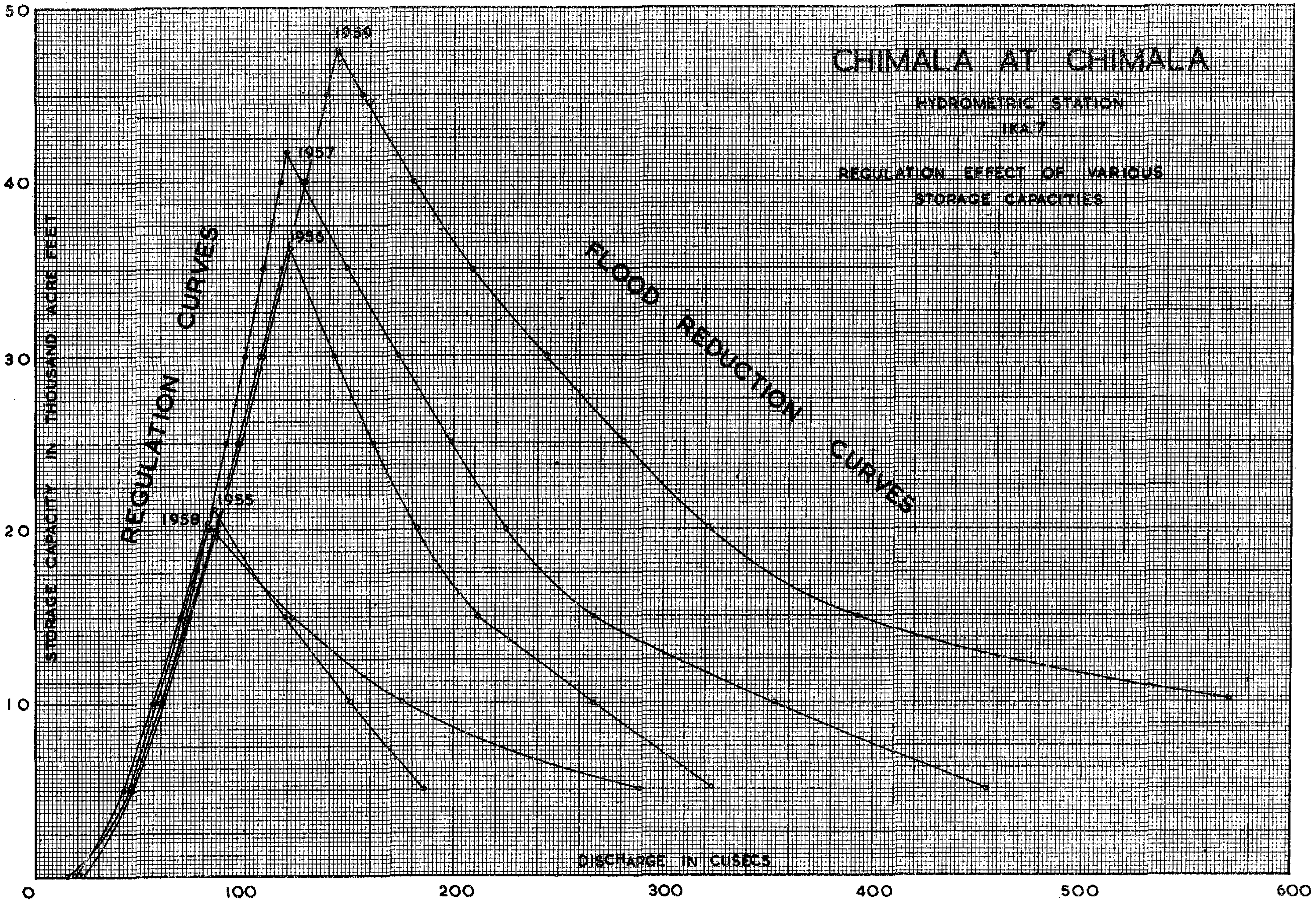
THE REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES.

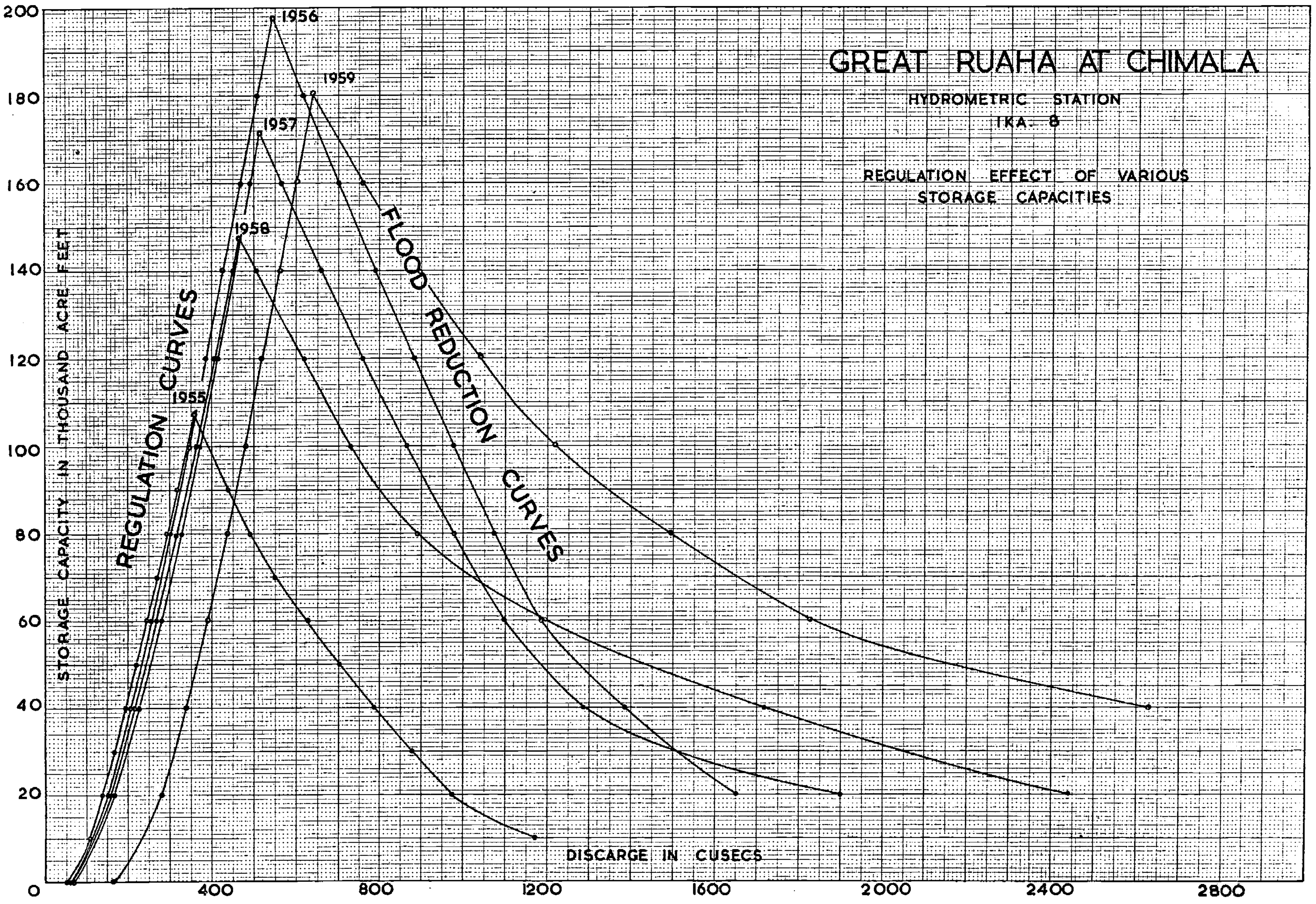

LITTLE RUAHA AT IRINGA
HYDROMETRIC STATION IKA 2
REGULATION EFFECT OF VARIOUS
STORAGE CAPACITIES
STORAGE CAPACITY IN THOUSAND ACRE FEET
DISCHARGE IN CUSECS
REGULATION CURVES
FLOOD REDUCTION CURVES
1955
1956
1957
1958
1959
0
40
80
120
160
200
500
1,000
1,500
2,000
2,500
3,000

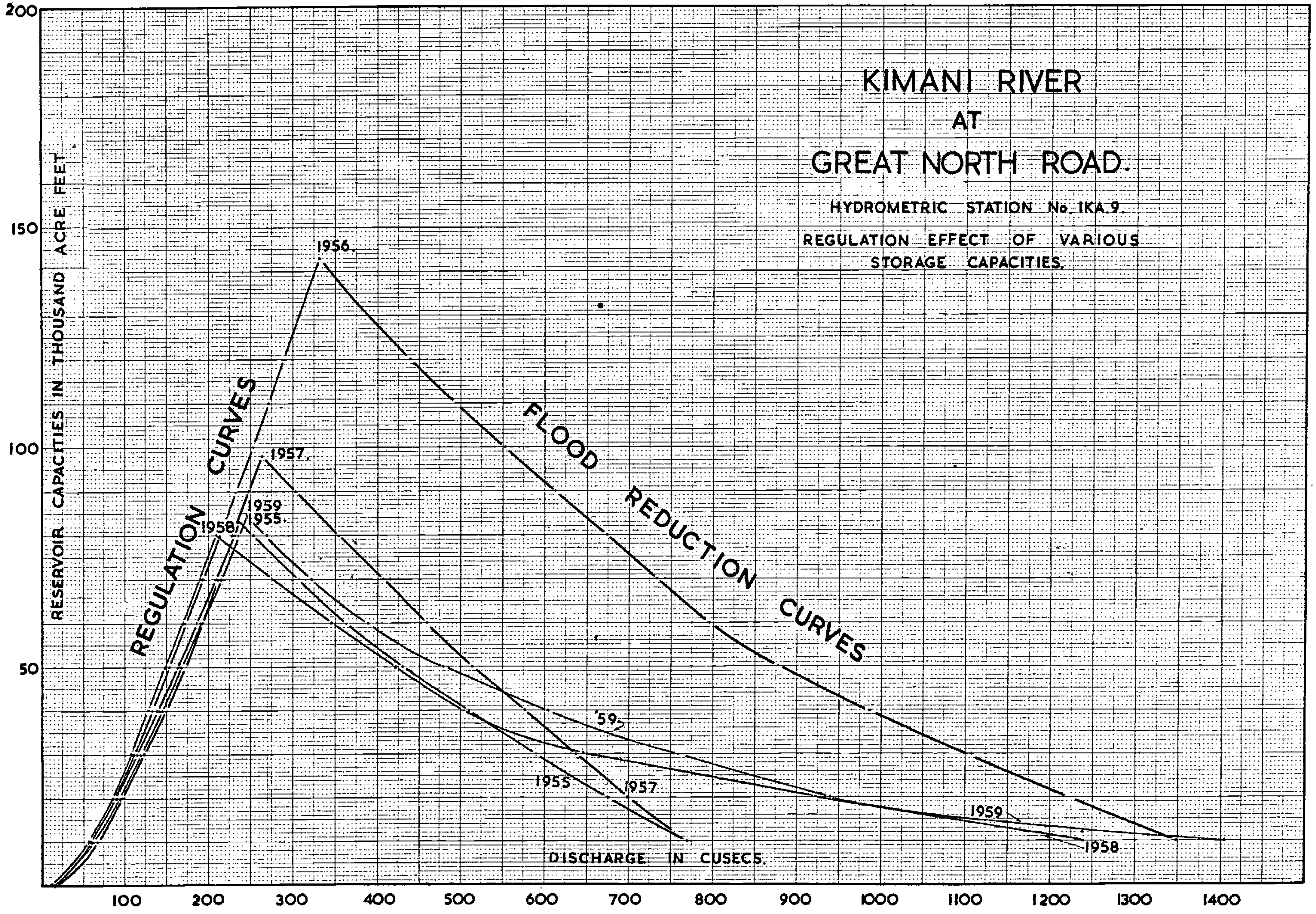

GREAT RUAHA RIVER AT KIDATU.
HYDROMETRIC STATION IKA3.
REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES.
RESERVOIR IN THOUSAND ACRE FEET.
DISCHARGE IN CUSECS.
REGULATION CURVES.
FLOOD REDUCTION CURVES.
1956
1957
1958
1959
1955
2,500
2,000
1,500
1,000
500
0
5,000
10,000
15,000
20,000
25,000
30,000

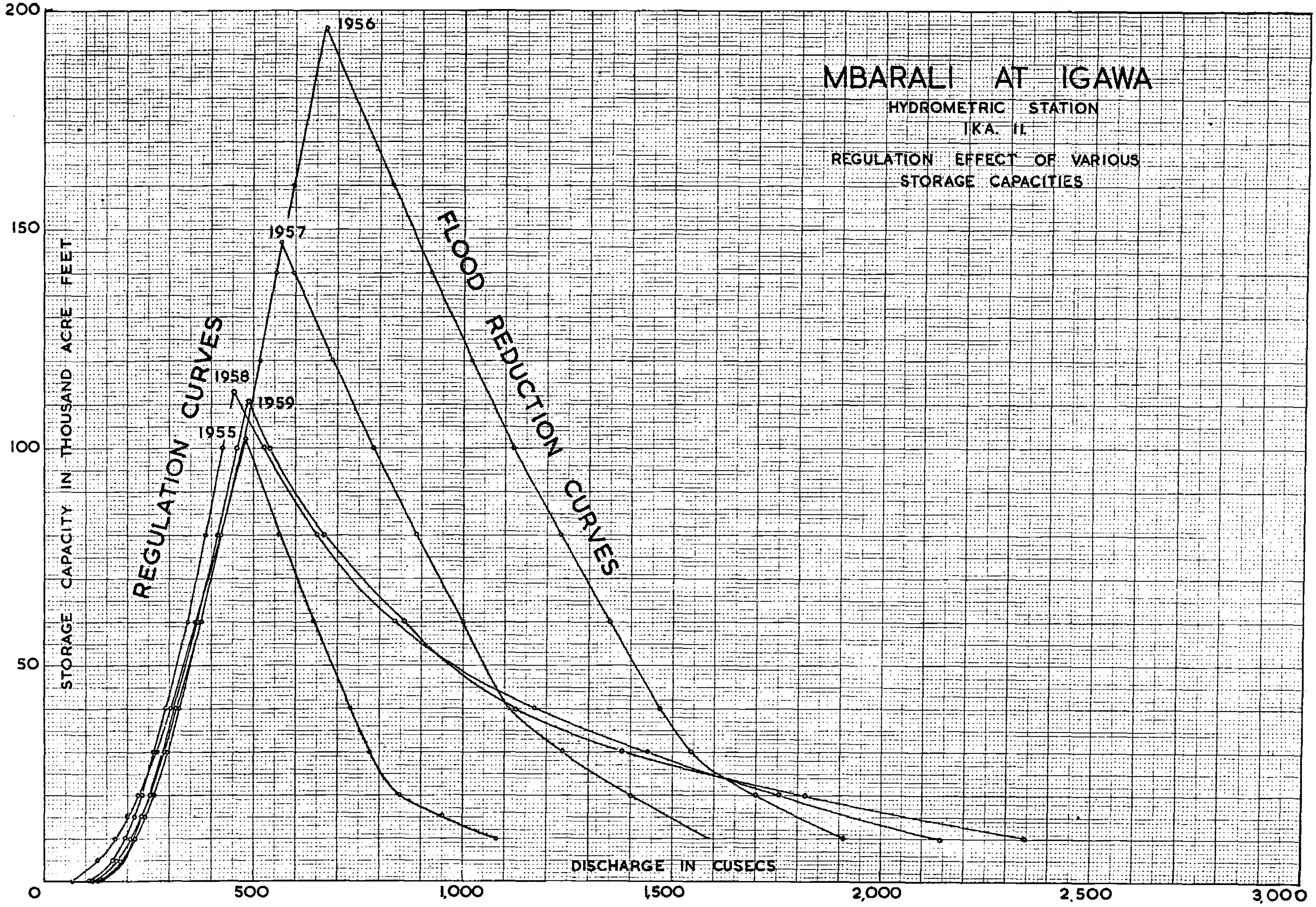

GREAT RUAHA AT MBUYUNI
HYDROMETRIC STATION
IKA. 4
REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES
STORAGE CAPACITY IN THOUSAND ACRE FEET
DISCHARGE IN CUSECS
REGULATION CURVES
FLOOD REDUCTION CURVES
1955
1956
1957
1958
1959
2000
1500
1000
500
0
2500
5000
7500
10 000
12500
15000

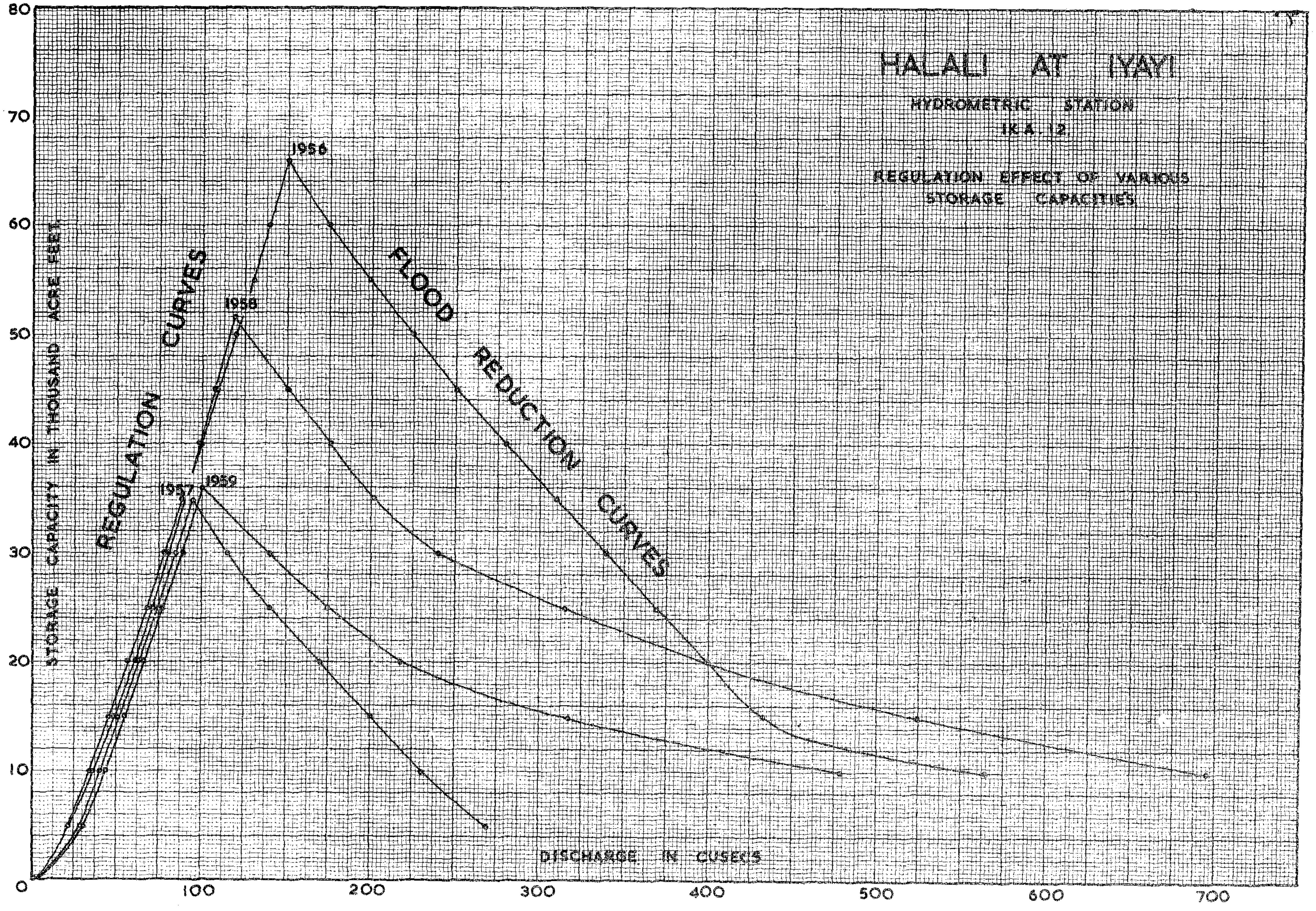

GREAT RUAHA AT MTERA
HYDROMETRIC STATION
IKA. 5
REGULATION. EFFECT OF VARIOUS STORAGE
CAPACITIES
REGULATION CURVES
FLOOD REDUCTION CURVES
1956
1957
1958
1959
1955
STORAGE CAPACITY IN THOUSAND ACRE FEET
DISCHARGE IN CUSECS
2000
1,500
1,000
500
0
2500
5000
7500
10 000
12 500
15000

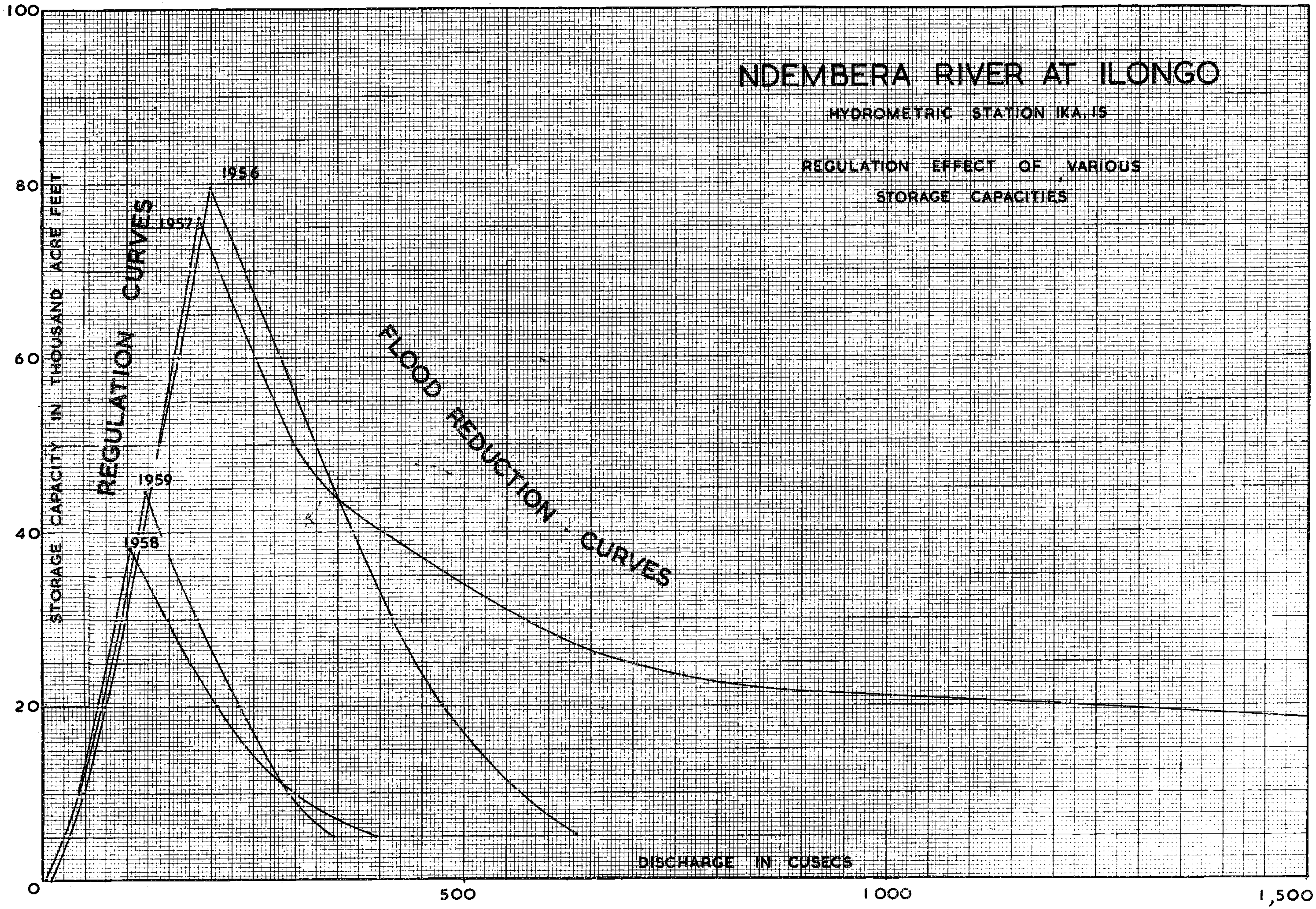

CHIMALA AT CHIMALA
HYDROMETRIC STATION
1KA 7
REGULATION EFFECT OF VARIOUS
STORAGE CAPACITIES
REGULATION CURVES
FLOOD REDUCTION CURVES
1959
1957
1956
1955
1958
STORAGE CAPACITY IN THOUSAND ACRE FEET
DISCHARGE IN CUSECS
50
40
30
20
10
0
100
200
300
400
500
600

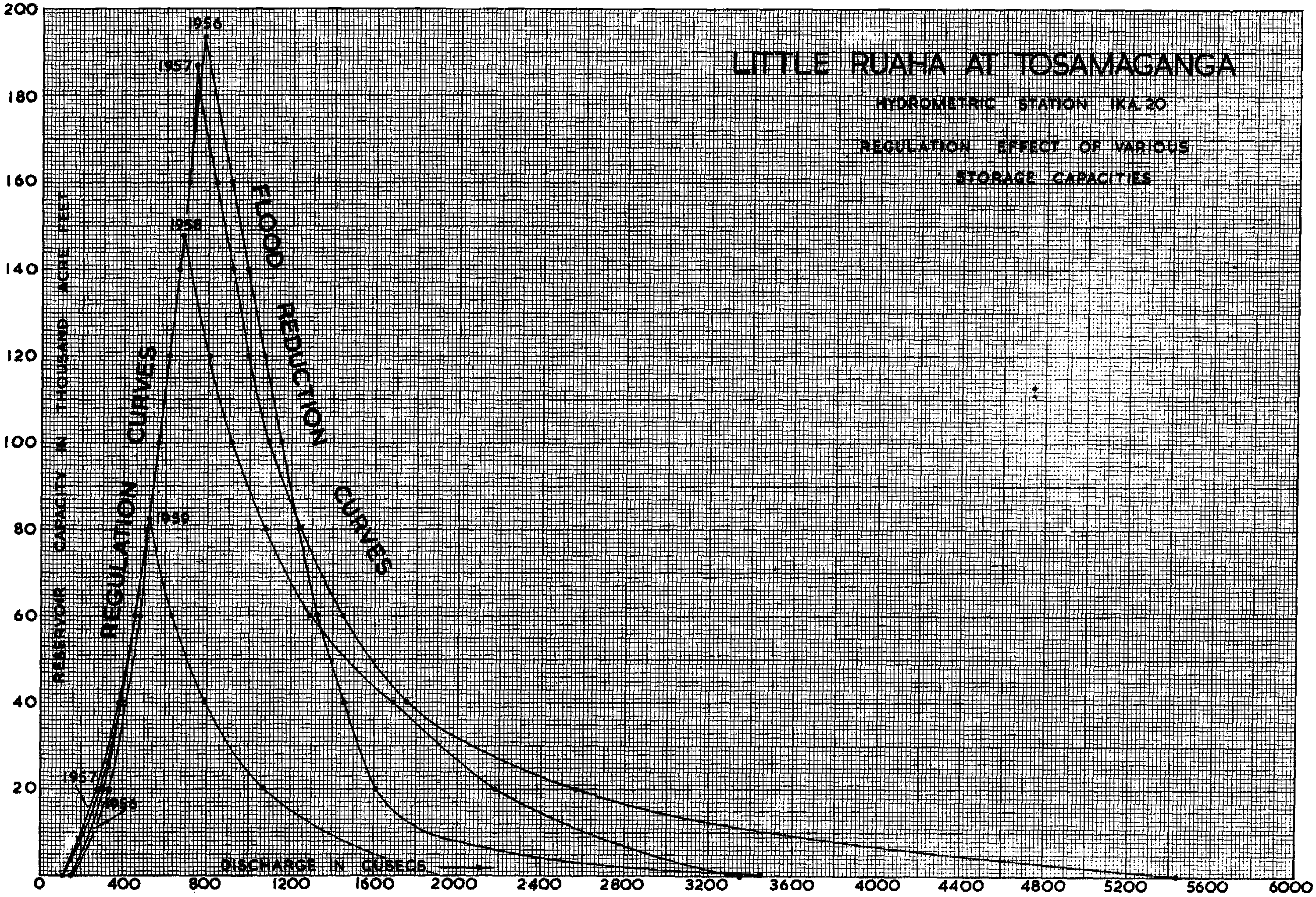

GREAT RUAHA AT CHIMALA
HYDROMETRIC STATION
1KA 8
REGULATION EFFECT OF VARIOUS
STORAGE CAPACITIES
REGULATION CURVES
FLOOD REDUCTION CURVES
1955
1956
1957
1958
1959
STORAGE CAPACITY IN THOUSAND ACRE FEET
DISCARGE IN CUSECS
0
20
40
60
80
100
120
140
160
180
200
400
800
1200
1600
2000
2400
2800

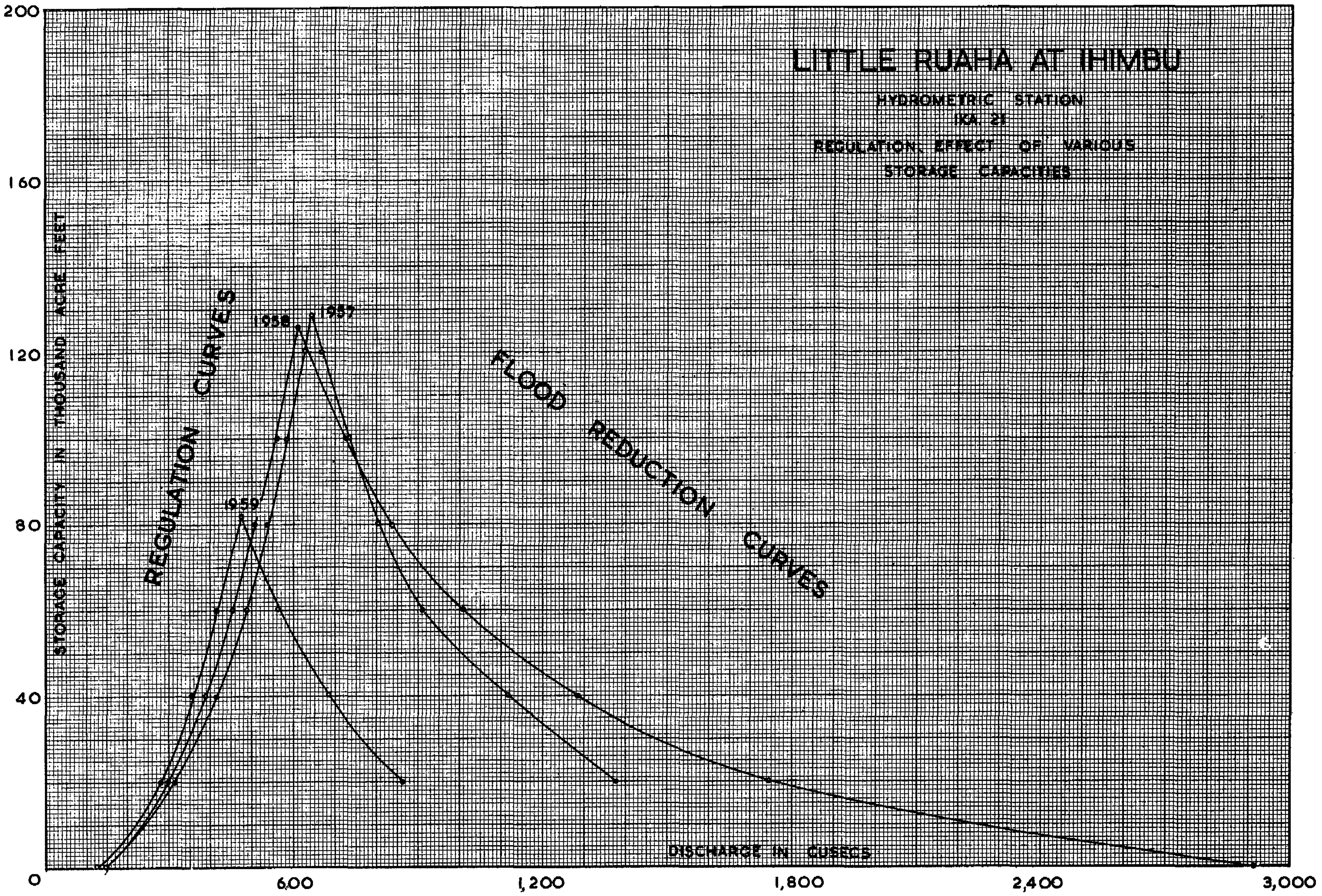

KIMANI RIVER
AT
GREAT NORTH ROAD.
HYDROMETRIC STATION No. IKA.9.
REGULATION EFFECT OF VARIOUS
STORAGE CAPACITIES.
RESERVOIR CAPACITIES IN THOUSAND ACRE FEET
200
150
100
50
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
DISCHARGE IN CUSECS.
REGULATION CURVES
FLOOD REDUCTION CURVES
1956.
1957.
1959
1955.
1958
'59
1955
1957
1959
1958

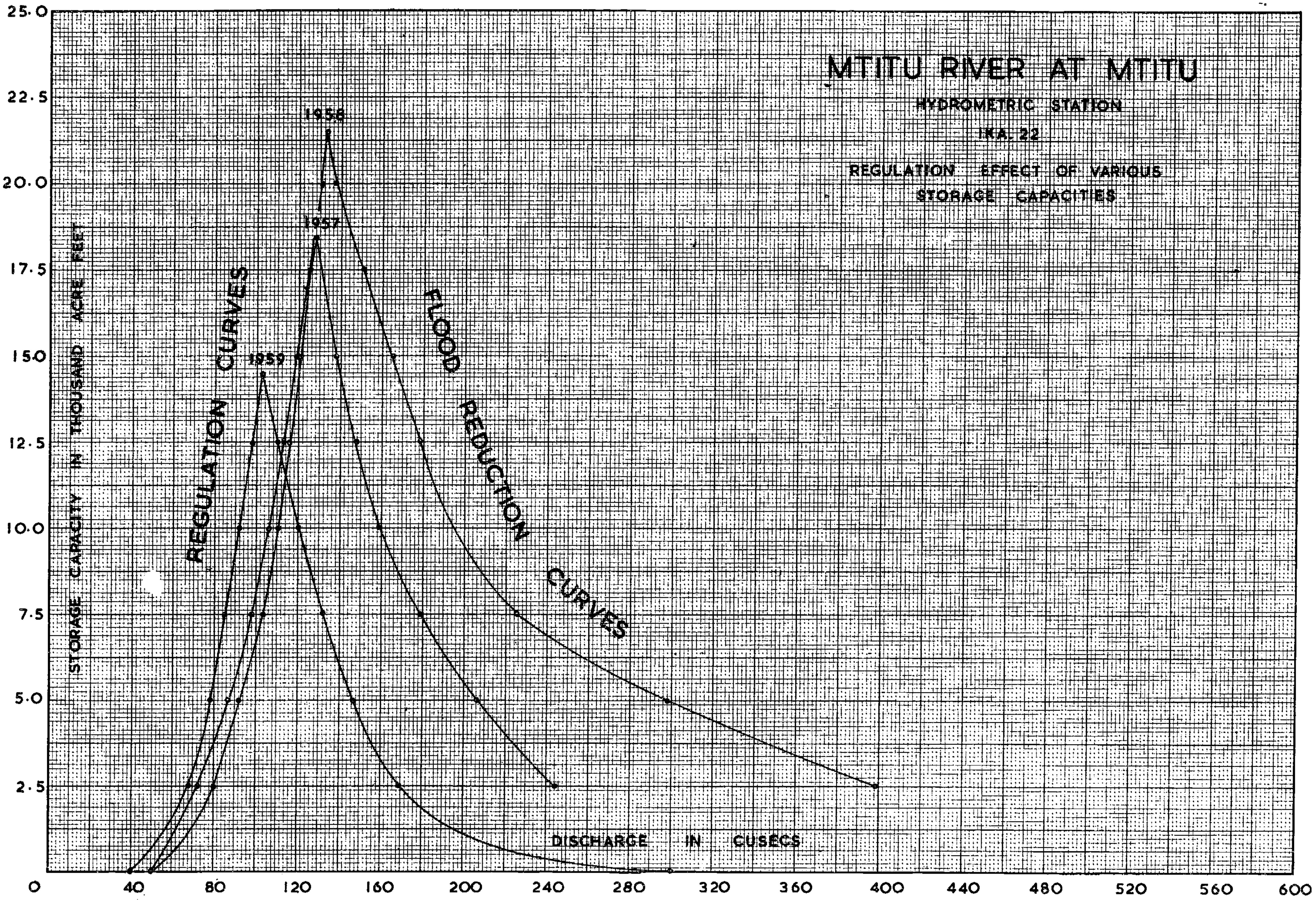

MBARALI AT IGAWA
HYDROMETRIC STATION
IKA. II.
REGULATION EFFECT OF VARIOUS
STORAGE CAPACITIES
REGULATION CURVES
FLOOD REDUCTION CURVES
1955
1956
1957
1958
1959
STORAGE CAPACITY IN THOUSAND ACRE FEET
DISCHARGE IN CUSECS
200
150
100
50
0
500
1,000
1,500
2,000
2,500
3,000

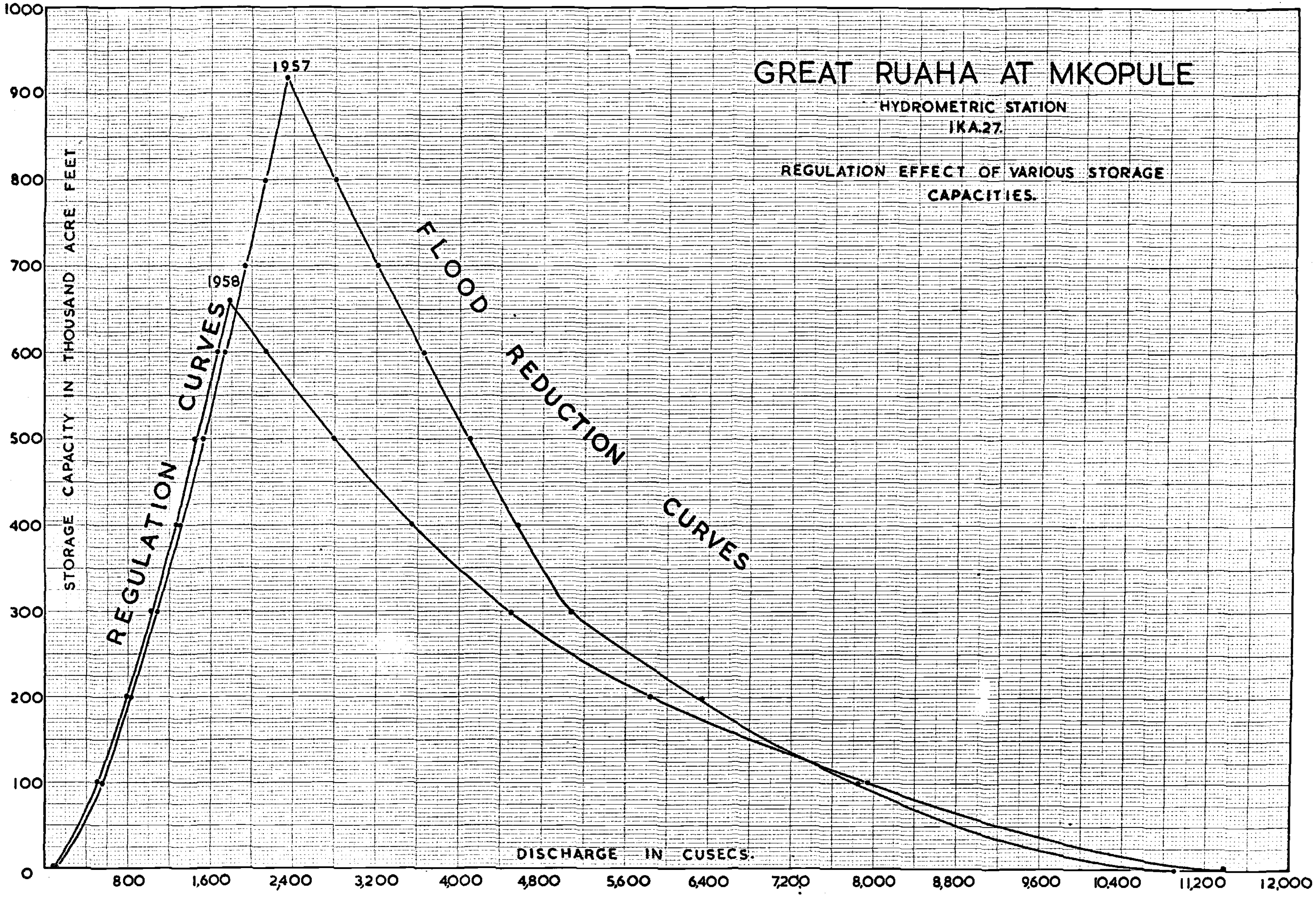

HALALI AT IYAYI
HYDROMETRIC STATION
IK A. 12.
REGULATION EFFECT OF VARIOUS
STORAGE CAPACITIES
STORAGE CAPACITY IN THOUSAND ACRE FEET.
DISCHARGE IN CUSECS
REGULATION CURVES
FLOOD REDUCTION CURVES
1956
1958
1957
1959
80
70
60
50
40
30
20
10
0
100
200
300
400
500
600
700


NDEMBERA RIVER AT ILONGO
HYDROMETRIC STATION IKA. 15
REGULATION EFFECT OF VARIOUS
STORAGE CAPACITIES
REGULATION CURVES
FLOOD REDUCTION CURVES
1956
1957
1959
1958
STORAGE CAPACITY IN THOUSAND ACRE FEET
DISCHARGE IN CUSECS
100
80
60
40
20
0
500
1000
1,500


LITTLE RUAHA AT TOSAMAGANGA
HYDROMETRIC STATION IKA 20
REGULATION EFFECT OF VARIOUS
STORAGE CAPACITIES
RESERVOIR CAPACITY IN THOUSAND ACRE FEET
DISCHARGE IN CUSECS
REGULATION CURVES
FLOOD REDUCTION CURVES
1956
1957
1958
1959
1957
1956
200
180
160
140
120
100
80
60
40
20
0
400
800
1200
1600
2000
2400
2800
3200
3600
4000
4400
4800
5200
5600
6000


LITTLE RUAHA AT IHIMBU
HYDROMETRIC STATION
IKA. 21
REGULATION, EFFECT OF VARIOUS
STORAGE CAPACITIES
STORAGE CAPACITY IN THOUSAND ACRE FEET
DISCHARGE IN CUSECS
REGULATION CURVES
FLOOD REDUCTION CURVES
1957
1958
1959
200
160
120
80
40
0
600
1,200
1,800
2,400
3,000


MTITU RIVER AT MTITU
HYDROMETRIC STATION
1KA. 22
REGULATION EFFECT OF VARIOUS
STORAGE CAPACITIES
1958
1957
1959
REGULATION CURVES
FLOOD REDUCTION CURVES
STORAGE CAPACITY IN THOUSAND ACRE FEET
DISCHARGE IN CUSECS
25.0
22.5
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0
40
80
120
160
200
240
280
320
360
400
440
480
520
560
600

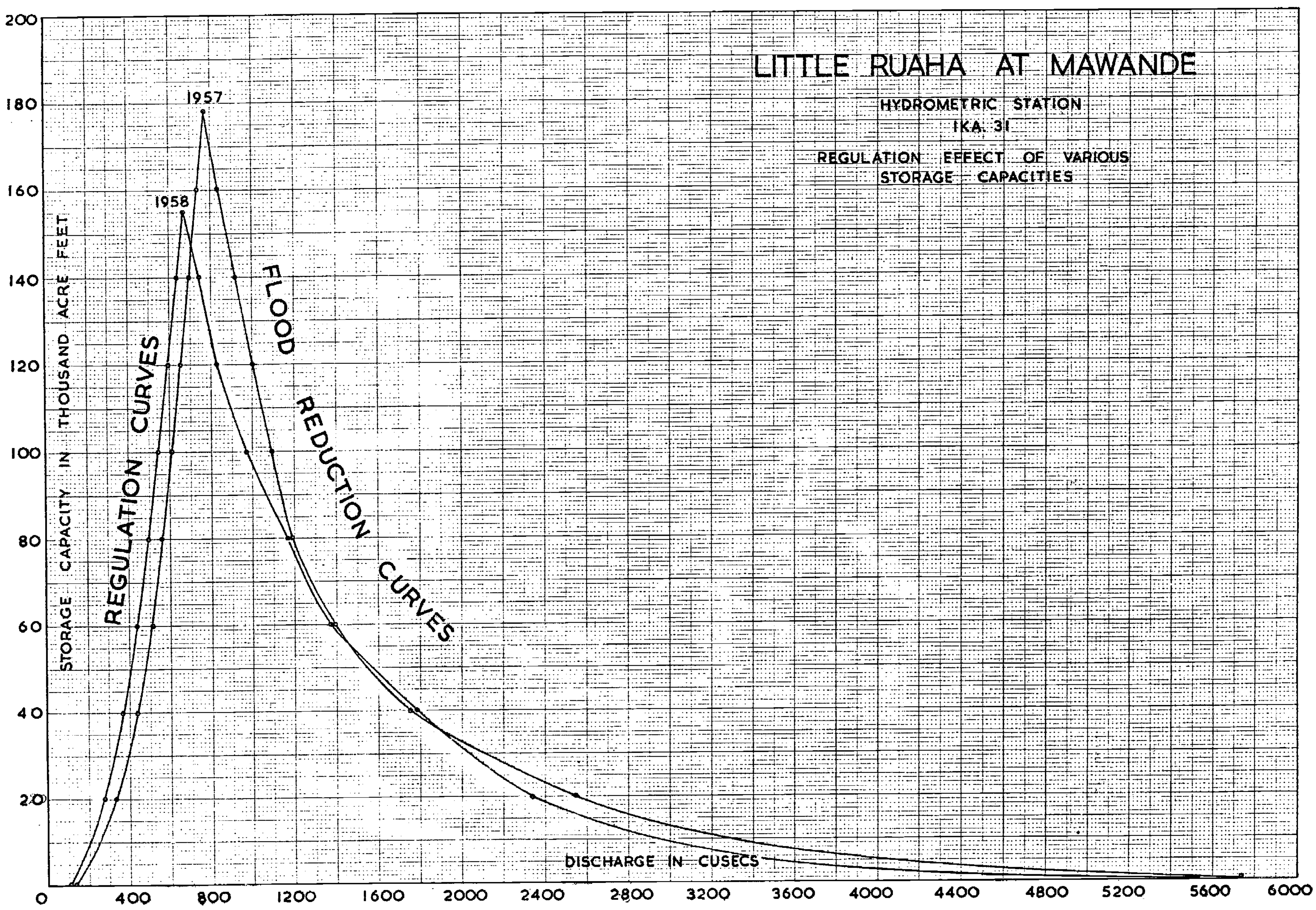


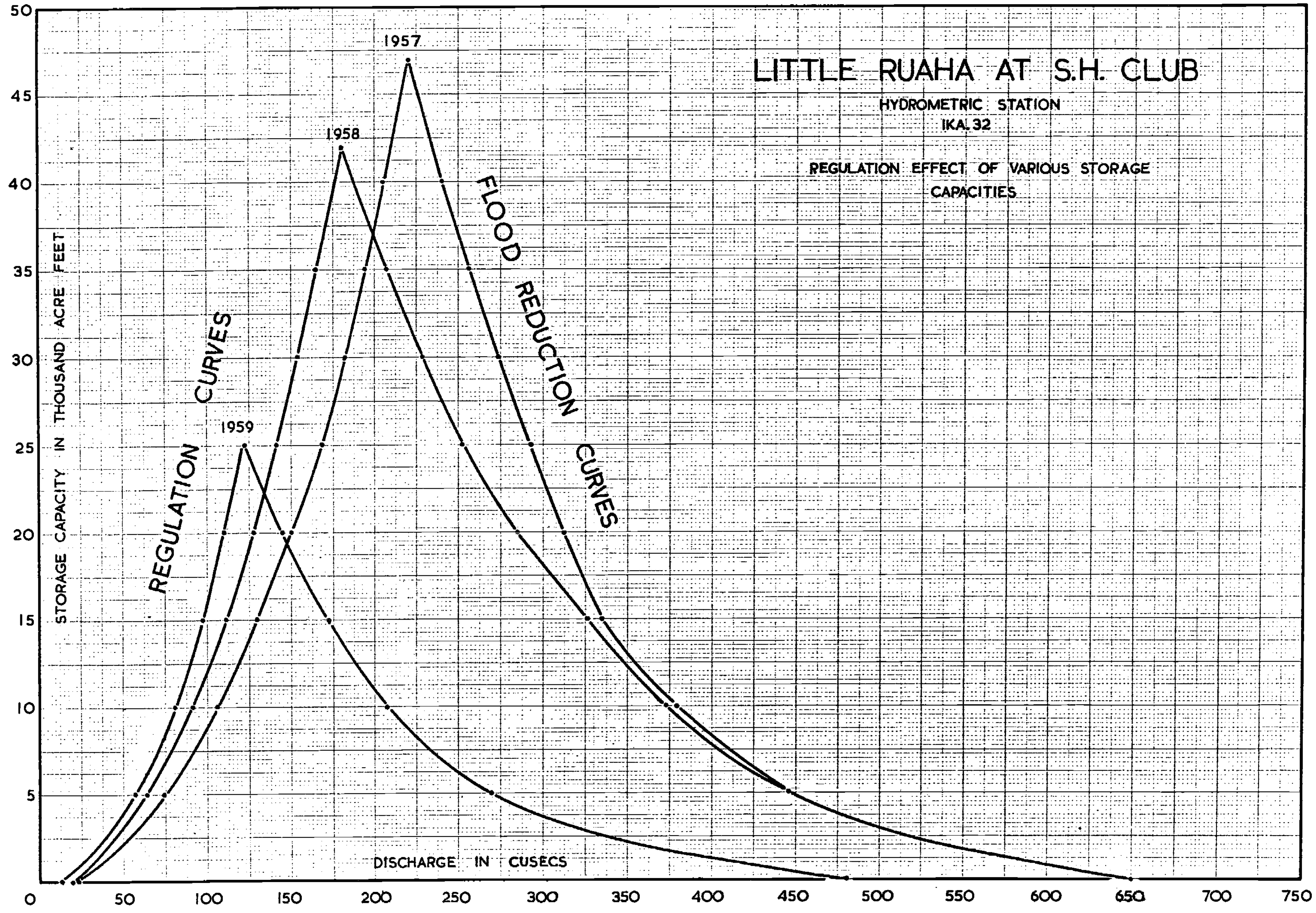
GREAT RUAHA AT MKOPULE

HYDROMETRIC STATION

IKA.27.

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES.

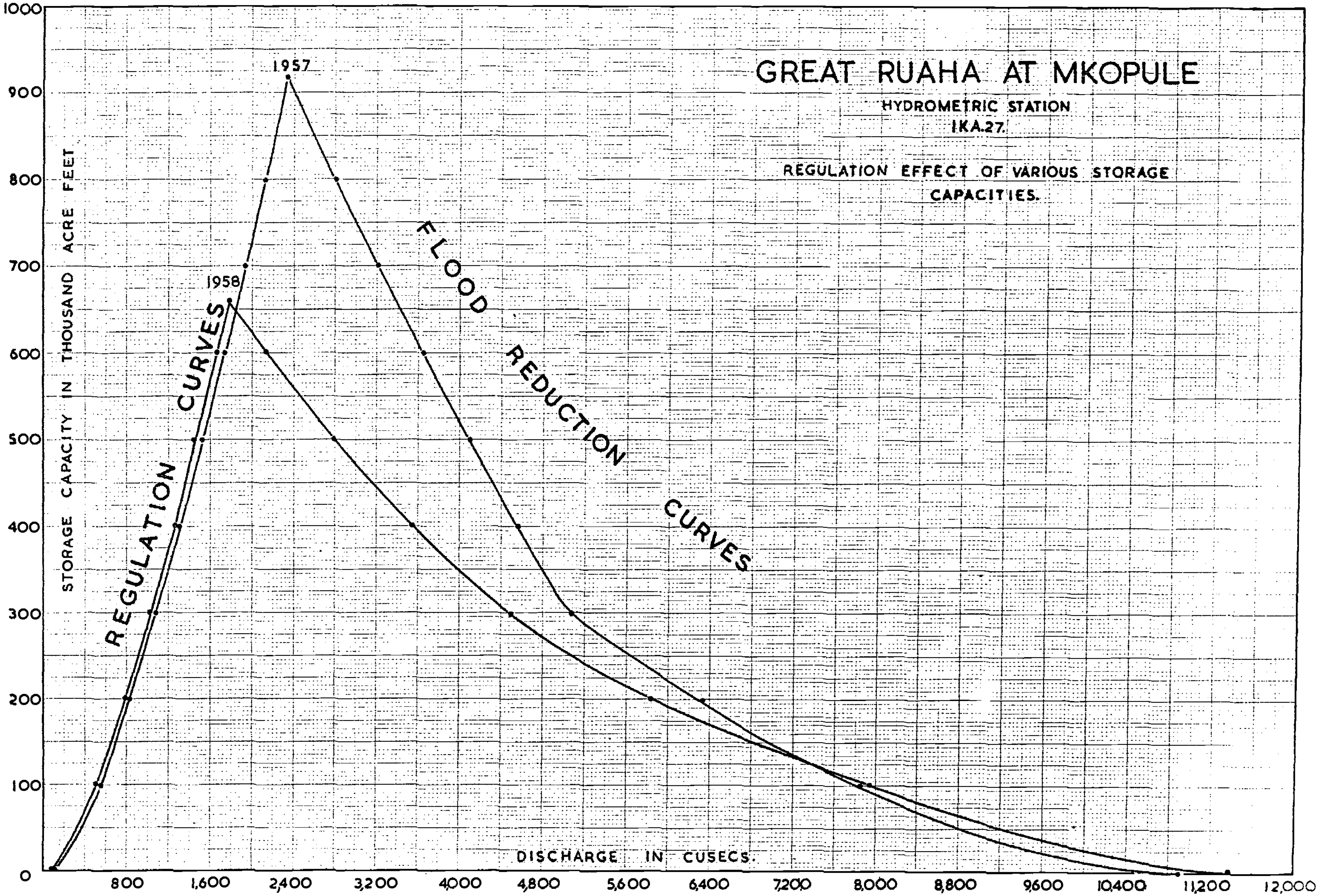

LITTLE RUAHA AT MAWANDE
HYDROMETRIC STATION
IKA. 31
REGULATION EFFECT OF VARIOUS
STORAGE CAPACITIES
1957
1958
REGULATION CURVES
FLOOD REDUCTION CURVES
STORAGE CAPACITY IN THOUSAND ACRE FEET
DISCHARGE IN CUSECS
200
180
160
140
120
100
80
60
40
20
0
400
800
1200
1600
2000
2400
2800
3200
3600
4000
4400
4800
5200
5600
6000



LITTLE RUAHA AT S.H. CLUB

HYDROMETRIC STATION
IKAL 32

REGULATION EFFECT OF VARIOUS STORAGE
CAPACITIES

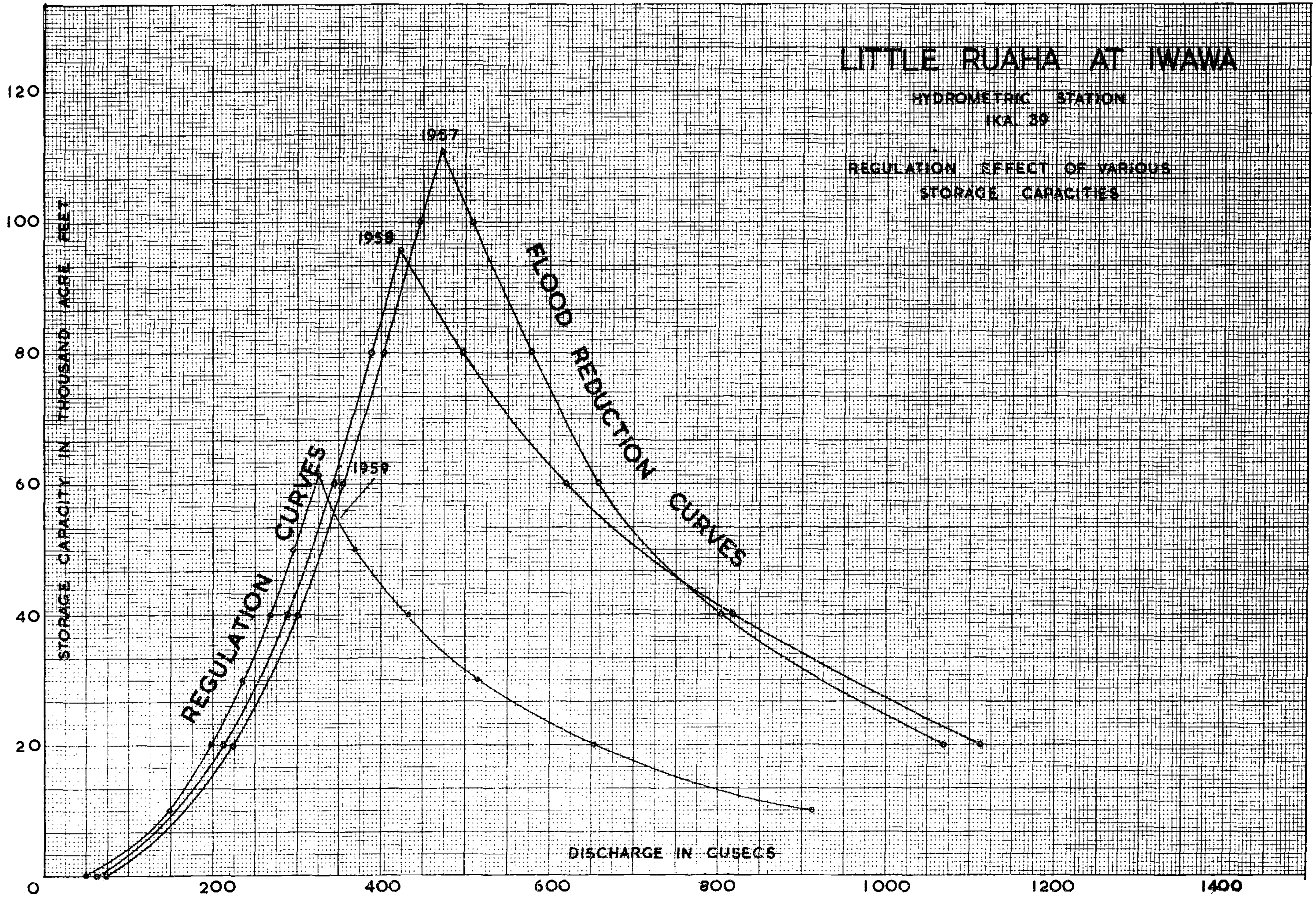


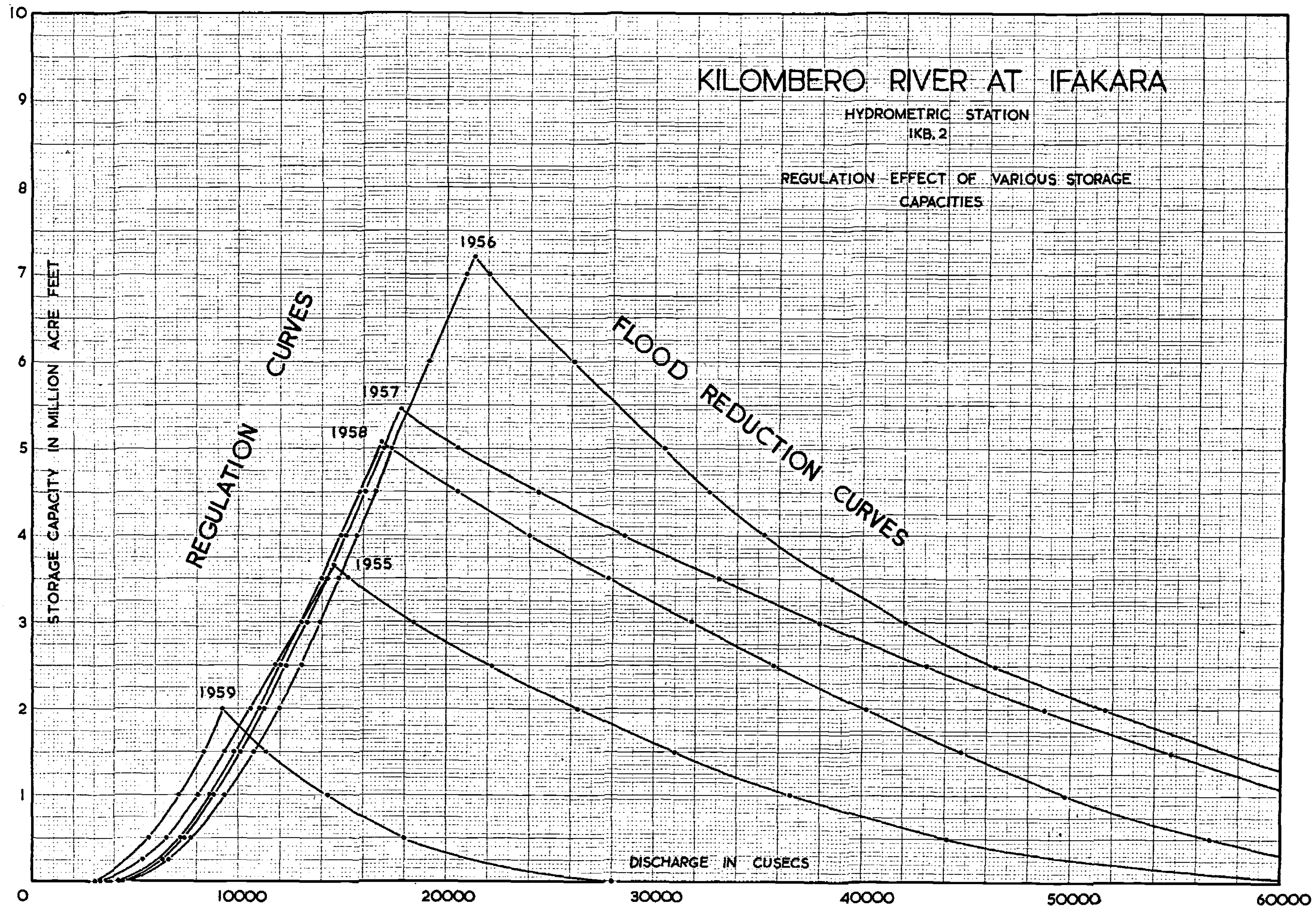
GREAT RUAHA AT MKOPULE

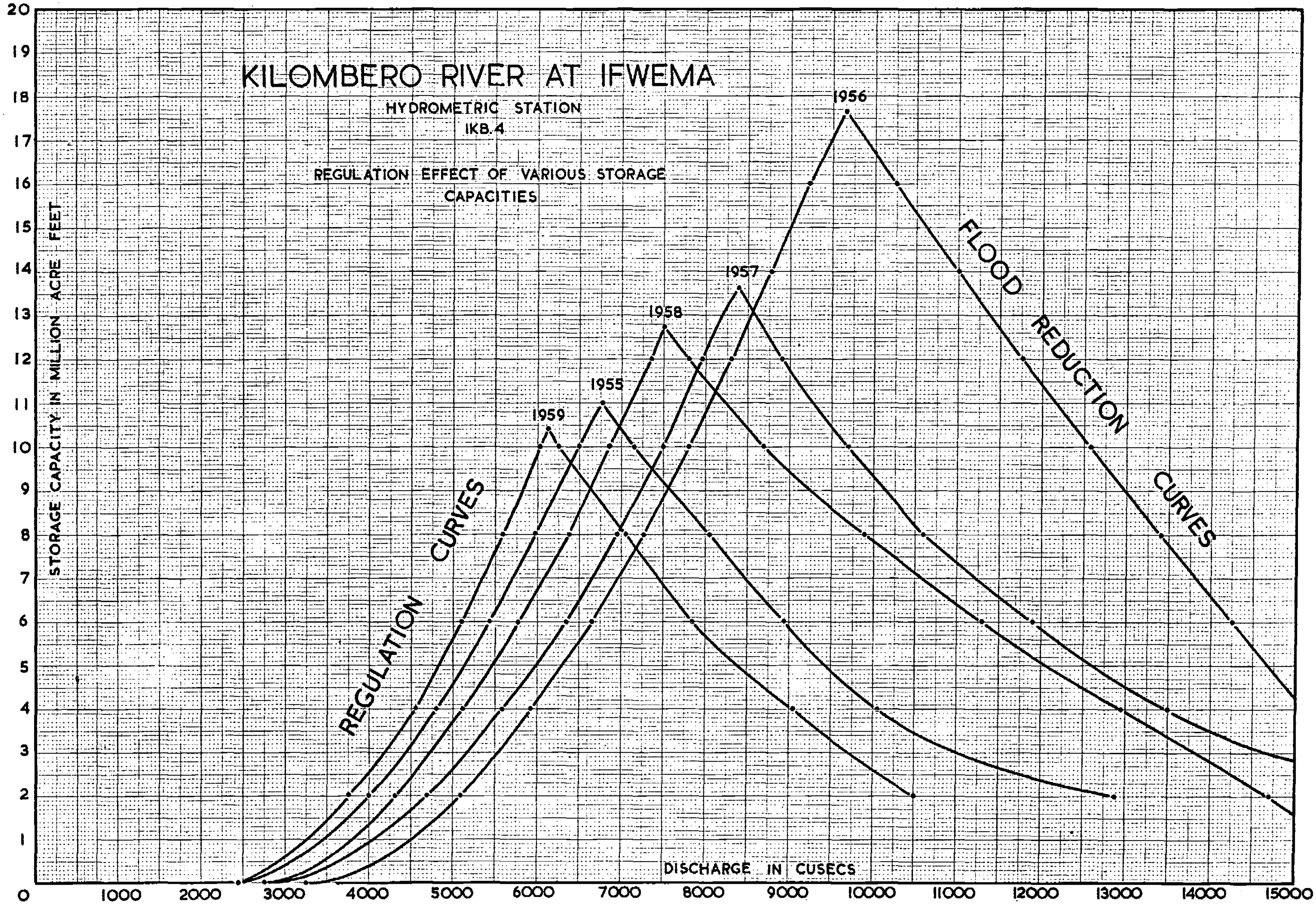
HYDROMETRIC STATION

1KA.27.

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES.


LITTLE RUAHA AT IWAWA
HYDROMETRIC STATION
IKAL 39
REGULATION EFFECT OF VARIOUS
STORAGE CAPACITIES
1957
1958
1959
FLOOD REDUCTION CURVES
REGULATION CURVES
STORAGE CAPACITY IN THOUSAND ACRE FEET
DISCHARGE IN CUSECS
120
100
80
60
40
20
0
200
400
600
800
1000
1200
1400

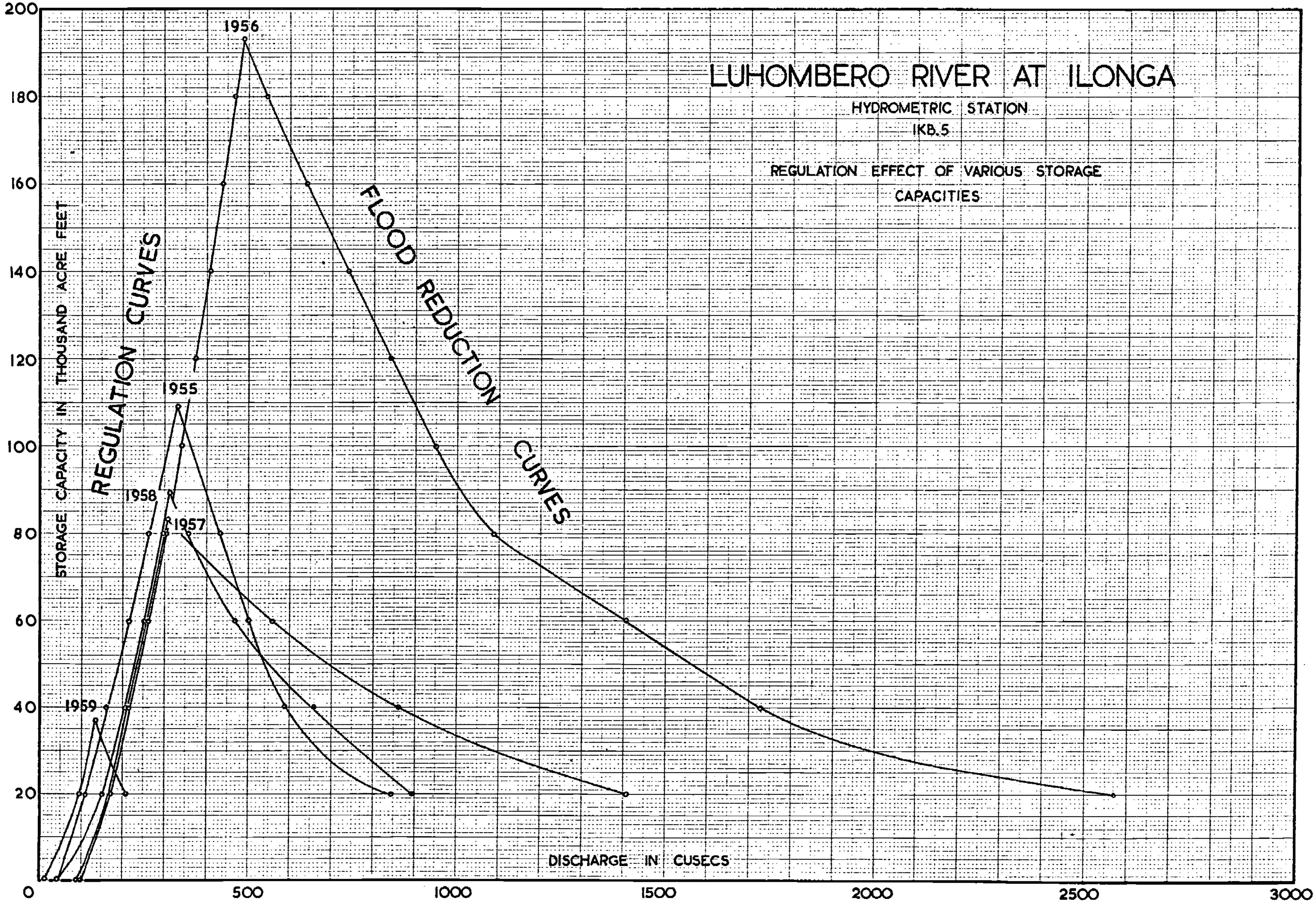

KILOMBERO RIVER AT IFAKARA
HYDROMETRIC STATION
IKB. 2
REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES
REGULATION CURVES
FLOOD REDUCTION CURVES
1956
1957
1958
1955
1959
STORAGE CAPACITY IN MILLION ACRE FEET
DISCHARGE IN CUSECS
0
1
2
3
4
5
6
7
8
9
10
10000
20000
30000
40000
50000
60000



KILOMBERO RIVER AT IFWEMA

HYDROMETRIC STATION
IKB. 4

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES

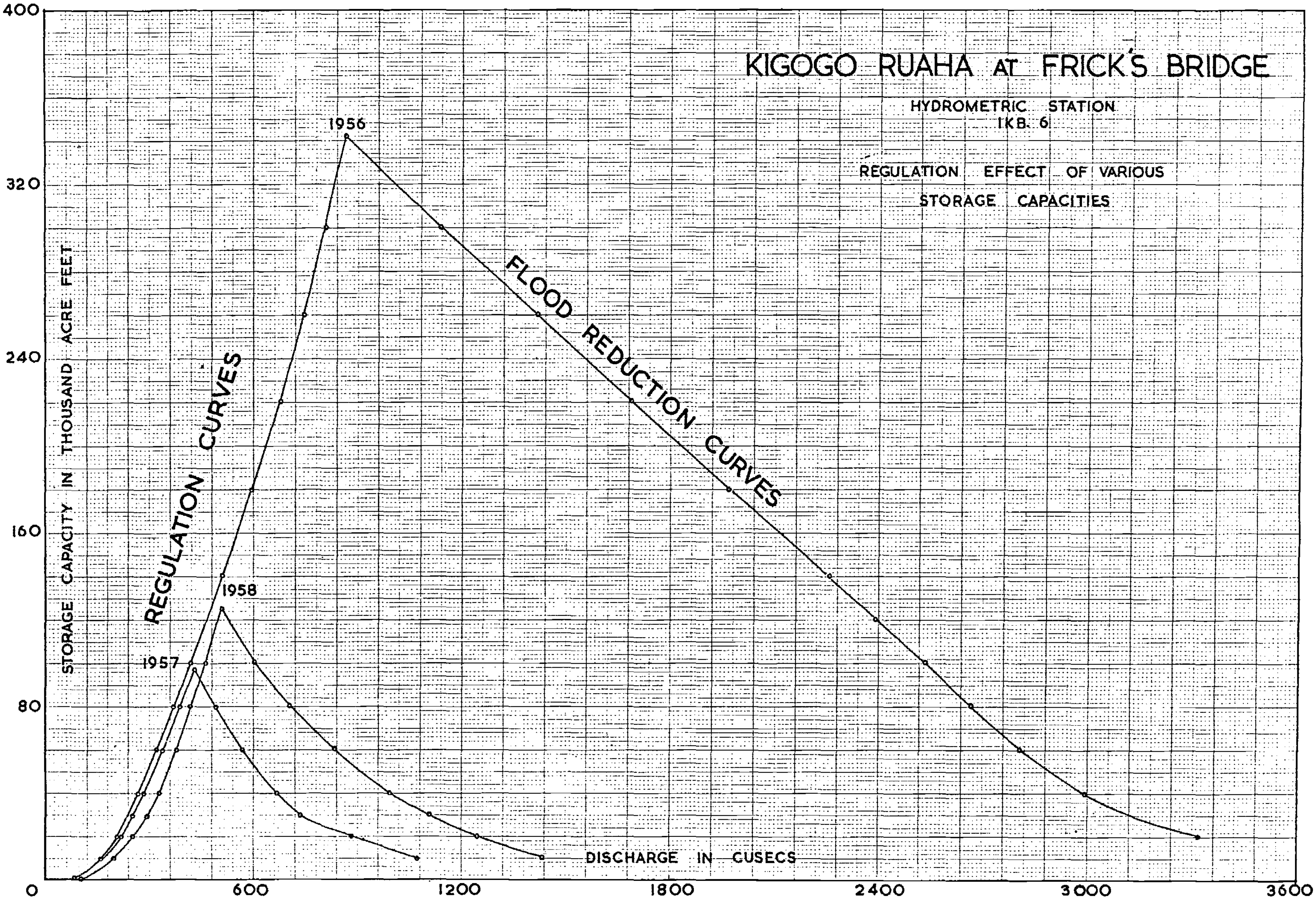


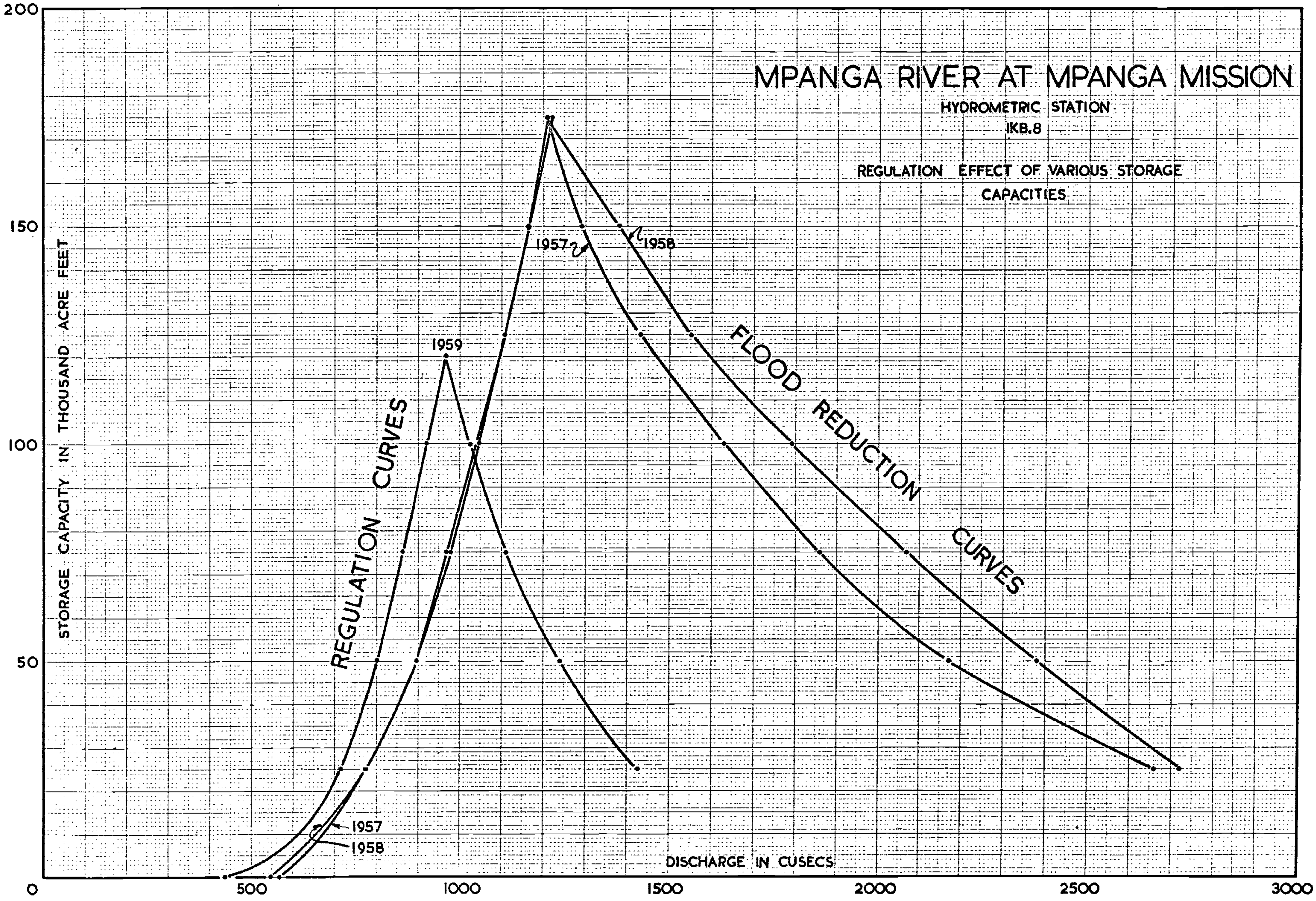
LUHOMBERO RIVER AT ILONGA

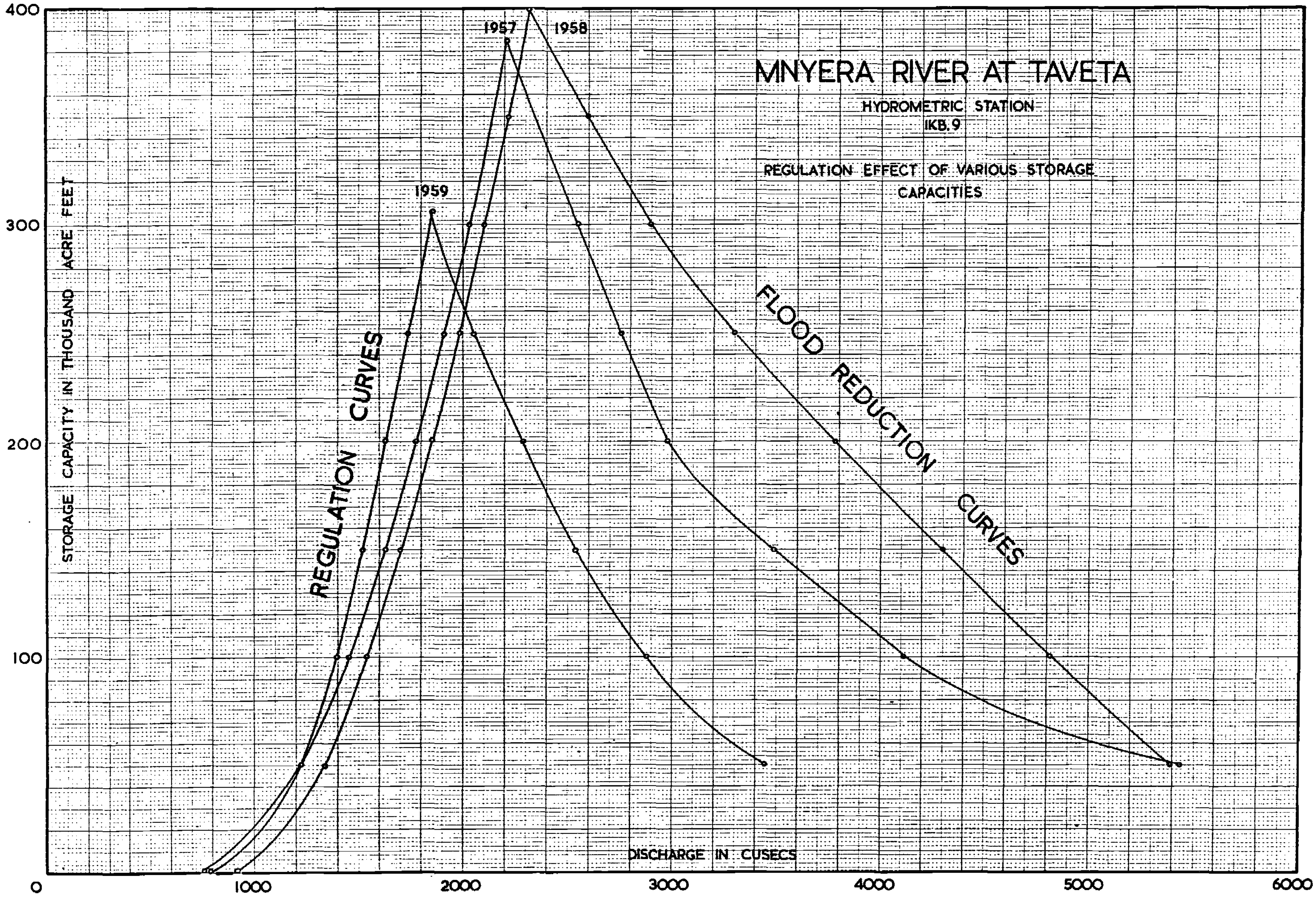
HYDROMETRIC STATION

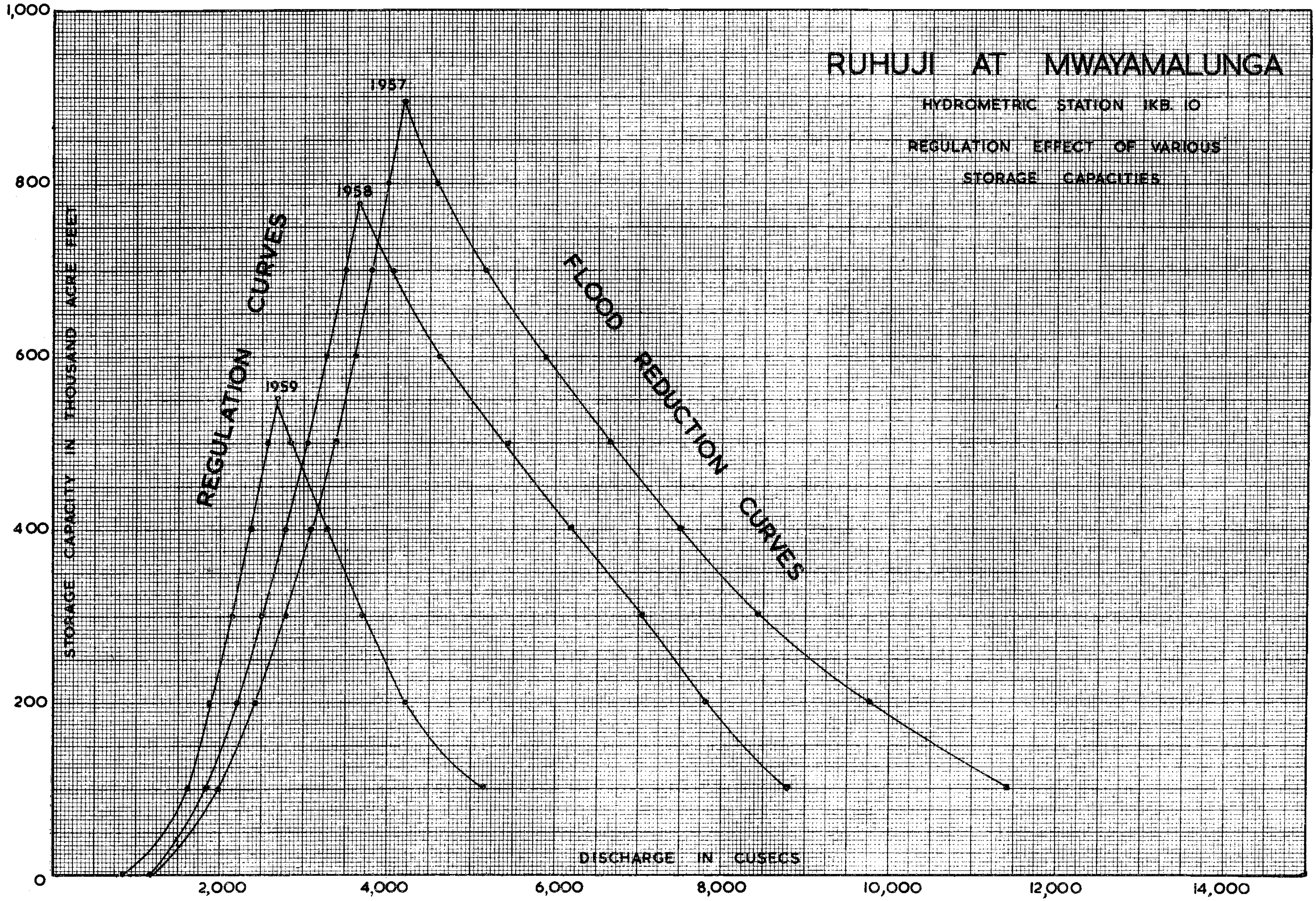
IKB.5

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES


KIGOGO RUAHA AT FRICK'S BRIDGE
HYDROMETRIC STATION
IKB. 6
REGULATION EFFECT OF VARIOUS
STORAGE CAPACITIES
1956
1957
1958
REGULATION CURVES
FLOOD REDUCTION CURVES
STORAGE CAPACITY IN THOUSAND ACRE FEET
DISCHARGE IN CUSECS
400
320
240
160
80
0
600
1200
1800
2400
3000
3600


MPANGA RIVER AT MPANGA MISSION
HYDROMETRIC STATION
IKB.8
REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES
STORAGE CAPACITY IN THOUSAND ACRE FEET
DISCHARGE IN CUSECS
REGULATION CURVES
FLOOD REDUCTION CURVES
1959
1957
1958
1957
1958
0
50
100
150
200
500
1000
1500
2000
2500
3000

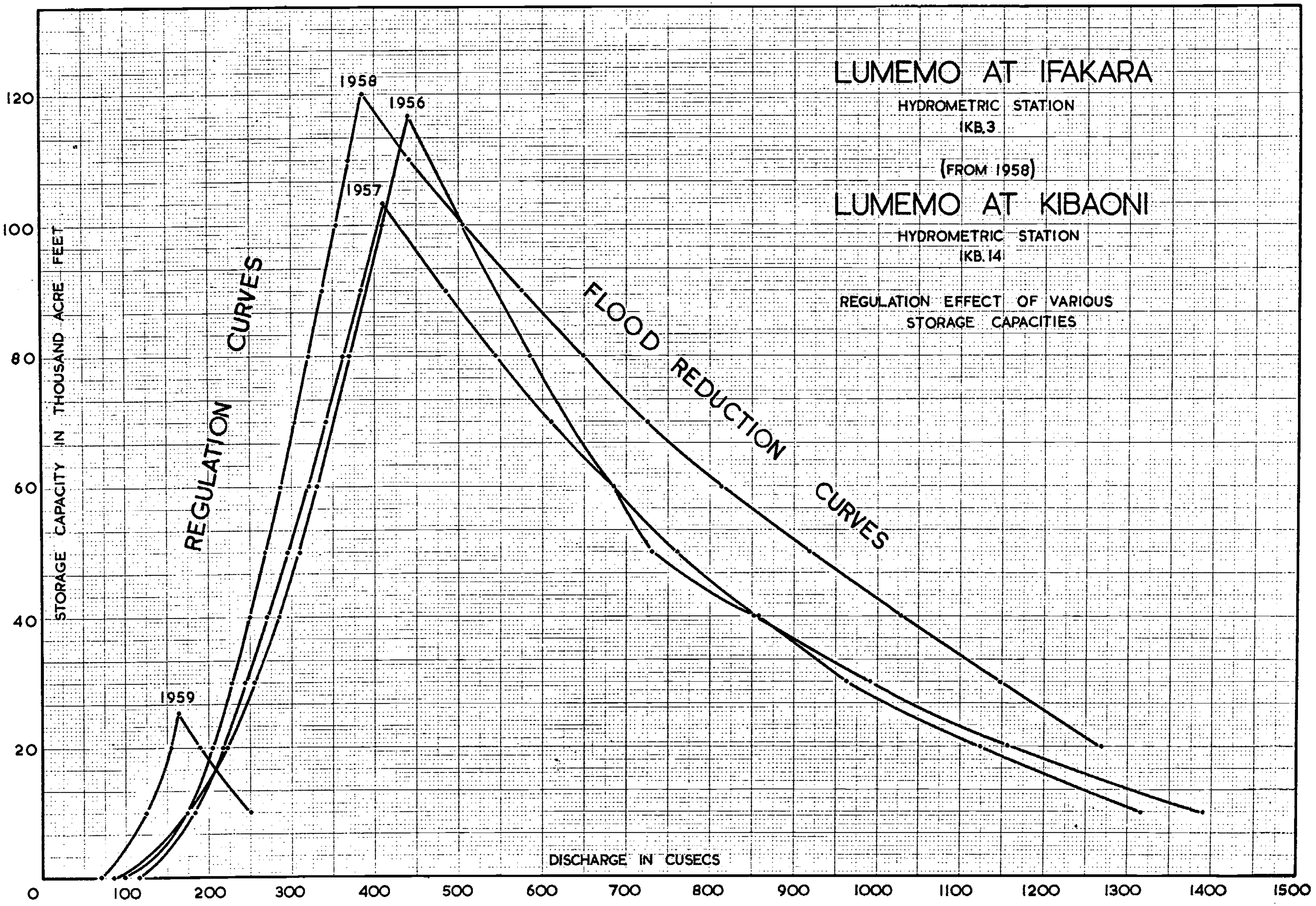

MNYERA RIVER AT TAVETA
HYDROMETRIC STATION
IKB.9
REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES
REGULATION CURVES
FLOOD REDUCTION CURVES
1957
1958
1959
STORAGE CAPACITY IN THOUSAND ACRE FEET
DISCHARGE IN CUSECS
0
100
200
300
400
1000
2000
3000
4000
5000
6000

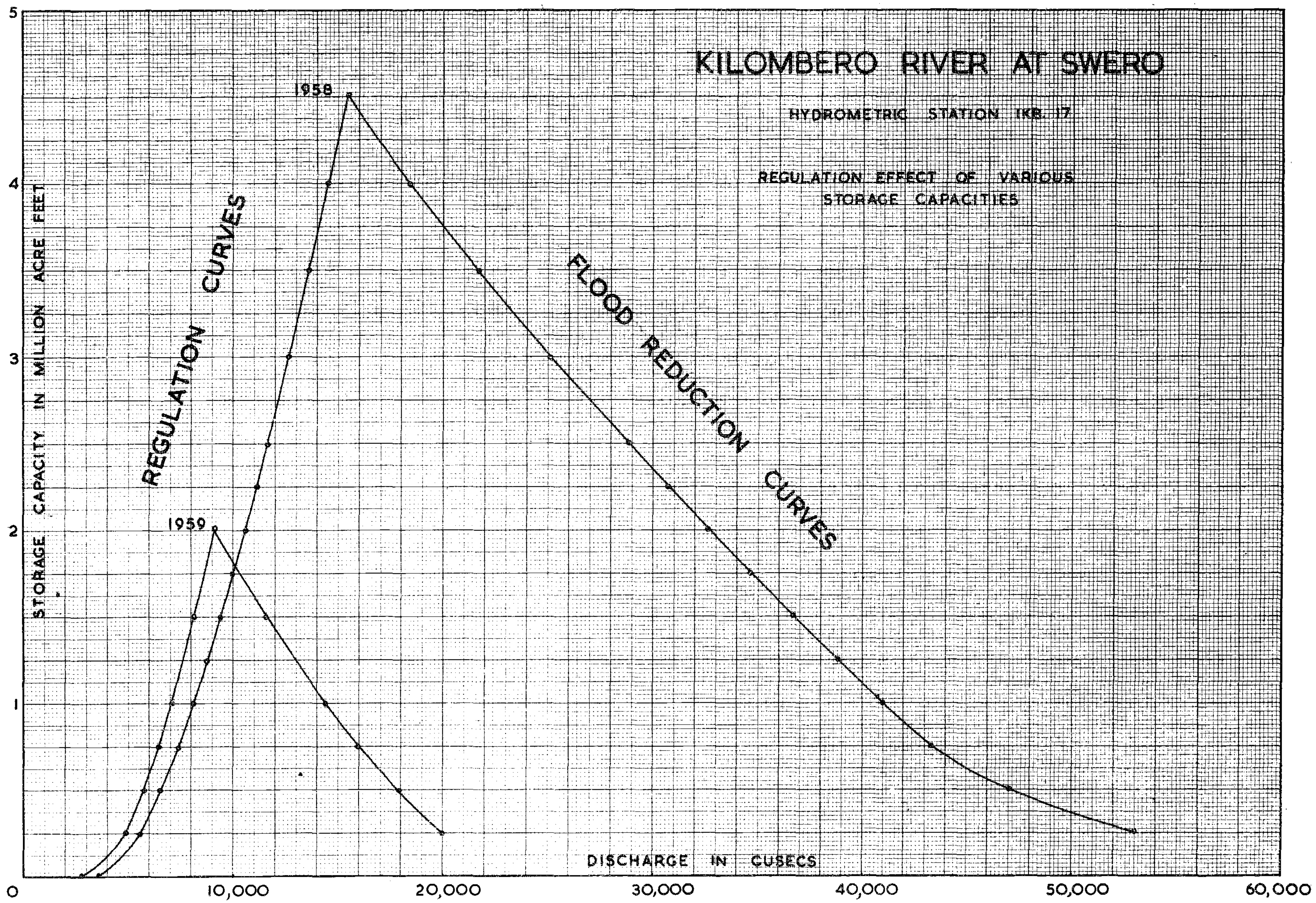


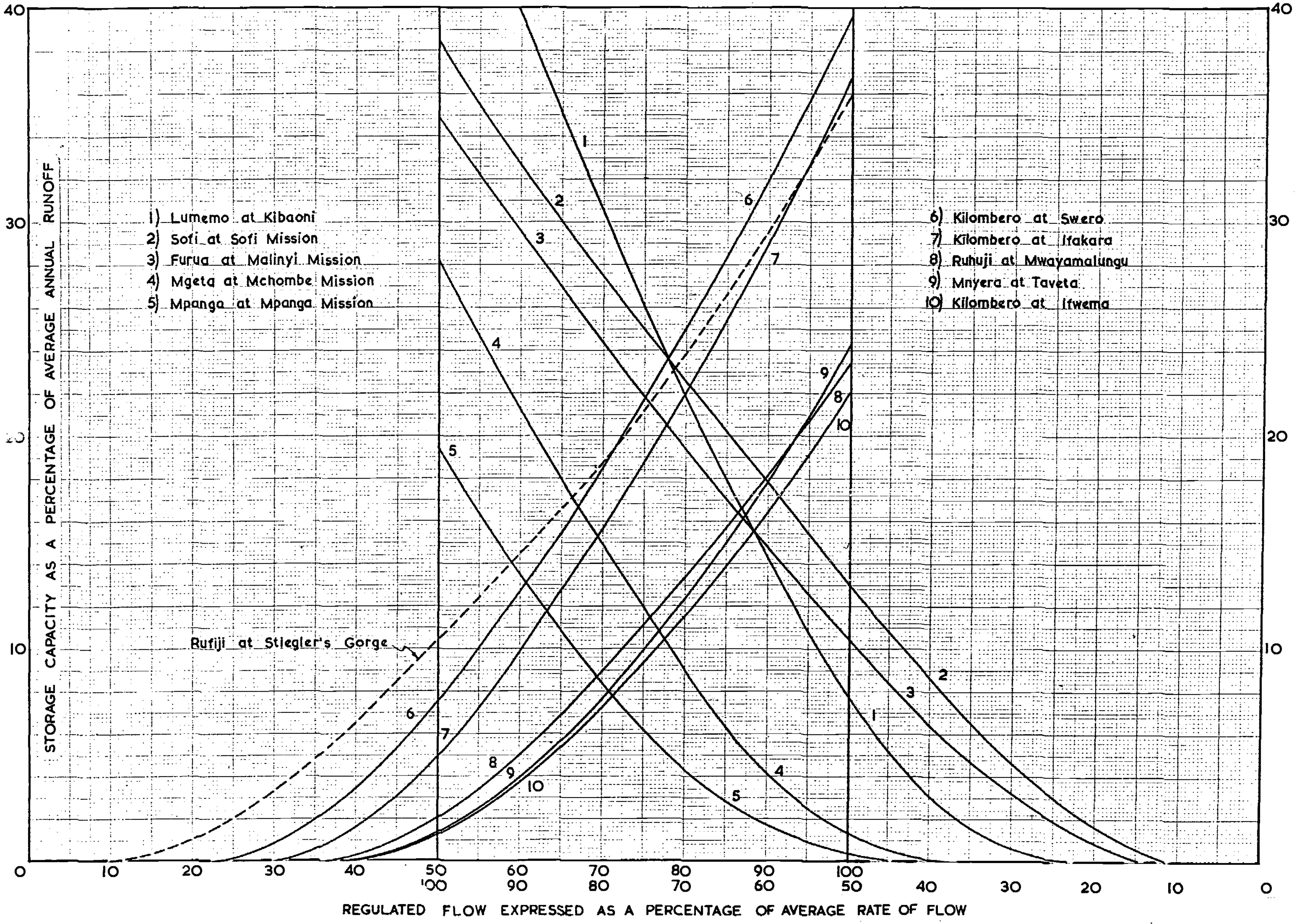
RUHUJI AT MWAYAMALUNGA

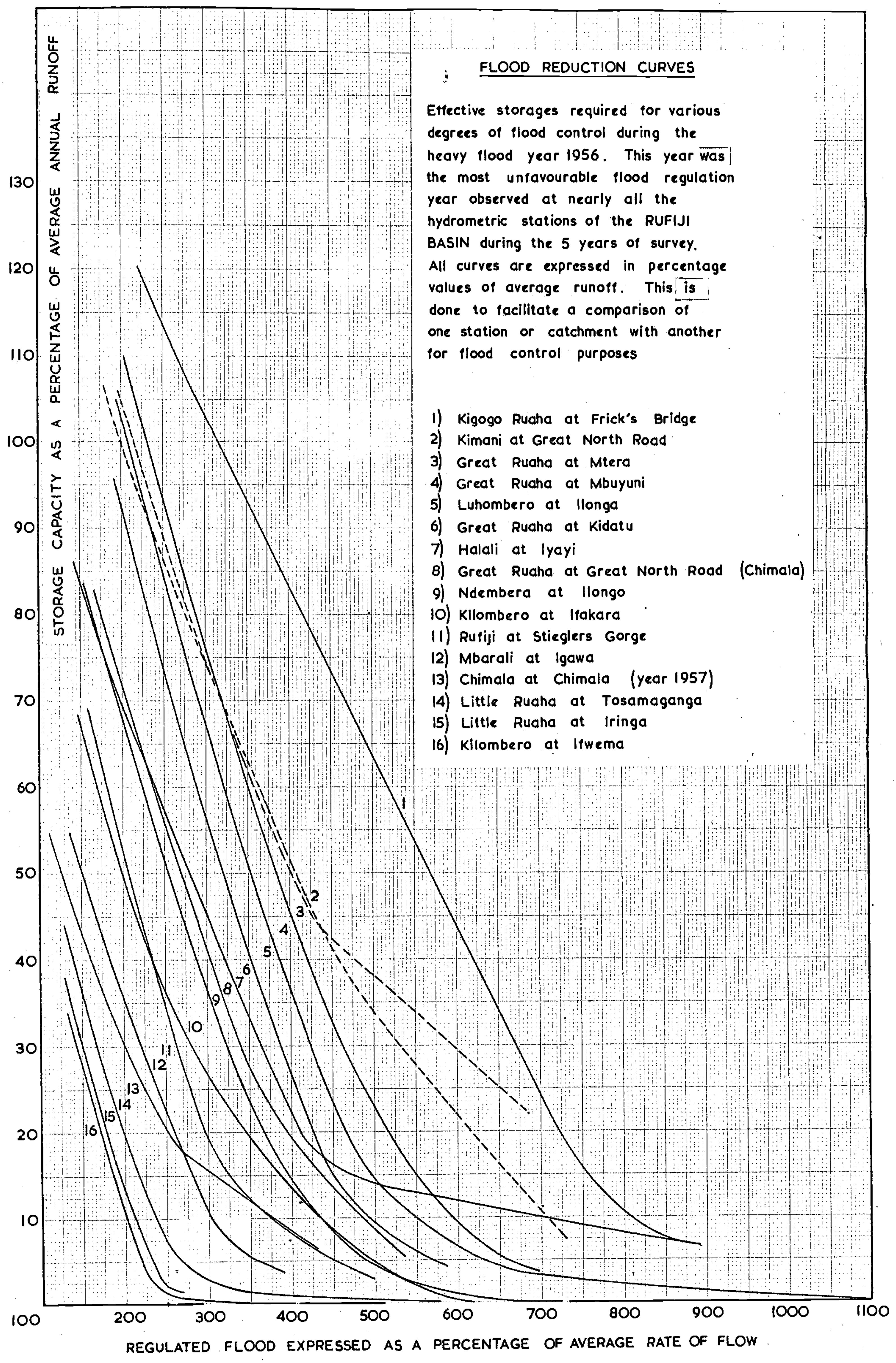
HYDROMETRIC STATION IKB. 10

REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES


LUMEMO AT IFAKARA
HYDROMETRIC STATION
IKB.3
(FROM 1958)
LUMEMO AT KIBAONI
HYDROMETRIC STATION
IKB.14
REGULATION EFFECT OF VARIOUS
STORAGE CAPACITIES
REGULATION CURVES
FLOOD REDUCTION CURVES
1958
1956
1957
1959
STORAGE CAPACITY IN THOUSAND ACRE FEET
DISCHARGE IN CUSECS
120
100
80
60
40
20
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500


KILOMBERO RIVER AT SWERO
HYDROMETRIC STATION IKB. 17
REGULATION EFFECT OF VARIOUS STORAGE CAPACITIES
REGULATION CURVES
FLOOD REDUCTION CURVES
1958
1959
STORAGE CAPACITY IN MILLION ACRE FEET
DISCHARGE IN CUSECS
0
1
2
3
4
5
10,000
20,000
30,000
40,000
50,000
60,000


STORAGE CAPACITY AS A PERCENTAGE OF AVERAGE ANNUAL RUNOFF
REGULATED FLOW EXPRESSED AS A PERCENTAGE OF AVERAGE RATE OF FLOW
1) Lumemo at Kibaoni
2) Sofi at Sofi Mission
3) Furua at Malinyi Mission
4) Mgeta at Mchombe Mission
5) Mpanga at Mpanga Mission
6) Kilombero at Swero
7) Kilombero at Ifakara
8) Ruhuji at Mwayamalungu
9) Mnyera at Taveta
10) Kilombero at Ifwema
Rufiji at Stiegler's Gorge
0
10
20
30
40
50
60
70
80
90
100
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
8
9
10



FLOOD REDUCTION CURVES

Effective storages required for various degrees of flood control during the heavy flood year 1956. This year was the most unfavourable flood regulation year observed at nearly all the hydrometric stations of the RUFIJI BASIN during the 5 years of survey. All curves are expressed in percentage values of average runoff. This is done to facilitate a comparison of one station or catchment with another for flood control purposes

15. A HYDROLOGICAL EVALUATION ON RIVER REGULATION.

a. INTRODUCTION

The Rufiji Basin has a large agricultural potential but comparatively small areas only can be utilised before the rivers are controlled and the large irrigable areas of good soil can be developed for cultivation. In this chapter an attempt is made to give a hydrological evaluation on the regulation possibilities and estimate to which degree the different rivers can be controlled by the means investigated during period of survey.

The description is made very brief and it must be emphasised that many problems will require further studies before all necessary details are known.

b. GREAT RUAHA RIVER

From tabulations in the previous chapter, it can be concluded that comparatively high storage percentages are required for an effective control of the head-water tributaries from the Kipengere Range. Reservoirs are proposed, see Vol. III, on the Mbarali, the Kimani, and the Upper Great Ruaha Rivers. An effective control of these rivers at the site of the dams can be achieved in an average year. The Great Ruaha and the Kimani storage capacities can possibly, even if costly, be enlarged to cover requirements in more wet years. If these storages were made larger they could, in an average year, be manœuvred, within their capacity, in agreement with runoff from downstream areas and thus contribute more to the regulation of the inflow to the Usangu Plain.

Storage possibilities might be available for some degree of control of the smaller rivers from the Poroto Mountains, and on the Chimala River, a study of the 1:50,000 DOS Map indicates a storage possibility of around 76 000 acre feet which is ample for the runoff. Besides this no detailed investigations were carried out as regards reservoirs in this region.

In the Halali sub-catchment a small storage possibility (reconnaissance survey only) is available for a control of the Ipwani-Ruaha Tributary and on the Ndembera a reservoir is proposed at Ngalenge, which would control a little more than half of this sub-catchments runoff to Madibira.

It will be seen that a number of the Upper Great Ruaha tributaries can be fully or partly controlled which will make land on these rivers available for cultivation, but for the whole family of rivers flowing into the Usangu Plains, the known storage possibilities are not sufficient for a full water control. Floods will be cut off on the regulated rivers and consequently reduced significantly for the whole area, but there will still be flooding which has to be prevented by additional means before the whole area can be fully utilised.

A special evaluation is carried out for the Usangu Plain as follows:

NOTATIONS.

A = Catchment Area, sq.Miles.
Qm = Average annual runoff in the established 15 years normal period 1940/41 to 1954/55, acre feet.
S = Storage Capacity, acre feet.
$\frac{Qm}{A}$ = Specific runoff, acre feet per sq.mile per year.

As regards names reference is made to the Runoff Map.

RUNOFF FROM ADJACENT HIGHER LAND INTO THE USANGU PLAINS.

		A	Qm	$\frac{Qm}{A}$
1.	Ndembera to Madibira	707	147 000	208
2.	Halali to Majojolo	1 014	205 000	202
3.	Area South of Gt.North Road from Mbarali to Chimala, both rivers included.	1 362	873 000	641
4.	Area South of Gt. North Road from Chimala to Western boundary of Rufiji Basin, Chimala exclusive.	362	345 000	953
5.	Area West of 3800' contour (1:125 000 map) between New Mbeya Road and Northern boundary of Makali River Catchment.	130	58 000	450
	Total (assumed as being runoff from higher country into Usangu Plains)	3 575	1 628 000	455

During an average year an <u>effective</u> storage capacity of approximately 1 000 000 Acrefeet would be required for a control of this inflow to the Usangu Plains

	A	Qm	$\frac{Qm}{A}$
Average runoff at Hausmann's Bridge below the Utengule Swamp at outlet of Usangu Plains.	7 700	1 346 000	175

The natural loss of water on Usangu Plains can be computed as the difference between inflow and outflow plus the rainfall on the Plains itself.

Difference inflow-outflow: 282 000 acre feet equals 1.3 inches.

Rainfall on Usangu Plains (average) 23 inches or 5 057 000 acre feet.

Total loss of water in this area, 24.3 inches or 5 343 000 acre feet.

Runoff from the Usangu Plains itself as far down as Hausmann's Bridge can be computed as follows:-

Average specific runoff = 90 acrefeet per sq.mile per year. Total runoff (4125 x 90) acrefeet = 371-000 acrefeet or 1.7 inches. This gives a runoff coefficient of 0.073.

In the above mentioned partial areas, storages are proposed in 1, 2 and 3 of which 3 carries the most water. Areas 4 and 5 would require storage and beside this the runoff from the Plain itself must be considered.

Storages are proposed as follows:-

	A	S	Qm	Storage %
Area 1, Ndembera	404	80 000	95 000	84.2
Area 2, Ipwani	455	23 000	86 000	26.8
Area 3, Mbarali	574	114 000	326 000	35.0
Kimani	173	130 000	134 000	97.0
Great Ruaha	328	107 000	238 000	75.0
Total	1934	454 000	879 000	51.6

The area above the reservoir sites is 54.1% of the total area of higher land bringing runoff to the Usangu Plain and the corresponding runoff percentage is 54.0. The average specific runoff from the regulated area is, therefore, the same as from the remaining part of higher country above Usangu Plain and the rate of spate inflow can possibly be reduced to about half of what it is in an unregulated state.

If the Usangu Plains are going to be drained, the runoff at Hausmann's Bridge will increase. This increase will depend upon the effectiveness of the new drainage system and the maximum runoff to be expected in an average year after drainage will be:-

(1 628,000 + 371 000) acre feet = 1 999 000 acre feet.

Compared with what is actually gauged at Hausmann's Bridge (1 346 000 acre feet) this means a maximum increase of 653,000 acre feet. It is a possibility that the runoff coefficient from the Plains itself will also slightly increase after drainage but the change in outflow is mainly covered by lesser losses of the water in transit. The drainage will never be as effective as assumed here and the runoff can therefore be said to be between 1 346 000 and 1 999 000 acre feet.

The Little Ruaha Catchment has a great water retaining capacity. Floods are comparatively low and the dry season flow high. Rivers of similar character are the Upper Tributaries of the Kilombero River and to some extent the Ndembera River. Small storage percentages are required for a control of such rivers and on the Little Ruaha storages are surveyed at Makalala and Iringa, see Vol. III, which can control the flow of this river.

On tributaries to the Great Ruaha from West, no storage investigations were carried out. This area is on a whole very dry and the rivers are intermittent. They are flashy during rains and can reach considerable heights in flood spates. The Kisigo, the biggest of these tributaries, drains an area of 10 206 sq.miles and has a runoff of 276 000 acre feet at Kinunguru. This river would require a storage capacity of around 200 000 acre feet for an effective control. It is expected that the evaporation losses are comparatively high in this region.

At Mtera on the Great Ruaha there is large storage possibilities. A reservoir of 5 million acre feet was surveyed and it was thought that the power potential was great if a dam could be built to its fullest possible height. However, great areas would be flooded and the evaporation loss so high that all inflow would evaporate from the surface. A much smaller dam, therefore, is the only possibility at this site. The regulation diagrams for Mtera, Mbuyuni and Kidatu in the previous chapter will indicate to what extent storages are required for flood control and regulated flow during the dry season in the Great Ruaha Valley downstream of Mtera. Water control is not a technical problem in this stretch of the river, although it is unwise to store water where the losses are so high. If there is no need for regulated water before the confluence with the Rufiji this water can be more economically stored in the proposed Stiegler's Gorge reservoir.

c. KILOMBERO RIVER

The Kilombero catchment has a very high runoff. At the outlet of the flood plains, at Swero, the annual average is 11 092 000 acre feet corresponding to a specific runoff of 859 acre feet per sq.mile per year. This water requires large storage capacities for an effective control.

The geographical distribution of average annual runoff is illustrated on the Runoff Map (see Map Folder). It will be seen that the runoff is highest in the mountains north of the valley and that a maximum of more than 2000 acre feet per square mile per year is reached on the mountain slopes between the Kihanzi and the Sanje-Msolwa Rivers. There is also high runoff from the Mahenge Massif in the south. The runoff contribution from the valley plains is smaller than from the surrounding high hills and escarpments. The upper half of the Kilombero catchment produces less runoff than the lower half. This is illustrated by the following figures:-

Station.	Catchment Area Square Miles.	Average Annual Runoff: Acrefeet.	Specific Runoff Acrefeet per sq. mile per year.
Ifwema	7048	5 235 000	743
Difference Swero-Ifwema	5867	5 857 000	998
Swero	12915	11 092 000	859

At stations where five years of observations are available, the year 1958 produces a median regulation curve. This curve has therefore been assumed to express storage requirements for various degrees of regulation in an average year, and ten curves for the Kilombero catchment are shown graphically in page 374. To facilitate an extended use of the curves they are expressed as percentages of average runoff. It will be seen that the Upper Kilombero Tributaries, the Ruhuji, the Mnyera and the Mpanga Rivers and all these three rivers gauged after their confluences at Ifwema, require far lesser storage percentages for the same degree of regulation than those tributaries joining further downstream. The whole partial sub-catchment between Ifwema and Swero requires comparatively more storage for a sufficient control than the Upper Kilombero. This fact is very unfortunate because a large proportion of the storage possibilities are to be located in the upper tributaries.

If treated independently the major tributaries and partial sub-catchments of the Kilombero will require the following storages to maintain the average flow at points indicated, using the 1958 regulation curve as representative for an average year. River names are shown on the Runoff Map.

Ruhuji to Mkasu Damsite: 3277 sq.miles

Average runoff - 2,248,000 acrefeet - 3111 cusecs.
Storage required - 23.7% - 533,000 acrefeet.

Mnyera to Taveta Damsite: 2264 sq.miles

Average runoff - 1,997,000 acrefeet - 2763 cusecs.
Storage required - 24% - 479,000 acrefeet.

Mpanga to Mdiku Damsite: 910 sq.miles

Average runoff - 844,000 acrefeet - 1167 cusecs.
Storage required - 19.3% - 163,000 acrefeet.

Kilombero to Ifwema: 7,048 sq.miles

Average runoff - 5,235,000 acrefeet - 7215 cusecs.
Storage required - 22.0% - 1,150,000 acrefeet.

Furua to Malinyi: 507 sq.miles

Average runoff - 604,000 acrefeet - 836 cusecs.
Storage required - 35.0% - 211,000 acrefeet.

Sofi to Sofi Mission: 62 sq.miles

Average runoff - 44,000 acrefeet - 61 cusecs.
Storage required - 38.4% - 17,000 acrefeet.

Kihanzi to Merera Damsite: 475 sq.miles

Estimated average runoff - 665,000 acrefeet - 920 cusecs.
Estimated storage required - 38.0% - 253,000 acrefeet.

Mgeta to Mchombe: 124 sq.miles

Average runoff - 284,000 acrefeet - 393 cusecs.
Storage required - 28.3% - 80,000 acrefeet.

Ruipa to Ngongwa Damsite: 535 sq.miles

Estimated average runoff - 1,017,000 acrefeet - 1407 cusecs.
Estimated storage required - 38.0% - 387,000 acrefeet.

Lumemo to Doliya Damsite: - 150 sq.miles

Average runoff - 280,000 acrefeet - 387 cusecs.
Storage required - 49% - 137,000 acrefeet.

Kilombero to Ifakara: 12,063 sq.miles

Average runoff - 10,560,000 acrefeet - 14,612 cusecs.
Storage required - 36.5% - 3,854,000 acrefeet.

Kilombero to Swero: 12,915 sq.miles

Average runoff - 11,092,000 acrefeet - 15,348 cusecs.
Storage required - 39.2% - 4,348,000 acrefeet.

All these data refer to an average year. In wetter years higher storage capacities are required as shown on the Runoff and Storage Data and Map at the end of this chapter. The storage requirements are calculated under the assumption that all storages are utilised as to even out the river flow as much as possible at the point under consideration. In other words this means that if water is drawn from the tributary storages to obtain an even river flow at the outlet of the reservoir, then the river flow at places further down the river will be uneven if no additional storage is available for a regulation of runoff contribution from the partial subcatchment below the reservoirs. This inflow to the river must be considered in draw off from upstream reservoirs for downstream purposes.

Except the Kingenenas reservoir, which might not be a practical solution, there are no apparent reservoirs on the main Kilombero, and downstream from the Kihanzi confluence there were found to be only small storage sites on the Ruipa (175 000 acrefeet) and the Lumemo (54 000 acrefeet). These storages will help considerably in cutting off high spates on these two tributaries, but this capacity is not sufficient for full control of the rivers. It is later learned that these two storages possibly can be made larger.

Storage sites are found sufficient (see Runoff and Storage Data and Map) on the Ruhuji, the Mnyera and the Mpanga to maintain an even river flow at the outlet of these reservoirs in an average year. An even flow can also be maintained at Ifwema (7215 cusecs) if these three reservoirs are operated correspondingly and in an average year it seems that the runoff at Ifwema can even be controlled by reservoirs on the Ruhuji and Mnyera only.

Some miles below Ifwema the Kilombero is joined by the Furua. This river would require a storage capacity of 211 000 acrefeet for an average control. Unfortunately, no obvious storage possibilities were found on the Furua and this river will therefore join the Kilombero in its natural state. A maximum flood of 8500 cusecs was observed in 1958 on the Furua at Malinyi and this flow added to the above regulated discharge at Ifwema would give a flow in the Kilombero of about 16000 cusecs which is just below the river channel capacity as measured at Ifwema. By increasing the upstream reservoir capacities for retaining more flood water during the high spates in the Furua, the flood of the Kilombero at the Furua confluence should be less than 16 000 cusecs, and flooding of the plains in this area should be limited.

On the Mpanga at Mdiku and on the Mnyera at Taveta the practical height of dam and corresponding storage capacity are very close to what is required for an average control (see Vol. III. Water Control, Part 4). On the Ruhuji at Mkasu it is possible to extend the capacity above average requirements to 1 470 000 acrefeet and another reservoir of 250 000 acrefeet capacity has been surveyed at Msana on the Kigogo-Ruaha, in the Mnyera catchment. This additional storage will contribute considerably to an effective control of the upper Kilombero, and is a necessity for better possible control of the lower regions of the Kilombero. As regards filling possibilities, the reservoirs can be utilized to the utmost extent in an average year and the whole capacity should therefore be effective. The only exception is the Kigogo-Ruaha, where the flow during an average wet season will only be able to fill about 200,000 acrefeet of the reservoir capacity, 250,000 acrefeet. However, any additional storage possible on this river would be of great value in wetter years.

On the Kihanzi a storage capacity of 253,000 acrefeet (1958 regulation curve) would be required to maintain an average outflow of 920 cusecs from a dam at Merera. The capacity of this reservoir could be made greater than this, but at high cost; of the flow in an average year up to 450,000 acrefeet would be available for storage, and perhaps 700,000 to 800,000 acrefeet in wet years. By regulating this reservoir together with those mentioned above, the regulated flow at Ifakara on the lower Kilombero in the dry season could be about 12,500 cusecs, and the maximum flood flow could be reduced considerably.

The following gives an overall picture of storage possibilities on the Kilombero:-

WATER STORABLE

Millions of Acrefeet

	Average Year	Totals	Wet Year	Totals
Ruhuji at Mkasu	1.470		1.470	
Kigogo-Ruaha at Msana	0.200		0.250	
Mnyera at Taveta	0.454		0.454	
Mpanga at Mdiku	0.156	2.280	0.156	2.330
Kihansi at Merera*	0.450	2.730	0.800	3.130
Ruipa at Ngongwa	0.309	3.039	0.309	3.439
Lumemoat Doliya	0.090	3.129	0.090	3.529

* Reservoir capacity contemplated is 0.200 million acrefeet.

The catchment area above these reservoir sites on the Kilombero is altogether 6611 square miles, 55% of the total catchment to Ifakara. For flood control a reservoir can only contribute to the extent of regulating its own catchment. Flood spates from those parts of the catchments which are below the reservoir sites will, on the proportion mentioned above, be a little less than half of the total rate of flow observed at Ifakara. The reduction in natural valley storage resulting from regulation must of course also be taken into account, but no data are yet available for such a study. On the other hand, it should be noted that on many of the tributaries which have storage possibilities, the gauged specific flood flows per acre are higher than those resulting on the whole catchment. Altogether, the available information indicates that if the storages mentioned above had been available during the five years of observation, the maximum flood at Ifakara would have been reduced to approximately:-

1955 - 31,000 cusecs
1956 - 45,000 cusecs
1957 - 42,000 cusecs
1958 - 35,000 cusecs
1959 - 13,000 cusecs

The capacity of the river channel to bank level at Ifakara is about 40,000 cusecs. It therefore seems that in an average year the storage capacities mentioned above would be adequate for flood control and the river flow could be kept within the channel at that point; even in a high year such as 1956 the excess would be relatively small.

In high years there will still be some flooding, and additional measures will have to be taken if full control is to be achieved in such years. The year 1956, which was a very wet year, would require 7.2 million acrefeet effective storage to achieve an even flow throughout the year at Ifakara. Any additional storages that can be constructed on unregulated tributaries will help to reduce flooding and there is a possibility that a lowering of the river control section at Swero will gradually increase the river slope and velocity of water above the present rapids in such a manner that the river will be capable of carrying higher discharges. The possibilities of such an excavation should be further studied, and also the effect that this will have on the ground water table of the lower reaches of the plains during the dry season.

When operating upstream storages for downstream purposes, the time lag must be considered. A foresight cannot always be depended upon and even with a good telecommunication system it is difficult to regulate storages as effective as they should be. On the Kilombero the time lag between Ifwema and Ifakara is on an average 10 to 14 days on a falling stage of river but is considerably longer at the rise of floods. At Ifwema the river rises to average flow in the middle of January while the average flow at Ifakara first is reached round the 10th of March or 1½ to 2 months later than at Ifwema. When some storage sites are built up river less water will be stored on the plains and the water will discharge at a faster rate. The time lag at the beginning of the year will then be shorter than it is with an unregulated river system.

d. LUWEGU RIVER

The Luwegu and Mbarangandu drain 9382 sq.miles to their confluence near Njangasi where a possible damsite was surveyed. (See Runoff and Storage Data and Map). The catchment is hilly and the river gradients steeper than on the other two main Rufiji tributaries. The area consists of Karoo rocks which erode at a comparatively fast rate and the sediment transport is great. The river is intermittent but has flashy floods. The average runoff is estimated to 2 600 000 acrefeet at proposed damsite.

A reservoir at Njangasi would reduce silting in the proposed reservoir at Stiegler's Gorge considerably, and especially if Stiegler's Gorge II is to be built, see Vol. III, a controlled Luwegu will make it possible to maintain a higher head in this reservoir for greater power production.

e. RUFIJI RIVER

A reservoir of 6.4 million acrefeet at Stiegler's Gorge will control the Rufiji in an average year. The average inflow to reservoir, 25 000 cusecs, can be evened out, and the average outflow will be approximately 23 000 cusecs correspondin to an evaporation loss of 8%.

In the wet year 1956, this reservoir could reduce the maximum flood from 252 000 cusecs to approximately 62 000 cusecs and flooding in the Rufiji Valley and delta would be very limited. The river channel capacity has been estimated at three places by corresponding water level graphs with Stiegler's Gorge as follows:-

Mtanza	65 000 cusecs
Utete	72 000 "
Ndundu	65 000 "

If storage sites are built on the Kilombero, Great Ruaha and Luwegu, the storage requirements at Stiegler's Gorge will be less, or in other words, the 6.4 million acrefeet storage will be able to reduce floods more than is indicated above.

The Stiegler's Gorge reservoir can be made much greater than this. See Stiegler's Gorge II, Vol. III. A possible capacity of 23.6 million acrefeet is available and with a maximum height of dam of 400 ft. the power potential is great.

Between Stiegler's Gorge and the Indian Ocean, 7394 sq.miles drains into the Lower Rufiji. Part of this area is shown on maps as discharging direct into the Ocean, but as some of it is covered during high floods, it is considered as belonging to the Rufiji Basin. It is of interest to get a runoff evaluation for this area, and this runoff contribution must be dealt with separately before the plains can be fully utilized.

The area receives on an average 12 992 000 acrefeet of rain equal to 33.0 inches per year.

There are no direct runoff observations in the Coast Area, neither on the Rufiji nor in any other adjacent rivers, but it is assumed that the specific runoff will be around 150 acrefeet per sq.mile per year. This gives a total runoff from the coast area of 1 109 000 acrefeet, corresponding to a runoff coefficient of 8.5 percent, which is a reasonable average figure on this flat land.

The Lower Rufiji can be sub-divided as follows:-

	Partial Areas	A	Qm
	North of Rufiji	Sq.miles	Acrefeet
1.	The whole river system flowing into the Indian Ocean at Mbuni.	1 137	170 000
2.	River from Ukutu Mts. Joining Rufiji some miles downstream of Mtanza.	357	54 000
3.	River joining Rufiji at Kwangwazi.	492	74 000
	South of Rufiji		
4.	Rivers between Utete and Kilindi.	723	108 000
5.	River Lukuliro, Namamba, Lihangwa and Longonya, to confluence with the Rufiji upstream of Mpanganya.	3 190	479 000
	Total.	5 899	885 000

The rest of the runoff (1 109 000 - 885 000) acrefeet = 224 000 acre feet comes from areas close to the main river and in between the mentioned partial areas.

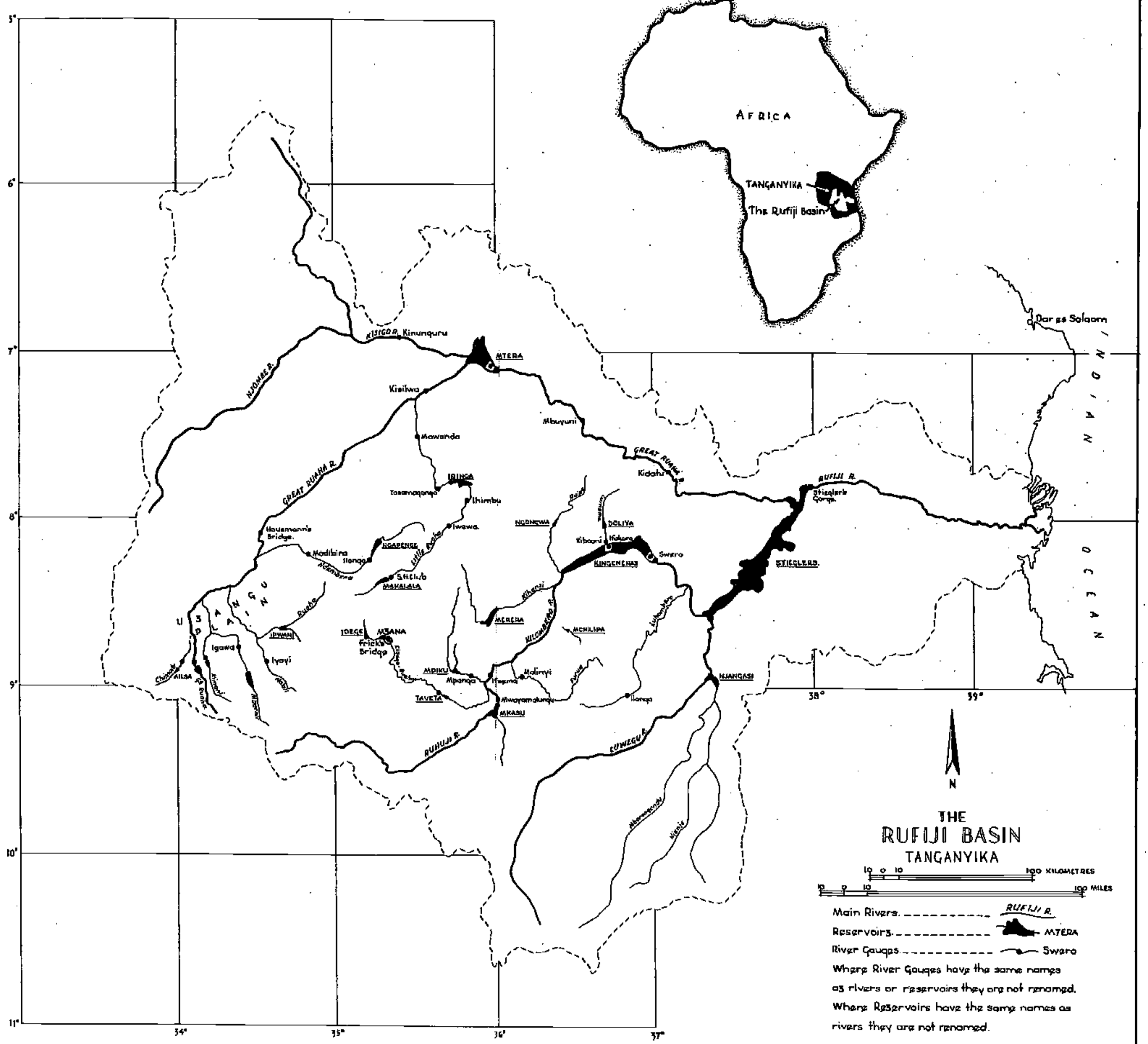
RUNOFF AND STORAGE DATA

RIVER	DAM OR GAUGING SITE	CATCHMENT AREA SQ. MILES	ANNUAL RUNOFF ACRE FEET			STORAGE CAPACITY REQUIRED IN A WET YEAR AC/FT	STORAGE REQUIREMENTS AS % OF AV. RUNOFF.	STORAGE CAPACITY SURVEYED, ACRE FEET. *	REMARKS.
			MAXIMUM	AVERAGE	MINIMUM				
CHIMALA	AILSA DAMSITE.	76	93 000	68 000	43 000			(76 000)	FROM 1:30,000 D.O.S. 100 F.T. V.I.
CNIMALA	CNIMALA, IKA 7.	83	120 000	76 000	46 000	48 000	63.3		
GREAT RUAHA	DAMSITE.	321	441 000	238 000	112 000			326 000	
GREAT RUAHA	GREAT NORTH ROAD, IKA 8.	328	441 000	238 000	112 000	198 000	83.2		
KIMANI	DAMSITE.	173	237 000	134 000	84 000			198 000	
KIMANI	GREAT NORTN-ROAO, IKA 9.	173	237 000	134 000	84 000	143 000	107.0		
MBARALI	DAMSITE.	374	523 000	326 000	183 000			114 000	
MBARALI	IGAWA, IKA 11	619	374 000	337 000	201 000	196 000	55.0		
IPWANI	DAMSITE	435	(131 000)	(84 000)	(34 000)			60 000	BASED ON RECONNAISSANCE ONLY
NALALI	IYAYI, IKA 12	302	137 000	76 000	30 000	66 000	86.8		
NDEMBERA	NGALENGE DAMSITE	404	174 000	95 000	37 000			1290 000	
NDEMBERA	ILONGO, IKA 13	404	174 000	93 000	37 000	79 000	83.1		
NDEMBERA	MADIBIRA, IKA 33	707	260 000	147 000	64 000				
GREAT RUANA	INFLOW TO USANGU PLAIN	3 373	(3000 000)	(1 628 000)	(800 000)	(1 300000)	(80.0)		
GREAT RUAHA	HAUSMANN'S BRIDGE, IKA 27.	7 700	1 727 000	1 346 000	985 000	1 200000	89.2		
LITTLE RUAHA	MAKALALA DAMSITE.	293	209 000	116 000	32 000			111 000	
LITTLE RUAHA	S.H. CLUB, IKA 32.	293	209 000	116 000	52 000	30000	43.1		
LITTLE RUAHA	IWAWA, IKA 39.	643	493 000	265 000	162 000	119 000	44.9		
LITTLE RUAHA	INIMBU, IKA 21.	937	730 000	394 000	214 000	137 000	34.8		
LITTLE RUAHA	IRINGA DAMSITE.	1 123	811 000	444 000	246 000			1066 000	
LITTLE RUANA	IRINGA, IKA 2	1 127	811 000	444 000	246 000	168 000	37.9		
LITTLE RUAHA	TOSAMAGANGA, IKA 20	1 273	794 000	439 000	257 000	194 000	44.1		
LITTLE RUANA	MAWANDE, IKA 31	2 003	802 000	463 000	214 000	180 000	38.7		
GREAT RUANA	KISALWA, IKA 26	13 844	2 139 000	1 300 000	939 000				
KISIGO	KINUNGURU, IKA 42	9 476	(600 000)	276 000	(110 000)				
GREAT RUAHA	MTERA, IKA 5	26 234	3 390 000	1 633 000	700 000	1 742 000	105.0		
GREAT RUAHA	MTERA DAMSITE	26 270	3 390 000	1 633 000	700 000			3 000 000	
GREAT RUAHA	MBUYUNI, IKA 4	28 274	3 670 000	1 712 000	920 000	1 880 000	109.0		
GREAT RUAHA	KIDATU, IKA 3	30 903	4 830 000	2 386 000	1 150 000	2 280 000	93.6		
FUAGI	IDEGE DAMSITE	21	26 800	18 300	13 000			38 000	
FUAGI	IDEGE, IKB 7	24	30 000	21 000	14 000				
KIGOGO-RUAHA	FRICKS BRIDGE, IKB 6	311	417 000	284 000	191 000	342 000	120.0		
KIGOGO-RUAHA	MSANA DAMSITE	329	440 000	299 000	200000			612 000	
MNYERA	TAUETA, IKB 9	1 930	2 326 000	1 694 000	1134 000	360 000	33.1		
MNYERA	TAUETA DAMSITE	2 264	2 976 000	1 997 000	1 358 000			304 000	
RUHUJI	MKASU DAMSITE	3 277	3 260 000	2 248 000	1 708 000			3 090 000	
RUHUJI	MWAYAMALUNGU, IKB 10	3 294	3 283 000	2 237 000	1 721 000	1 100 000	48.8		
MPANGA	MDIKU DAMSITE	910	1 182 000	844 000	608 000			398 000	
MPANGA	MPANGA, IKB 8	937	1 219 000	869 000	629 000	243 000	29.0		
KILOMBERO	IFWEMA, IKB 4	7 048	7 025 000	5 235 000	4093 000	1 790 000	34.2		
FURUA	MALINYI, IKB 16.	307	1 000000	604 000	392 000				
KIHANZI	MERERA DAMSITE.	473	(900 000)	(640 000)	(430 000)	(640000)	(100.0)	500000	
RUIPA	NGONGWA DAMSITE	533	1 200 000	(850 000)	(390 000)	(873 000)	(103.0)	175 000	
LUMEMO	DOLIYA DAMSITE.	130	337 000	280 000	212 000			54 000	
LUMEMO	KIBAONI, IKB 14.	164	400000	312 000	234 000	120000	38.5		
KILOMBERO	IFAKARA, IKB 2.	12 063	16 780 000	10 560 000	6040 000	7 200000	67.6		
KILOMBERO	SWERD, IKB 17.	12 915	17485 000	11 092000	6 333 000	(7300000)	(67.6)		
KILOMBERO	KINGENENAS DAMSITE.	13 121	17,485 000	11 092000	6 333 000			4 080000	
LUNOMBERO	ILONGA, IKB3	395	378 000	182000	104 000	193 000	106.0		
LUWEGU	NJANGASI DAMSITE.	9 382	(3 700 000)	(2 600 000)	1300 000	2 080 000	(80.0)	4 730000	
RUFIJI	STIEGLERS GORGE DAMSITE.	61 102	29 800 000	18 030 000	10 730 000	12 500 000	69.0	23 600 000	
RUFIJI	STIEGLER'S GORGE, IK3.	61 106	29 800 000	18 030 000	10 730 000	12 500 000	69.0		
RUFIJI	AREA BETWEEN STIEGLER'S GORGE AND INDIAN OCEAN.	7 394		(1 109000)					

Storage requirements refer to the total effective storage capacity required above the gauging station to maintain an even river flow throughout the most unfavourable regulation year observed at the station. The maximum storage was required at practically all stations during the year 1936. At stations where observations commence later, the storage requirements given in this tabulation have been adjusted also to represent the year 1936.

Figures in brackets are derived as follows:-

Average runoff is extracted from the Runoff Map of the Rufiji Basin. Maximum and minimum runoff is computed as percentages of average by analogy with rainfall and also with runoff in adjacent rivers. Storage requirements are computed in comparison with other rivers of the same character and also with storage requirments for larger areas to which the partial sub-catchments belong.



* Of "STORAGE CAPACITIES SURVEYED" only selected reservoirs, modified in capacity, are contemplated for actual development. See Volumes I & III.

RUNOFF AND STORAGE DATA AND MAP

Compiled by the Rufiji Basin Survey Hydrological Section, Tanganyika.

16. FUTURE WORK ON RIVER GAUGINGS

a. INTRODUCTION

It is hoped that funds will be made available for a continuation of the hydrological investigations of the Basin. Practically all river gauging stations at present in operation should continue for many years to come, and the stations kept in proper order and improved wherever possible and necessary. Some of the stations should be shifted to better sections of the river. This is discussed in detail in part 2 of this report. A number of additional river gauges should be established on rivers not investigated, as suggested below.

b. KILOMBERO RIVER

It is very important to get more information on the flooding of the Kilombero Plains. It is suggested that a number of additional river gauges are incorporated in these investigations and that gauges should be established on tributaries above any backwater influence from the flooded plains. The most important tributaries not gauged at present are the Kihanzi and Ruipa Rivers. Beside these a number of smaller tributaries from both sides of the valley should be gauged, and on all tributaries runoff should preferably be gauged at various altitudes. This will enable more reliable runoff maps to be established giving the total runoff from higher land on to the Kilombero Plain. Actual discharge observations on the main river after entering the plains are very difficult during floods. Large areas are flooded and stable control sections are scarce if to be found at all. Nevertheless, water level records in themselves are of great importance and it is suggested that about six additional gauges are established on the main river between Ifakara and Ifwema. It would be of advantage to have automatic recorders, and Griffin Gauges for check of extreme floods, which then would facilitate a better study of river behaviour and movement of water within and beside the main river channel. A detailed hydrological study of the extent of the flooding on plains is very important, but would require good contour maps before definite plans could be drawn up.

c. LUWEGU RIVER

This tributary contributes a large quantity of water and has flashy floods carrying large proportions of silt. It would be of importance to have permanent station installations on the Mbarangandu and Luwegu for future studies of runoff and sediment transport on these rivers.

GREAT RUAHA RIVER

A number of the most important tributaries have permanent stations but it would be advantageous to have additional gauging stations on some of the tributaries from the west. Water level gauges should be established on rivers throughout the Usangu Plain and the Utengule Swamp and one or two gauging stations on the main river between Hausmann's Bridge and the Kisilwa gauging stations.

d. COASTAL AREA

No information is available on runoff from the Coastal Area, and due to flooding it was found extremely difficult to get reliable runoff records of tributaries below Stiegler's Gorge. It is suggested that these tributary streams should be investigated for possible gauging sites some distance away from the main river and if suitable sites are not to be found there, some coastal rivers adjacent to the Rufiji Basin should be gauged. Results from these rivers could thereafter be transferred for application in the Lower Rufiji area. The investigations of the extent of flooding and of measures to protect valuable land form a task similar to that of the Kilombero Plains.

In all areas it is almost impossible to gauge every small river and stream. A fair representation must be selected only, and it is important that these gauged rivers cover areas of various runoff conditions. For the establishment of runoff maps the gaugings of runoff from smaller catchments, say 30 to 100 sq.miles, are of value and if such areas are spread fairly evenly over the Basin reliable runoff estimates for ungauged areas located between these can be made.