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TANGANYIKA

Annual Report

of the

Department of
Water Development and Irrigation
1958

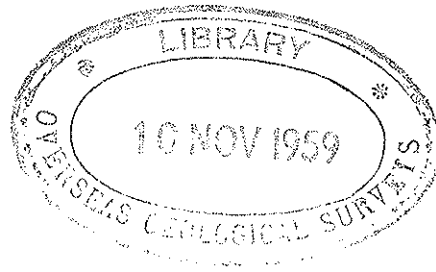
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BRITISH GEOLOGICAL SURVEY



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Water Development and Irrigation
1958



Igombe Dam—Tabora.
Official opening by His Excellency, the Governor of Tanganyika,
Sir Edward Twining, G.C.M.G., M.B.E.
January 27th, 1958.

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TANGANYIKA

ANNUAL REPORT OF THE DEPARTMENT OF WATER DEVELOPMENT AND IRRIGATION, 1958

I.—INTRODUCTION

The encouraging growth of water-mindedness among Native Authorities previously reported has been confirmed during the past year. Interest continues to centre mainly on improved water supplies for domestic purposes and for cattle, involving usually the construction of small earth dams, pipelines or boreholes, but in a few areas the value of Water Conservation and of irrigation is also appreciated and requests for several small irrigation works are currently being dealt with. The programme of investigations, surveys and construction involved in meeting these demands has kept departmental staff fully occupied, and the need for an enlarged establishment is now being felt more than ever.

No new water conservation or irrigation projects have been commenced during 1958, but designs are in preparation for some important schemes, which are expected to be ready for construction in 1959, and further progress has been made at Mlali, Mang'onji and Kalimawe.

The need for new piped water supplies to Government Minor Settlements and Outstations has reached saturation point, although improvements and extensions to existing works become necessary from time to time. However, the great benefits resulting from work done in the past has clearly been appreciated and the Department is now attending to an extensive programme of piped supplies for Native Authority Minor Settlements.

The Water Boring Section has been kept busy throughout the year with an average of six drilling rigs in the field, despite the comparatively high cost of operating borehole water supplies. It is frequently the case that no alternative source of water is available and the contribution made by the many successful drilling works towards development is becoming increasingly recognised. With the purchase of new equipment enabling larger holes up to 12 inches to be drilled, teams will be better placed to produce good results, even in areas where fine sand and other natural hazards have to be contended with.

The work of the Project Planning Section at Ubungu was continued during the year under the direction of an Irrigation Engineer. Steady progress has been made, but activities are still on a limited scale pending the filling of the vacant post of Chief Planning Engineer and recruitment of additional Designs, Computing and Survey Staff. The two major investigations undertaken as in the previous year were those connected with the Ruvu and Pangani Rivers, each of which is in the hands of an F.A.O. Expert. An Interim Report on the Pangani River was drawn up and forwarded to Rome for processing prior to presentation to the Tanganyika Government; a similar but less detailed report on the Ruvu River is currently under preparation. The essential part played by Hydrology in the planning of the territory's water resources is now generally recognised and this work is being steadily expanded, the data being recorded, analysed and computed at Ubungu.

The map coverage of the territory has been further advanced during the year by the Department of Lands and Surveys, the areas concerned including the lower half of the Bubu River Catchment and a few remaining sections of the Pangani and Ruvu River Catchments. Although many other areas vital to the development of water resources still remain to be covered by the 1 : 50,000 contoured series, the assistance derived from the work already done by the Department of Lands and Surveys has been great and the progress made with the Pangani and Ruvu investigations is largely due to this factor.

Three new Sub-Divisions have been established during the year, one each in the Tanga, Northern and Central Provinces but as these are not yet fully staffed, their activities were restricted generally to survey and investigations and a limited amount of construction.

To meet the growing demand for water for all purposes in the territory the Department must be greatly expanded both in staff and equipment. The development of the water resources is vital to the development of other natural resources in Tanganyika.

II.—DEPARTMENTAL ORGANISATION

It was decided after careful consideration to establish a separate mechanical section in Dodoma under a Mechanical Engineer thus relieving both the Divisional Engineer and Engineering Geologist of responsibility for maintenance and overhaul of plant, vehicles and equipment. The new arrangement came into effect in August and the result has been satisfactory. A certain amount of re-adjustment of office accommodation and stores was necessary and this will not be completed until 1959.

The big demands for water development in the Mbulu District of the Northern Province have at last led to the establishment of a new Sub-Division with an Executive Engineer in charge. The local Native Authority has drawn up an ambitious six-year programme backed by considerable Native Treasury funds, and it is therefore likely that the activities of the Department in this area will expand rapidly.

Other new Sub-Divisions have been started in Korogwe in the Tanga Province and at Kondoa-Irangi in the Central Province. At Korogwe, only temporary accommodation is at present occupied by the Executive Engineer, but plans for a new depot are in hand. At Kondoa-Irangi, a small depot of semi-permanent construction is nearing completion.

The sub-divisional organisation at Iringa has been built up and now includes a permanent office with stores and parking bays; being the centre of an area blessed with considerable water resources, including perennial rivers and streams, the activities of the Department in this District are widening and an important construction programme is under preparation. At the other end of the Southern Highlands Province, an Engineering Assistant, was stationed temporarily at Tukuyu who undertook a programme of surveys and investigations. These have now been completed and the Officer is about to return to the Divisional Headquarters at Mbeya.

In Head Office, Dar es Salaam, self-accounting came into effect on the 1st July, 1958, and the new system has now been launched successfully, and with the minimum of difficulties. An extension to one wing of the Head Office building is nearing completion, which will make possible adequate storage of accounts records.

The Water Control Executive is now established in Arusha and two of the Water Wardens are working in close co-operation with the Divisional Engineer's staff on hydrological investigations, one in Moshi and the other in Arusha.

III.—STAFF

At Head Office in Dar es Salaam, the staff position has remained largely unchanged, although the Deputy Director was absent on vacation leave for three-and-a-half months. At the Project Planning Station, Ubungu, the important post of Chief Planning Engineer remained unfilled (but formalities for early recruitment of a suitable officer are about to be finalised).

Three new Executive Engineers arrived from the United Kingdom and thus brought the Department up to full establishment in this grade. Unfortunately, the resulting improvement was largely offset by the effects of the recruitment "freeze", and has resulted in the Department remaining no less than 26 Engineering Assistants short of its full establishment.

The arrival in March of a second Mechanical Engineer made possible the amalgamation of the workshops and stores at Dodoma, which were placed under his direct supervision with effect from August.

In the Water Boring Section, the Engineering Geologist proceeded on leave pending retirement in July, and with one of the two remaining Geologists absent on vacation leave from the middle of January to the middle of July, work undertaken by this Section had of necessity to proceed at a slower pace. With the retirement of the Engineering Geologist, Mr. Max Coster, under the age limit, one of the few remaining officers who have served with the Department since its inception, has departed. A Manual on the Underground Water Resources of Tanganyika prepared by Mr. Coster prior to his departure covering the results of his work in the territory over a period of many years is due for publication shortly and will certainly prove of great value to Geologists in general and the Water Boring Section of this Department in particular.

This section suffered a grievous loss by the sudden death of Mr. J. Melchers, Drilling Superintendent, and I would like to put on record the high esteem in which this officer was held.

On the office and clerical side, the Department has found it difficult to cope with the increased work in view of the steady drain resulting from normal wastage, which, again due to the "freeze", has not been made good. The non-replacement of Secretary/Stenographers in several Divisions has proved particularly inconvenient.

Encouraging results of the first Junior Engineering Assistants' Training Class at Ubungu decided Government to increase the number of students for the 1958 Course; 20 students were subsequently enrolled in place of the original 10 and high hopes are entertained for these new entries. The top student who was outstanding during the 1958 Course was recommended for a Government Tied Bursary to study Civil Engineering at the Royal Technical College, Nairobi.

On completion of the Departmental Training Course at Ubungu, the students were dispersed among the eight Divisions and also to the Project Planning Station for a further two years' practical training in the office and field.

In general, the staff position has not improved and the "freeze" on recruitment has prevented the filling of numerous vacant posts.

The latter has particularly affected the Departmental establishment of Engineering Assistants, whose services are so necessary for Engineering Surveys, Planning and Design.

Efforts continue to absorb and train local recruits, but this is a long term plan, the results of which will not be seen for some years to come.

IV.—EXPENDITURE

Gross expenditure incurred by the Department during the year amounted to £835,487, an increase of £9,438 over the figure for 1957.

Recurrent Expenditure rose by £49,200 to £426,854, partly as a result of a small increase under the Personal Emoluments Vote but mainly due to the purchase during the latter half of 1958 of three earth-moving Units at a cost of approximately £40,000.

The Works Programme, however, showed an overall decrease of £39,710 in relation to the previous year, the main variations occurring under the following Heads:—

Water Supplies (Capital Equipment), a reduction of £52,988 resulting from reduced expenditure on purchases of plant, vehicles and equipment and on the construction of offices, workshops and stores, the majority of the depots and sub-depots now having been completed.

Water Supplies (Construction).—A fall in expenditure amounting to £18,908 due to a reduction in the number of Outstations and Minor Settlement Water Supplies installed and to the completion of the £30,000 scheme undertaken for the Chagga Council in Northern Province; these decreases were partly offset by an increase in expenditure on installations provided for the Native Authorities in cotton-growing areas of Lake Province and financed from the loan from the Lint and Seed Marketing Board.

Water Supplies (Native Authorities).—Revealed a most encouraging increase of £44,992, approximately 66½ per cent above the figure for 1957; the increasing demand by Native Authorities for water supplies is the direct result of the decision to increase the maximum rate of assistance from C.D. & W. Funds from 50 per cent to 75 per cent.

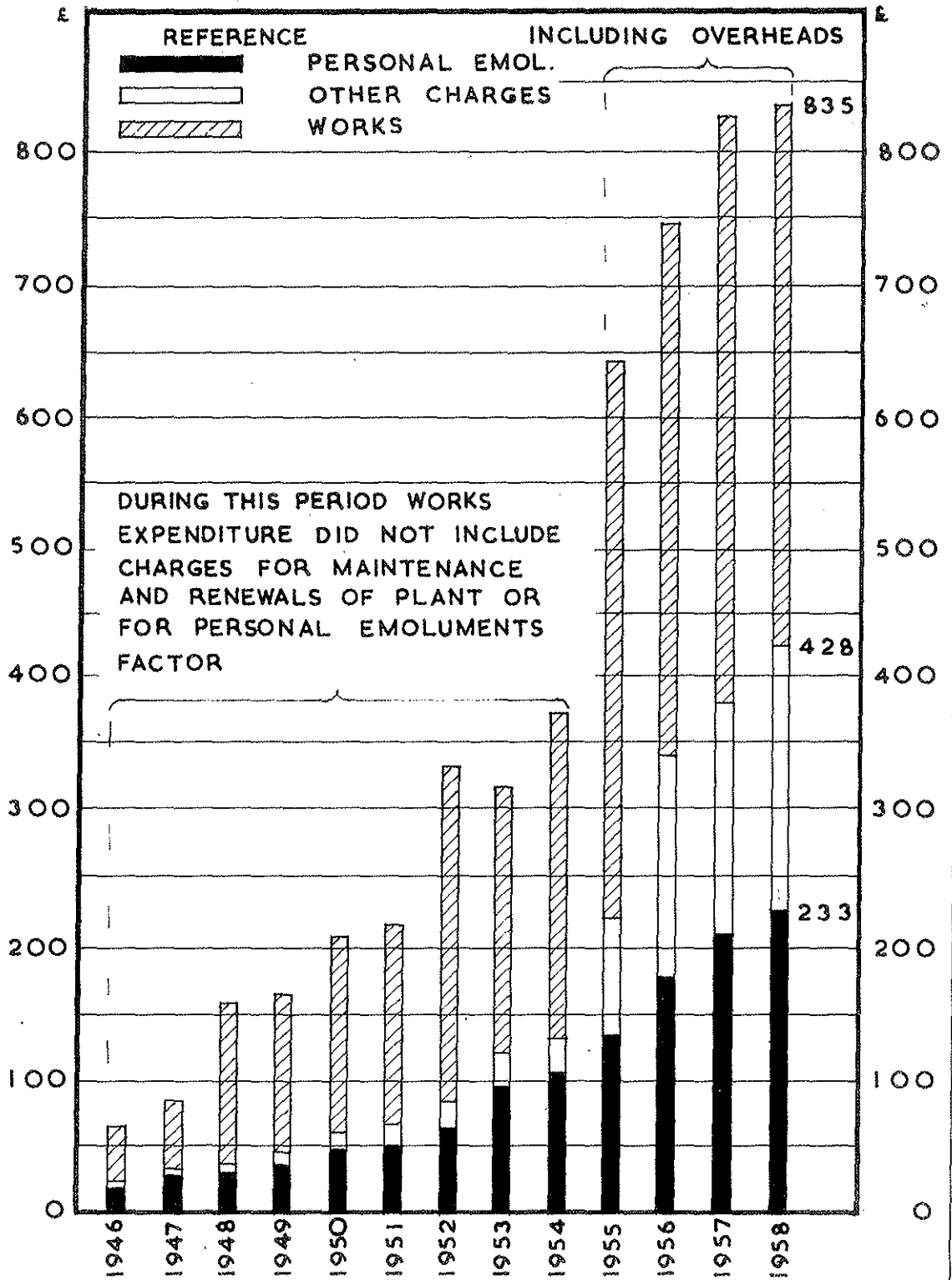
COMPARATIVE STATEMENT OF EXPENDITURE FOR THE YEARS 1957 AND 1958

Item	Details of Expenditure	Actual Expenditure 1957 £	Actual Expenditure 1958 £
<i>1. Recurrent:</i>			
	Personal Emoluments	217,036	233,691
	Other Charges	78,787	77,697
	Special Expenditure	5,581	6,409
	Recurrent	76,250	109,057
	<i>Total Recurrent</i>	377,654	426,854
	<i>Less Appropriations-in-aid:—</i>		
	Works Charges	23,537	68,528
	Maintenance Charges Plant and Transport	15,775	23,693
	<i>Net Total Recurrent</i>	338,342	334,633
<i>2. Miscellaneous:</i>			
	Miscellaneous Services	1,317	1,265
<i>3. Capital:</i>			
	Water Supplies (Capital Equipment) ...	107,911	54,923
	Water Supplies (Construction)	104,765	85,857
	Water Supplies (Survey and Investigation)	47,324	54,471
	Water Supplies (Native Authorities) ...	67,534	112,526
	Water Supplies (Conservation and Irrigation)	40,447	36,744
	Water Supplies (Land Utilization)	15,927	12,312
	Water Supplies (New Administrative Station—Kiom boi)	2,995	1,168
	Water Supplies (Other Govt. Depts.) ...	51,634	44,180
	Maintenance of Native Authority Water Supplies	5,937	5,187
	Masai Development Plan	2,499	—
	Hydrometric Stations (Rufiji Basin) ...	105	—
	<i>Total Capital Expenditure</i>	£447,078	£407,368

THOUSAND

EXPENDITURE CHART

THOUSAND



V.—SURVEYS AND INVESTIGATIONS

In keeping with the increased demand throughout the territory for water supplies, including irrigation schemes, there was an increase in surveys and investigations both in number and scope from previous years, the limiting factor being the survey staff available.

The surveys could be roughly divided into (a) Irrigation Schemes, (b) Water Supplies, and (c) Hydrological. To assist in the larger irrigation schemes it was fortunate that the Department was able to call on the services of Survey Teams working under the control of the Department of Lands and Surveys, but surveys for all other schemes and smaller irrigation schemes were undertaken by the W.D. & I.D. staff. The five officers seconded from the Department to the Rufiji Survey Team assisted in the investigations of the Rufiji Basin Scheme, and hydrological staff was also busy on the investigations of the Pangani and Ruvu River systems.

The publication during the year of further 1: 50,000 survey maps covering areas previously inadequately mapped has assisted the work of planning the available water resources and of investigating possible water supply schemes, as well as thereby reducing preliminary instrumental surveys. These included the sheets covering the lower Bubu River Catchment, where detailed hydrological investigations are in progress.

Of particular importance in investigations of schemes involving earthworks is a study of the soil, and it is now standard practice in the Department to obtain soil samples for analysis by either the Government Chemist or the Materials Engineer, Public Works Department. Water sampling for irrigation or domestic use has been the rule for a number of years, but all these samples are now being routed through the Project Planning and Research Station for recording, so gradually building up a useful dossier of soil and water characteristics for various parts of the territory.

The predominant types of surveys varied between Divisions, and while in Northern Province approximately a hundred preliminary investigations followed by some sixty instrumental surveys were mainly on gravity pipeline supplies, in Tanga the bulk of the investigations and surveys was on irrigation schemes, including the Kalimawe-Lasa Bridge Channel. In the Central Province approximately ten major dam sites were surveyed by precise levelling, with a large number of minor schemes investigated in addition.

Sub-surface exploratory investigations were carried out for a dam site at Chilongwa by means of diamond drilling to ascertain the suitability of the foundation for a high earth dam.

The emphasis on dam site investigations also typified conditions in the Lake Province, where surveys for Native Authority Minor Settlements and Trading Centre water supplies, and the proposed seven-mile pumped supply from Lake Victoria to Ukiriguru Research Station were carried out. In Western Province again the bulk of the surveys and investigations was for dam supplies, but the year's work included a survey of 500 acres below Kazima Dam, Tabora, for a proposed irrigation scheme. Surveys for river control, flood protection and drainage in Kilosa District were added to the other usual surveys and investigations in the Eastern Province. Flood protection from the Ruvuma River at Chiumo in Southern Province was a major survey work, including the gauging of the river over a 12-mile length. Piped supplies to Native Authority Trading Centres and dams took up the remaining surveys, and demands for wells required the calling in of another Banka Drill to assist in the investigations. In the Southern Highlands Province two proposed irrigation schemes at Kalenga and Pawaga were the major surveys, followed by surveys for Native Authority Trading Centres' piped supplies. An active programme of Water Court work and hydrological investigations was again carried out in this Province, as in the Northern, Tanga and Eastern Provinces, where permanent rivers and streams of the territory are concentrated.

VI.—HYDROLOGY

The building up of the Hydrological Section has continued and it can now be said that the foundations for a well-balanced unit have been laid. This is particularly true of the staff at the Central Project Planning and Research Station at Ubungo, who have been working during the year under the direction of an Irrigation Engineer. Nevertheless, a large number of additional trained staff at all levels is still needed to handle the vital work of recording and analysing the flows of the Territory's rivers and streams. As the early appointment of a Chief Planning Engineer has been foreshadowed, this should increase greatly the further development of the Department's hydrological planning work.

At the end of the year, the staff at Ubungo included in addition to the Irrigation Engineer in Charge, one Executive Engineer, three Engineering Assistants, three Senior Computing Assistants, four Computing Assistants and two Junior Draughting Assistants. One of the Engineering Assistants was sent to America for four months, with the assistance of an F.A.O. Fellowship, to study hydrology, and on his return prepared a schedule of training in field work. It will also now be possible to produce a Water Year Book, the first to cover 1959, and preparations were put under way to this end.

In the Divisions the greatest concentration of staff on hydrological work is devoted to investigatory work in connection with permanent rivers and streams in the Northern and Tanga Provinces, where three Engineering Assistants and Junior staff, supplemented at times with other senior staff, are fully occupied on this work. Two Water Wardens, under the control of the Water Officer, were employed in this area to investigate and report on water applications, but the bulk of this work still remained on the shoulders of departmental officers.

The demand for water conservation works in the dry Central Province has drawn attention to the paucity of records of surface flow measurements and, to remedy this, a programme of installing automatic water flow recorders in the Bubu River Catchment was started in the middle of the year. It is proposed to embark on a similar programme in the catchment area of the Kinyasungwe River. Elsewhere in the Territory the number of gauging stations is being slowly increased, the rate of growth being dependent on availability of trained staff and funds. This increase is illustrated in the attached chart.

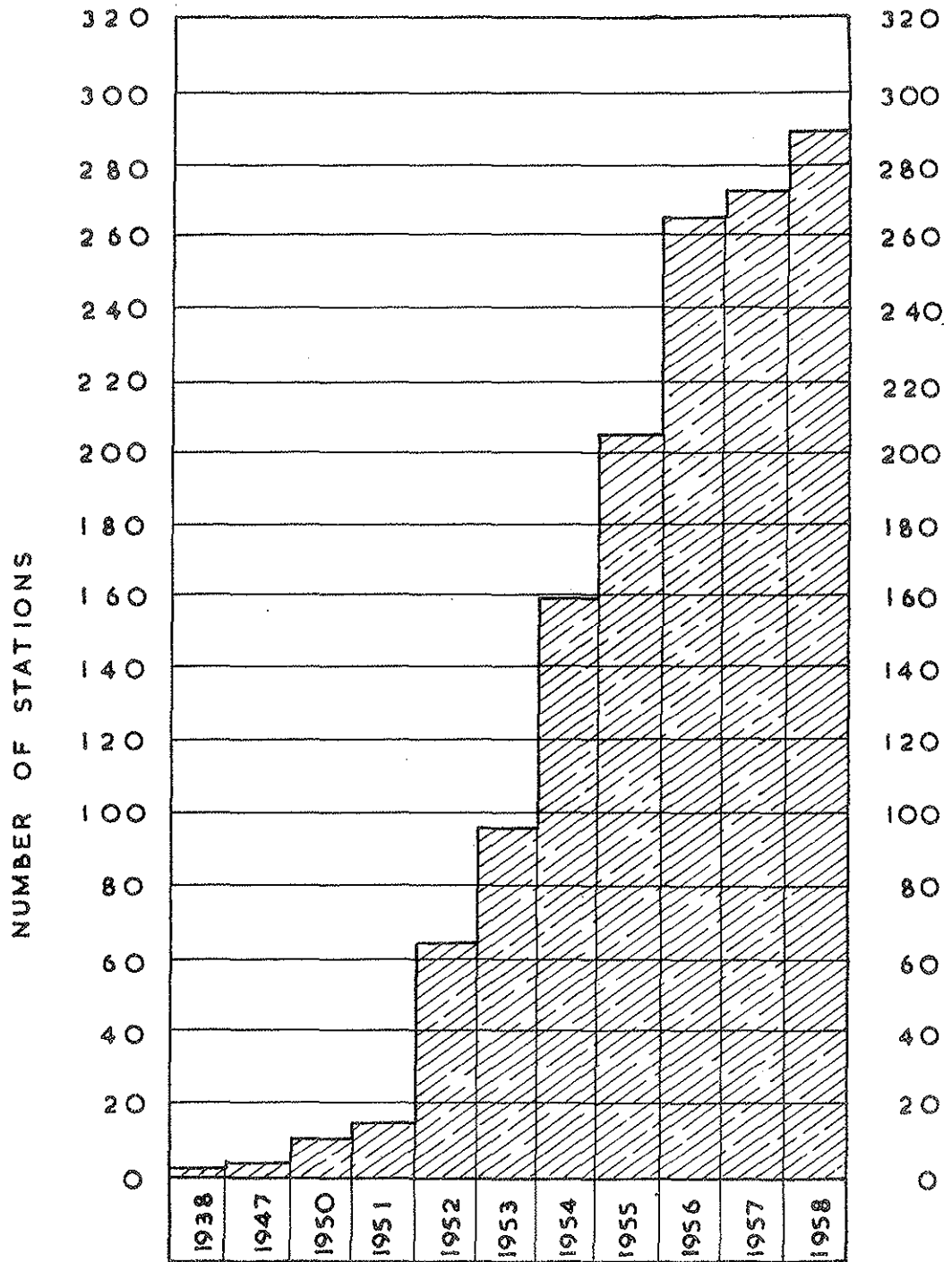
A programme of suspended silt and water analyses has been initiated in conjunction with the Government Chemist, who has been training an officer of this Department for this purpose. This work will shortly be carried out departmentally at Ubungo where laboratory accommodation is available. The bulk of these analyses cover samples from the Pangani and Ruvu Rivers and their tributaries, but the range will be extended to include other river systems in due course.

The hydrological investigations in the Rufiji Basin continue to be carried out by the F.A.O. specialists with the assistance of staff from this Department, who have been seconded for training and to provide continuity when the work is handed over to this Department. This handover will take place in mid-1959 and not 1960 as originally planned, and appropriate arrangements are being made.

Dr. Dolfi and Mr. Chablani, F.A.O. specialists, continue their investigations of the Pangani and Ruvu River systems respectively, actively assisted by departmental staff.

At the Third Formal Conference on Hydrology held at Kampala in August, the Department was represented by the Director and Mr. R. G. MacWilliam, Divisional Engineer, Central Province. Accompanying them as an observer was Mr. J. Otnes, F.A.O. Hydrologist seconded to the Rufiji Basin Survey Team. Papers on varied aspects to Tanganyika's hydrological problems were presented by Mr. Otnes, Mr. MacWilliam, and Mr. Arnold, Executive Engineer (Hydrology), Project Planning and Research Station.

REGULAR GAUGING STATIONS SITE ESTABLISHMENTS





Transplanted Rice. Ikowa Irrigation Scheme.

VII.—IRRIGATION

Although no new irrigation schemes have been completed during the year, experimentation and small scale development has continued at Ikowa, Lower Uru and Mang'onyi, while at Kalimawe work is in hand on the construction of a high level channel which will bring 1,000 acres under irrigable command. The results achieved with the growing of the first crop of maize and cotton on the 300 acre Compensation Area have been encouraging.

At Mlali, the possibility of increasing the availability of water by diversion from a neighbouring catchment is being investigated with a view to bringing more land under cultivation. This small irrigation scheme continues to be very popular with the local people and the recent rice harvest has been most successful.

Irrigation schemes now being investigated and designed include Kitivo in the Tanga Province (700 acres), Kalenga in the Southern Highlands Province (1,000 acres), and Pawaga, also in the Southern Highlands Province (1,000 acres plus).

VIII.—WATER CONSERVATION AND FLOOD CONTROL

There has been a pause in the construction of dams primarily for water conservation and flood control, but several schemes constructed during the year in the Central Province are designed to serve this purpose, as well as the provision of water for domestic use and for cattle over a widespread area by making rivers flow during many months of the "dry" season.

The provision of water conservation dams has resulted in greatly boosting the local fishing industry. In some areas, dams, such as Igombe, Ikowa, Hombolo, Mianje Mungaa and Kalimawe only stocked in recent years with Tilapia species have created an alternative profitable occupation for many local inhabitants, who have settled on the fringes of such newly-created inland fishing grounds. The food thus provided is a welcome supplement to the diet.

The value of flood control schemes was well illustrated in December, 1958, on the Upper Mkomazi River, when storms of cyclonic force were experienced giving rise to an unprecedented flood. The river water lapped the decking of the main Tanga/Moshi Road bridge and destroyed numerous African houses and cultivation; it was the considered opinion of this Department, supported by the P.W.D., that the flood absorption effect of Kalimawe dam immediately upstream was the vital factor responsible for saving the bridge and for preventing much greater damage to property. Similar results have been noted below Ikowa dam and elsewhere, thus emphasising one of the many benefits of water conservation and flood control work.

Of interest from a water conservation point of view are the series of earth dams being built on the South-East slopes of Kilimanjaro. Here, the natural topography, and particularly the rather steep valleys, do not lend themselves to the construction of large impounding reservoirs, but the value of smaller storage works has already been demonstrated at Mworororo, while a second dam is nearing completion at Sholo. The water stored in these small reservoirs is distributed by gravity pipeline and important new areas will as a result be opened for cultivation on the lower slopes.

IX.—DOMESTIC AND CATTLE WATER SUPPLIES

The demand for piped water supplies, so increasingly apparent over the last few years, continued even more strongly, and a study of Appendix I will show how the demand has been met. The number of supplies completed or put in hand during the year is a record for the Department.

All but one or two Government Minor Settlements in the Territory have now piped water supplies installed. With the Public Works Department taking over practically all these water supplies for maintenance, only three or four Settlements still remain under this Department's control, and when works, after modernisation, have been completed, they also will be handed over.

This change has been more than made up for by the increase in demand for piped supplies in Native Authority Minor Settlements, and in all Provinces the Department has been hard stretched to cope with the increased demand. The normal evolutionary wish of the people for more readily available water has been greatly encouraged and assisted by an increase in the rate of assistance from C.D. & W. grants, the average for which over the year was 75 per cent. Water supplies, like other beneficial services, are their own best ambassadors, and the benefits of a recently-installed supply are soon broadcast and lead to demands from other areas.

The above remarks apply not only to piped supplies in Minor Settlements and Trading Centres, but to dams, pipelines and boreholes to supply domestic and cattle needs in remote areas. This is particularly apparent in the Northern Province where a large programme of gravity pipelines from permanent streams and springs will distribute water over vast areas of unwatered country.

Government Minor Settlement Water Supplies.—Mahenge Water Supply in Eastern Province was completed during the year and handed over to the Public Works Department for maintenance purposes. In the Central Province work is nearing completion on the Kondoa-Irangi Water Supply, and improvements have been made to Manyoni Water Supply. On completion of the works on the former, the whole supply will be handed over to P.W.D., but there still remains outstanding work at Manyoni, which will be done when funds become available. At Kiomboi, an extraordinary flood was recorded, which damaged the spillway to some extent and repair work on this will be carried out during the next dry season. Nzega Water Supply was completed early in the year and handed over to the P.W.D.; a small extension from this supply was also completed during the year to Uchama Middle School. Also in the Western Province, the construction of Mpanda Water Supply continued throughout the year under great difficulties resulting from heavy rainfall; this required the carrying out of repairs to the spillway caused by heavy discharges and in addition minor slips of the embankment had to be dealt with. Water has been supplied to the Settlement for the best part of the year. Two supplies in Lake Province were under construction during the year, one of which, Mantare, was completed in the first half of the year and handed over to the P.W.D. The other, Geita, has had a new pump-house installed and it was possible to pump from the new dam at the end of the year. Funds were not available to carry out the proposed improvements to the distribution system. A proposed supply to Sanya Juu Minor Settlement in the Northern Province had to be abandoned when an analysis of the borehole water, which was to be the source of the supply, revealed that the fluorine content was too high for domestic use. Alternative sources for this supply are being investigated. Although Same Water Supply in Tanga Province was taken over by the P.W.D. last year, this Department returned to the area and installed a new deep well pump in No. 2 borehole. Still under the control of this Department is the Handeni Water Supply in the Tanga Province, and arrangements were under way to provide a supplementary supply of water to the station from an existing borehole. In the Southern Province, an extension to the distribution system in Masasi was completed during the year and the whole supply handed over to P.W.D. In Southern Highlands, a small supply based on a borehole was installed at the new Tunduma Customs Post on the Northern Rhodesia border, and this was in operation at the end of the year prior to the handover to P.W.D.

Native Authority Water Supplies.—In Eastern Province a start was made on the water supply to the large Ifakara Native Authority Minor Settlement, and in Bagamoyo District, three dams with a total capacity of 71 acre/feet were completed. Two dams were constructed in the Central Province, both in the Dodoma District, and a third dam, which had been practically finished in 1957, was completed during the year. The total capacity of these three dams when full will amount to approximately 23,000 acre/feet. In Singida District, the Elysia dam, with a capacity of 148 acre/feet, was completed, and Mgori dam, with a capacity of 1,556 acre/feet, made a

good start and was nearing completion at the end of the year. In addition to the dams, nine piped supplies from boreholes, a spring, and an existing E.A.R. and H. pipeline, were installed. Five dams for Native Authorities in the Western Province cover the year's work; three of them being new dams started the previous year. No piped supplies other than to cattle troughs below the above dams were installed during the year. In Lake Province, two dams with a combined capacity of 1,100 acre/feet, were completed and work started on two other dams with a combined capacity of 654 acre/feet. Two piped supplies to Minor Settlement and Trading Centres were completed during the year and a start made on a third supply to a Trading Centre. In the Northern Province, the bulk of the Divisional staff has been concentrated on N.A. water supplies. Two small dams were started during the year, one being the raising of the embankment of an existing dam. Eight gravity pipelines, with a total length of 27 miles, were completed or started during the year, and, in addition, headworks were installed on two boreholes in Masailand, and one borehole in Mbulu District. Relatively little work on N.A. water supplies has been carried out in Tanga Province, the only work during the year being to redesign and reconstruct the derelict Chatto dam. In the Southern Province there is a particular keenness for piped supplies in Trading Centres, and five such supplies were either completed or started during the year. The demand for well supplies was such that it was necessary to make arrangements for the transfer of an additional Banka Drill to this Province, and a start was made on the construction of some of the eleven wells to be provided. Three dams with a total capacity of 174 acre/feet, all in Masasi District, were constructed during the year. At Kyela Native Authority Minor Settlement in Southern Highlands Province a start was made on a water supply from two boreholes, and, at the end of the year, the work was practically completed. No other N.A. water supplies were carried out, but the demand for these is obviously increasing in this Province, and an enlarged programme for next year has already been laid down.

X.—WATER BORING

The year under review has not shown the normal expansion prevalent in the last few years, and this can largely be accounted for by the fact that, for the greater part of the year, only one Geologist was available, who was responsible for the administration of the Water Boring Section, and the geological and geophysical investigations. The latter were of necessity reduced in number, and, consequently, the number of boreholes drilled was also reduced. The Engineering Geologist before proceeding on retirement was seconded to special duties and continued with the preparation of his Manual on the Underground Water Resources of the Territory, of which he has an unqualified knowledge. One of the two Geologists was on leave for six months of the year, and the work during that period fell on the shoulders of the remaining Geologist. This burden was unfortunately increased by the untimely death of the Drilling Superintendent early in the year who was not replaced.

Towards the end of the year it was possible to relieve the Acting Engineering Geologist of the duties of maintaining drilling rigs and vehicles. A Mechanical Engineer arrived in the Territory in the middle of the year, and, in the reorganisation of the mechanical maintenance and repair services at Dodoma, this officer took over the maintenance and repair services of all vehicles and equipment belonging to the Engineering Geologist and the Divisional Engineer, Central Province. The Mechanical Engineer also took over the stores, including Mechanical and Stores personnel, of both the Engineering Geologist and Divisional Engineer.

The results of this reorganisation are being studied with interest but it is early yet to report upon it.

With the promotion of a Senior Works Foreman to Drill Foreman, the Boring Section is now up to establishment with eight Drill Foremen.

Drilling activities in all Provinces, except Southern and Eastern, resulted in operations at 39 sites—a drop on last year's total. This was due mainly to shortage of staff during the first half of the year, and to the fact that three-quarters of the total boreholes were drilled in Granite and Basement areas. Only one hole was drilled in the softer coastal deposits in Tanga Province. Work on the 39 boreholes resulted in the completion of 31, 21 of these successfully. Of the ten unsuccessful boreholes, eight encountered little or no water, and two were deemed unsuitable because of excessive fluoride content. Four boreholes were successfully cleaned and/or pump-tested, and four remained uncompleted at the year end. The approximate footage drilled was 6,855 feet, 4,500 feet of this on successful holes. Cleaning work amounted to approximately 318 feet. The total yield for the year was approximately 29,000 g.p.h. of which the successful boreholes accounted for 25,800 g.p.h.

The new scheme of Government subsidies for unsuccessful private boreholes, drilled for agricultural purposes, was unfortunate perhaps in that it started off at a time when farmers and others with agricultural interests were finding difficulty in obtaining money, and no great increase in demands for private drilling resulted. One subsidy was paid to a private client after his borehole had been declared unsuccessful, and one subsidy was paid to a Native Authority.

Borehole drilling was carried out for Government Departments (24), Native Authorities (9), and private clients (6); this shows a considerable drop in drilling for private clients over the last three years and confirms the scarcity of money already mentioned.

Geological and Geophysical Surveys.—Thirty-two Surveys were carried out in all Provinces except Southern, 16 being for Government Departments, 10 for private clients, and 6 for Native Authorities.

As far as geophysical results were concerned, there was, in general, satisfactory agreement between the resistivity graphs and drilling results. During the year, the total number of depth probes was 317, totalling approximately 73,000 feet, and the total number Constant Separation Traverses 27, totalling approximately 20 miles. One Magnetometer Traverse totalling 9,000 feet was carried out.

Ground-Water Geology.—Details of various boreholes drilled are as follows:—

I.—CENTRAL PROVINCE

Dodoma District.—One borehole was completed at the beginning of the year for the Public Works Department for Dodoma Water Supply, a yield of 4,600 g.p.h. being obtained. As in the past, water was struck below the clays and marls which overlie limestones and decomposed granite.

Manyoni District.—At Kintinku a "fresh-water" drainage line through the clays of the notoriously saline Bahi Depression, was exploited and yielded 600 g.p.h. from a medium/fine-grained sand between calcareous cements and the underlying weathered granite.

Further west, a borehole at Mkwesi, north of Manyoni, was abandoned because of fine sand entering through the perforations. A sieve analysis of the borehole samples has shown that at certain levels the amount and uniformity of fine material present would prevent the creation of a screen by surging, and, short of drilling a large diameter hole and inserting selected gravel, it is hoped to make a successful second attempt by varying the position and size of the perforations in the casing string, so that certain strata may be excluded.

At Kurungu, North of Itigi, a small yield of 150 g.p.h. was struck in coarse-grained acid granite.

Singida District.—Two boreholes for the Veterinary Department at Kindai near Singida penetrated cements and gravels to decomposed granite. In the first of these saline water was encountered in sands and sandy clays, but a second attempt a mile distant yielded acceptable water from a gravel at 65 feet.

At Ikungi, further south, a borehole for the same Department was successful in decomposed granite, overlain by sandy clays.

Iramba District.—The two attempts at Tumuli were abortive, no water being struck. In the first borehole, hard unweathered granite was encountered at 53 feet, and in the second attempt an andalusite schist 130 feet in depth was penetrated, the borehole ending in hard granite. This schist showed fracturing, and is probably of Nyanzian age, as an enclave within the granite.

Mpwapwa/Kongwa District.—At Pandambili on the east-west road a coarse-grained hornblende-biotite gneiss was drilled to a depth of 600 feet, a negligible amount of water being encountered at 230 feet depth.

2.—WESTERN PROVINCE

Nzega District.—At Iyomboo in the south-east of the district water was encountered at the base of 71 feet of sands and gravels which overlie fresh granite, but the supply was too small for use by the Veterinary Department.

At Bukene, in a borehole for the Public Works Department, saline water was struck at the margin of a dolerite at 80 feet. This was cased off and 1,200 g.p.h. of potable water obtained from a zone of weathering and fracturing within the dolerite.

Tabora District.—At Tumbi, a yield of 270 g.p.h. was struck in phyllite and schist at varying depths down to 215 feet.

3.—LAKE PROVINCE

Geita District.—At Ibondo, a borehole for a Cotton Ginnery was drilled to 183 feet in hard fresh acid granite with a shallow covering of sandy clay, a small but acceptable yield being encountered in a fracture in the granite at 96 feet.

Musoma District.—At a new Cotton Ginnery at Ushashi, water was struck at 70 feet at the junction between sandy clays and very decomposed hornblende granite.

Shinyanga District.—In a 150 feet deep borehole for a Native Authority Middle School at Ibadakule, sand, gravel and weathered granite yielded 550 g.p.h. from a depth of 76 feet. Subsequent analysis of the water, however, showed its unsuitability as a school supply.

4.—NORTHERN PROVINCE

Mbulu District.—A 200 feet borehole for the Veterinary Department stock route at Ndori yielded 1,000 g.p.h. from clays and sands. These deposits are thick and represent lake beds of Quaternary age, in an area formerly occupied by a more extensive Lake Manyara.

Moshi District.—At Sanya Juu, drilling for a Minor Settlement supply resulted in a 200 feet deep borehole yielding 1,000 g.p.h. from tuffs and agglomerate of Tertiary-Recent age. Unfortunately, the quality of this water was not suitable for the Minor Settlement.

North Masailand.—Six boreholes were completed for the Masai Resettlement Scheme, three of these successfully.

In the extreme west, at Kakessio, a successful borehole in biotite gneiss and schist yielded 600 g.p.h. and followed an unsuccessful attempt in fissured hornblende gneiss, when a negligible quantity of water was obtained.

North of Ngorongoro, in the Oldonyo Ogol Hills area, two boreholes, each yielding 1,800 g.p.h., were drilled in weathered micaceous gneiss and schist overlain by pyroclastics.

Some twenty to thirty miles further east two other boreholes were abandoned at depths of 300 feet/400 feet in volcanic ashes and stratified tuffs containing waterworn basalt pebbles, indicating that the deposits were laid down in a lake basin. Drilling water was lost at several horizons, and it was impossible to keep the boreholes vertical. It had been hoped to penetrate the cover of pyroclastics and to obtain water in the underlying quartzites of the Basement.

5.—TANGA PROVINCE

Same District.—At the base of 165 feet of clayey sands and gravels, a yield of 960 g.p.h. was obtained in decomposed acid gneiss. In the same region, another borehole for an African cattle rancher encountered a good yield in very decomposed hornblende mica gneiss, the depth of weathering at this locality extending below 300 feet in the Pare Fault Zone.

Tanga District.—The one borehole drilled during the year in coastal sediments was successful in obtaining a satisfactory yield from 53 feet Tertiary limestones overlain by clays.

6.—SOUTHERN HIGHLANDS PROVINCE

Chunya District.—A stand-by borehole for Chunya water supply, only 82 feet deep hornblende epidote granite, yielded 2,400 g.p.h.

Mbeya District.—At Tunduma, on the south-western border of the Territory, a yield of 270 g.p.h. was obtained from muscovite schist at shallow depth.

Rungwe District.—Two boreholes, each yielding 1,800 g.p.h. were drilled in Quaternary alluvium at Kyela on the alluvial flats some ten miles north-west of Lake Nyasa.

Njombe District.—Sands, cement, and weathered pink hornblende granite were penetrated by a 57 feet deep borehole at Ilembule Mission, and a yield of 1,500 g.p.h. obtained.

QUALITY OF BOREHOLE WATERS

In the saline Bahi Depression between Dodoma and Manyoni, boreholes have in the past been drilled for brine, and water with a total dissolved solid content of 67,200 p.p.m. (Fluoride 33 p.p.m.) obtained. At Kintinku a borehole in 1956 produced water containing 22,400 p.p.m. solids (Fluoride 11 p.p.m.). Borehole 39/57 at Kintinku proves the existence of "fresh-water" drainage lines through the saline clays, water with a total dissolved solid content of 910 p.p.m. (Fluoride 4 p.p.m.) being obtained.

Borehole 19/58 Kindai near Singida was abandoned, water at 40 feet/50 feet showing a total dissolved solid content of 12,800 p.p.m., and when this was cased off, another aquifer 10 feet below, showing total dissolved solids amounting to 8,060 p.p.m. (Fluoride 7 p.p.m.). At Bukene in Nzega District, the exclusion of a saline aquifer (T.d.s. 6,770 p.p.m.) resulted in acceptable water (T.d.s. 1,960 p.p.m.) with a much lower sodium, chloride and sulphate content, being obtained.

Excess fluoride in volcanic areas is a big problem, borehole 12/58 for Sanya Juu Minor Settlement west of Kilimanjaro, yielding 2,400 gallons of water per hour (T.d.s. 680 p.p.m.), acceptable apart from the presence of fluoride amounting to 8 p.p.m. As much as 96 p.p.m. fluoride has been recorded from borehole waters in the area.

Similar cases occur in North Masailand where two boreholes in Basement rocks overlain by pyroclastic deposits showed fluoride amounting to 15 p.p.m. and 24 p.p.m. respectively; the former showing a reduction in fluoride content with depth, indicating that it is directly related to the overlying Volcanics. Further west where the pyroclastics are absent, fluoride amounted to 8 p.p.m. in borehole 23/58 at Kakessio.

Borehole 9/58 at Ibadakule School in Shinyanga District yielded water containing 7 p.p.m. fluoride and the supply has been condemned on that account. The area is one in which hot springs are known. A similar case is that shown by borehole 3/58 at Ndori east of Lake Manyara in Northern Province—also in a hot-springs area, one aquifer yielding water with 76 p.p.m. fluoride (T.d.s. 4,990 p.p.m.).

A borehole in the Manyoni District of Central Province showed on analysis, water with very high nitrate content of 640 p.p.m., and as this is not balanced by a high potassium content, might indicate organic contamination. Waters from the Manyoni area are, however, known to be high in nitrate, the Minor Settlement supply containing more than 200 p.p.m. In the case of the Kurungu borehole water, further analysis is desirable.

BANKA DRILLING

Because of concentration of well-sinking work in one Division, it became necessary to transfer an additional Banka Drill from another Division to assist. This was unusual as there has been a growing tendency in most Divisions to use the Banka Drills more on underground exploratory work below proposed dam sites and less on searching for shallow-well water supplies. This trend follows the demand for surface supplies from dams as against shallow-well supplies, which is becoming apparent among Native Authorities.

DIAMOND DRILLING

Exploratory work at the proposed dam site at Chilonwa in Dodoma District resulted in the drilling of 24 holes totalling 1,117 feet 7 inches. Of these holes, 17 were at 50 feet intervals along the line of the proposed dam and spillway, and the remainder across the valley 150 feet—200 feet upstream.

These holes revealed sands, gravels and calcrete varying in depth from nil to 31 feet, overlying decomposed granite gneiss.

XI—MECHANICAL

Staff.—A most welcome addition to the strength of the Section occurred with the arrival at the end of March of a new Mechanical Engineer. The new Officer was posted to Dodoma where he started the necessary groundwork for the integration of all departmental mechanical staff and equipment. Arrangements were completed in July, and in August the Officer took over the main workshop, spare parts stores and full responsibility for all mechanical matters in the Central Province. By the end of the year the new organisation was functioning satisfactorily, despite being beset by subordinate staff problems.

Vacancies in the Assistant Inspector (Mechanical) Grade existed throughout the greater part of the year and it was unfortunate that the receipt of application forms from three suitable persons coincided with the recruitments "freeze". Vacancies have also continued in the Foreman Mechanic Grade which have proved difficult to fill, though there was no lack of applicants. Once more it is necessary to draw attention to the need for the proper training of boys similar to that afforded to trades apprentices in the United Kingdom. A great challenge is presented here which can only be met by a well-planned and resolute approach.

Workshops.—No further expansion of departmental workshops was undertaken this year.

Vehicles.—Thirty-two new vehicles were received during the year against seven written off. The total vehicle strength as at 31st December, 1958, is shown in Appendix IV. Fifteen new vehicles are on order.

Accidents.—It is gratifying to report a falling in the accident rate, ten this year as against eighteen during last year. There were no serious injuries or deaths. In only two cases did vehicles require major repairs. Investigations revealed that only two

accidents were directly attributed to W.D. and I.D. drivers. The causes of the accidents covered the usual wide range from drunkenness to burst tyres, and included even the inevitable stray dog.

Earth Moving Equipment.—The Department's fleet of earth moving equipment at the end of the year is shown in Appendix IV.

By virtue of age and service the International T.D. 18 tractors and some of the Caterpillar D. 7 tractors have reached the end of their economic lives. These tractors have been relegated to less arduous tasks than continual operation with scrapers, and their output has been replaced by the purchase of three Caterpillar D.W. 15 tractors with No. 428 scrapers. The latter units were not received in Tanganyika until mid-October, and did not move to their first site of operation until the beginning of December, coinciding, unfortunately, with the start of the light rains. It is considered that these new machines will make a welcome increase in the Department's earth moving capacity, though it is too early to give an opinion on their performance. However, as the result of trials and their subsequent initial use on dam construction, it is obvious that push-loading with our aged D. 7 tractors is inadequate, and funds are being requested in the 1959/60 Estimates for the purchase of at least one D. 8 tractor chiefly for pushing duties.

Construction of dams in the Eastern Province was held up in the final quarter of the year by lack of machinery and by the necessity to transfer a team of D. 4 tractors and 4 cu. yd. scrapers for the construction of a 7½ mile canal on the Kalimawe Irrigation Scheme in the Tanga Province. Invitations to contractors to tender for the Eastern Province Dams resulted in offers averaging about 50 per cent above the departmental estimate, which could not therefore be taken up.

The quantity of earth moved on all construction jobs during the year totalled 520,000 cu. yds. approximately. This figure shows a considerable increase over that of last year's (298,000 cu. yds.), and is due mainly to a more balanced works programme.

The general standard of mechanical serviceability remains satisfactory. However, it is felt that a warning note must be sounded with regard to staff shortages already referred to, and unless the Department is able to fill its vacancies, equipment serviceability, so essential to the successful completion of projects, cannot be guaranteed.

Plant Maintenance and Replacement.—This was the most successful year for the Scheme since its inception in July, 1954, and for the financial year July 1957 to June 1958 satisfactory balances were obtained between revenue and expenditure. During the early part of 1958 it was decided to transform the Maintenance Scheme into a Hire Scheme, which as well as all maintenance and repair charges, should include operational expenses, i.e. operators and drivers wages, fuel, etc. By the end of the year it was still too early to make comment on the Hire Scheme though first results indicate that the Scheme will prove satisfactory.

XII—MAINTENANCE OF NATIVE AUTHORITY WATER SUPPLIES

The Native Authorities' Water Development Maintenance Fund completed a full year's operation, and it is now possible to make a preliminary review of its working.

This Fund is permissive, and twelve Native Authorities decided to accept the services of this Department for the maintenance of their rural water supplies, and paid into the Fund the estimated costs for this work. In only three instances did departmental expenditure exceed estimates, and, generally speaking, it was possible to show a saving on each Native Authority's supply, this saving being returned to the Fund.

It is the policy of the Department to carry out maintenance to all the supplies on a planned routine programme so that each supply receives a visit from a mechanic or Works Foreman not less than once every three months. Unfortunately, it has not

been possible through lack of staff to carry out the planned routine fully, and progress has been further hindered by the inaccessibility of a number of the smaller supplies. One Native Authority has decided that it would be more advantageous and economical to carry out its own maintenance, and has informed the Department of its wish to opt out of the Fund and be responsible for the maintenance of its own supplies. This Department is only too anxious to foster this attitude as it is felt that these supplies should be the responsibility of the Native Authorities themselves, and every encouragement will be given in the way of training staff and advice to any other Authority who would like to take over similar responsibility.

At the end of the year, ten Native Authorities remained in the Fund, with a request from another large Authority to enter the Scheme. It is not proposed to accede to the request of this last Authority until suitable staff is available in the area concerned.

XIII—CONCLUSION

On the eve of my retirement I would like to place on record my appreciation of the splendid co-operation received from all those members of the Department, who by their unflinching efforts and loyalty have made it possible to meet the many obligations, especially in view of the almost impossible demands made on the staff during the year.

Dar es Salaam,
April, 1959

W. A. GUTHRIE, O.B.E., B.Sc. (Civ. Eng.), M.I.C.E.
Director of Water Development and Irrigation

APPENDIX I
SUMMARY OF WORKS CARRIED OUT IN 1958

Name and Location	General Description	Exp. during year
EASTERN PROVINCE		£
<i>Kisarawe District:</i>		
Magindu Dam	Earth dam for domestic supply, capacity 10 acre feet	1,409
<i>Morogoro District:</i>		
Mlali Irrigation Scheme	Levelling of land to form terraces	1,829
Mlali Irrigation Scheme	Installation and construction of Parshall Flume and minor improvements to Headworks	287
Mlali Irrigation Scheme	Levelling Right Bank Area for cultivation	941
<i>Mahenge District:</i>		
Mahenge Water Supply	Gravity water supply from spring for domestic use—10,000 gallons per day	3,711
Ifakara Minor Settlement Water Supply	Pumped supply from river for domestic use—15,000 gallons per day	3,070
<i>Bagamoyo District:</i>		
Rupungwe Dam	Earth dam for domestic use—capacity 34 acre feet	1,698
Manda Dam	Earth dam for domestic use—capacity 27 acre feet	391
Mzinge Weir	Extension to weir	230
CENTRAL PROVINCE		
<i>Dodoma District:</i>		
Automatic Water Level Recorder, Chilonwa	A 4' diameter well equipped with an automatic recorder to obtain river flows	209
Ikowa Irrigation Scheme	Extension of main channel and construction of field channels to serve new area	675
Ikowa Irrigation Scheme	Construction of drainage channels throughout irrigation area	426
Hombolo Dam	Construction of earth dam to impound 18,200 acre feet for flood control and water conservation	2,322
Chamwale Dam	Construction of earth dam to impound 296 acre feet for domestic and stock purposes	6,472
Nondwa Dam	Earth dam with 3' dia. sluice draw-off for domestic and stock use. Capacity 4,444 acre feet	12,863
<i>Manyoni District:</i>		
Manyoni Minor Settlement Water Supply	Construction of high level storage tank and sinking of exploratory well to augment the present borehole supply. Extension to distribution system.	758
Kintinku Water Supply	Installation of pumping unit from a borehole with 1 mile of delivery pipe to a 3,200 gallon storage tank; also distribution piping	1,174
Doroto Borehole	Installation of handpump and rising main	10

APPENDIX I—(contd.)
SUMMARY OF WORKS CARRIED OUT IN 1958

Name and Location	General Description	Exp. during year
<i>CENTRAL PROVINCE—contd.</i>		
<i>Singida District:</i>		
Elysia Dam	Construction of earth dam with a capacity of 148 acre feet, for domestic and stock use	3,880
Mgori Dam	Construction of earth dam to impound 1,556 acre feet with a 3' diameter draw-off tower	6,391
Kiomboi Dam	Construction of retaining walls on Left Bank spillway after flood damage	1,168
Ndago Windmill	Installation of Climax Windmill and construction of 6,000 gallon storage tank	429
Kondoa Water Supply	Construction of a pumped supply with 20,000 gallons storage tank and distribution mains	8,521
Bubu River Survey	Construction of 5 automatic recorder stations and cableways, complete with temporary accommodation for operators	366
<i>Mpwapwa District:</i>		
Hogoro Borehole	Installation of pump and engine and 3,200 gallon storage tank	1,073
Tambi Irrigation Scheme	Construction of weir to divide the flow of the Tambi River in accordance with Water Court Order	135
Nhungomalo Pipeline	Construction of intake from spring and laying 1½-inch diameter pipe to existing cattle trough	250
Chunyu Supply	Construction of a 2,000 gallon storage tank, fed from E.A.R. & H. Pipeline, to supply village	136
<i>WESTERN PROVINCE</i>		
<i>Tabora District:</i>		
Igombe Dam	Completion of dam and pumphouse	5,141
Igigwa Dam	Completion of Dam	917
Tumbi Tobacco Farm	Extension and improvements to Water Supply	50
Igigwa Irrigation Scheme	Extension to Irrigation Scheme	38
<i>Nzega District:</i>		
Nzega Water Supply	Completion of Treatment Plant	4,338
Idudumo Dam	Completion of earthworks	4,272
Igurubi Dam	Earth dam for domestic and cattle needs, capacity 123 acre feet	2,611
Kahangali Dam	Improvements to Dam	586
Lubebo Dam	Improvements to hand-built dam near Igurubi	140
Uchama Middle School	Installation of rising main and storage tank from Nzega Water Supply to School	687
<i>Mpanda District:</i>		
Mpanda Water Supply	Completion of works, including dam repairs and pumphouse	11,828
<i>LAKE PROVINCE</i>		
<i>Kwimba District:</i>		
Mantare Water Supply	Construction of sump, pumphouse, 9,000 feet of 3-inch rising main, 20,000 gallon storage tank, and 12,000 feet of 2-inch diameter distribution main	2,886

APPENDIX I—(contd.)

SUMMARY OF WORKS CARRIED OUT IN 1958

Name and Location	General Description	Exp. during year
LAKE PROVINCE—contd.		
<i>Maswa District:</i>		
Malya Dam Wall	Construction of toe-wall and repairs to up-stream slope of existing dam	488
Sakwe Dam	Construction of 250 acre feet earth dam for domestic and cattle use	7,700
Nguliati Dam	Construction of 404 acre feet earth dam for domestic and cattle use	1,760
<i>Shinyanga District:</i>		
Usia Dam	Construction of 280 acre feet earth dam for domestic and cattle use	9,684
<i>Geita District:</i>		
Chigolwe Dam	Construction of 820 acre feet earth dam for domestic and cattle use	6,721
Geita Water Supply	Construction of pumphouse, installation of one pumping set, construction of flocculating tank and 20,000 gallon pump sump, laying of 4-inch dia. G.W.I. rising main 6,000 feet long	13,771
<i>Bukoba District:</i>		
Kamachumu Water Supply	Construction of pumphouse, 3,000 feet of 2-inch rising main and 5,000 gallon main storage tank together with distribution system and kiosk	783
Rubungo Water Supply	Construction of sump, pumphouse, 5,300 feet of 2-inch rising main, 8,000 gallon main storage tank, distribution system and kiosk	4,500
<i>Ngara District:</i>		
Mabawe Water Supply	Construction of sump, pumphouse, 3,300 feet of 2-inch rising main, 3,200 gallon main storage tank, distribution system and kiosk	4,272
<i>All Areas:</i>		
Biharamulo, Nansio, Ngudu Ngara, Nyanguge, Malya, Malampaka, Tarime, Ukiriguru	Installation of main meters on existing Water Supplies	631
NORTHERN PROVINCE		
<i>Moshi District:</i>		
Mtiro Pipeline Phase II	Extension to Mtiro Pipeline Phase I, totalling 38,000 feet of pipe with ancillary storage, distribution and break pressure point installations. Delivery 115,000 galls/day.	2,075
Mtiro Pipeline Phase III	Extension to Mtiro Pipeline Phase II totalling 17,200 feet of pipe plus ancillaries as for Phase II	5,378
Sholo Dam	26,000 cubic yard earth dam impounding 63 acre feet draw-off	2,991
Mwororo Dam	Raising of the embankment of an existing dam and installation of additional draw-off facilities and alternative spillway. Earthworks in raised embankment 8,500 cubic yards	250
Mashati Pipeline Phase I	First phase of 250,000 galls/day, 26,650 feet long pipeline to convey water to the lower foothill areas of Kilimanjaro	5,140
Nyumba ya Mungu	Installation of recorder well for automatic gauging of river	119
Lower Uru Irrigation Scheme	Modification to main supply channel, construction of siphon, culvert and division box	330

APPENDIX I—(contd.)
SUMMARY OF WORKS CARRIED OUT IN 1958

Name and Location	General Description	Exp. during year
NORTHERN PROVINCE— <i>contd.</i>		
<i>Arusha District:</i>		
Leguruki Pipeline Phase I	First phase of scheme to provide the Leguruki/Kingori area with a gravity supply from the Letete Springs. Phase I comprises 33,000 feet of 6 inch dia. pipe carrying 250,000 galls/day	9,958
Leguruki Pipeline Phase II	Extension to Phase I. Length 40,315 feet 4 inch diameter	Nil
Nasula River (Ngare Nanyuki)	Provision of furrow intake on Nasula River 4,400 feet, and small diameter pipeline, $\frac{3}{4}$ inch diameter, from Leguruki Pipeline as compensatory supplies for Monas Farm	240
Temi Veterinary Holding Ground	15,000 feet extension rising main for grazing facilities in holding ground area, capacity 1,000 g.p.h.	3,915
<i>Masailand:</i>		
Essiminger	9 mile pipeline, G.W.I. pipe of 2 $\frac{1}{2}$ inch dia. and smaller serving six farms in alienated land area together with ancillary headworks, break pressure, etc., structures	1,935
Kitumbeine	Modification to existing pipeline and storage facilities	1,330
Engaruka Furrow	Modification and improvements to existing furrow, from Rift Wall into adjoining plains	150
Legumai Pipeline	2 $\frac{1}{2}$ mile extension to an existing pipeline in 1 $\frac{1}{2}$ inch dia. G.W.I. pipe serving a 10,000 gallon storage tank and cattle trough together with other small ancillary works. Compensatory supply for Masai	1,600
Kakessio Borehole II No. 23/58	Installation of pumping unit and provision of engine and stores sheds and cattle watering point. Compensatory supply for Masai	930
Njureta Borehole No. 22/58	Installation of pumping unit and provision of engine and stores sheds and cattle watering point. Compensatory supply for Masai.	850
Lemuta Borehole No. 21/58	Installation of pumping unit and provision of engine and stores sheds and cattle watering point. Compensatory supply for Masai	50
<i>Mbulu District:</i>		
Ndori Borehole	Provision of borehole equipped with power pump and ancillary engine and stores sheds and cattle watering point on stock route	1,400
Endamaghai Pipeline	Provision of piped water supply to Kikuyu Settlement compensatory headworks and storage facilities together with 8,000 feet of 2 inch dia. pipeline	2,350
Galappo Pipeline	Modification of existing 3 inch dia. pipeline to safeguard headworks and upper section pipeline from floods in valley	300
TANGA PROVINCE		
<i>Same District:</i>		
Kalemawe Dam	Construction of 30 ft. high Dam retaining 15,000 acre feet of water	2,459
Kalemawe Compensation Area	Irrigation scheme of 300 acres with furrow from Ndungu River	11,143
Kalemawe Compensation Area	Ploughing 250 acres of Compensation Area	622
Chatto Dam	Improvements to dam involving the movement of 6,000 cu. yds. of earth. Existing spillway trimmed and widened and an additional high level spill built on left-hand bank	3,741
Kalemawe—Lasa Bridge Channel	7 $\frac{1}{2}$ mile channel to carry irrigation water from Kalemawe Dam	5,180

APPENDIX I—(contd.)
SUMMARY OF WORKS CARRIED OUT IN 1958

Name and Location	General Description	Exp. during year
TANGA PROVINCE—contd.		
<i>Handeni District:</i>		
Handeni Water Supply	Construction of spillway training wall and opening up of filter drains	187
<i>Lushoto District:</i>		
Mkomasi Valley near Mombo	Construction of temporary weirs at selected points on Mkomasi River to assist irrigation of adjoining lands	1,267
SOUTHERN PROVINCE		
<i>Newala District:</i>		
Chiumo	Construction of embankment and sluice gates for partial flood protection of rice-growing area	162
<i>Mtwara District:</i>		
Nanyamba Trading Centre	Pumped water supply to School and trading centre, 20,000 galls/day	1,855
<i>Nachingwea District:</i>		
Various Locations	Stock route water supply points	2,002
<i>Masasi District:</i>		
Masasi Minor Settlement	Water supply extension to new town area	821
Liputu	Gravity water supply pipeline and kiosk—2,000 galls/day	1,453
Lukuledi	Earth dam impounding 36 acre feet of water for domestic supply	3,176
Sululu	Earth dam impounding 49 acre feet of water for domestic supply	2,525
Manema	Earth dam impounding 89 acre feet of water for domestic supply	3,200
Nanyindwa	One well	180
Various Locations	Ten wells with hand-pumps	402
<i>Lindi District:</i>		
Mingoyo Trading Centre	Pumped water supply from stream to trading centre—20,000 galls/day	7,423
<i>Tunduru District:</i>		
Matemanga Trading Centre	Pumped water supply from stream to trading centre—3,000 galls/day	2,398
<i>Songea District:</i>		
Nyantumbo	Pumped water supply from stream to Health Centre—1,000 galls/day	601
SOUTHERN HIGHLANDS PROVINCE		
<i>Mbeya District:</i>		
Tunduma Customs Post Water Supply	Pumped water supply from borehole to storage tank 3,200 gallon capacity and distribution	3,685
Mbeya Range Catchment Experiment	Silt chambers to record the discharge of silt from Catchment A.	200
<i>Rungwe District:</i>		
Kyela Minor Settlement Water Supply	Pumped supply from two boreholes to raised storage tank 20,000 gallon capacity and distribution within the Settlement	8,228

APPENDIX II
DETAILS OF BOREHOLES DRILLED DURING 1958

Location No. Map II	Bore-hole No.	Date completed	Depth in feet	Yield per hour in gallons	Static Water Level in feet	Depth at which water was struck in feet	Total Solids	Total Cost Shs. Cts.	Applicant	Locality and Province	Formation	Remarks
1	30/57	27.1.58	250	60	12	68-71	—	11,481 13	Veterinary Department	Iyomboo, Nzega, Western	Sands, gravels on granite	Abandoned due to small yield of 60 g.p.h.
2	37/57	25.1.58	295	4,600	79.5	165	708 p.p.m. F 1 p.p.m.	21,517 23	Public Works Department	Makatupora, Dodoma, Central	Clays, marls, limestone, bedrock cements, granite	For Dodoma Township Supply.
3	39/57	13.1.58	120	600	47	75	910 p.p.m. F 4 p.p.m.	8,198 29	Native Authority	Kintinku, Manyoni, Central	Sands, cements, decomposed granite	Good quality water struck in drainage channel through saline clays of Bahi Depression.
4	40/57	1.9.58	183	140	72	96	520 p.p.m. F 1 p.p.m.	45,301 87	Nakasero Commercial Corp. Ltd.	Nyamililo Ginnery, Geita, Lake	Sandy clay, weathered and fresh granite. Water in fracture in hard un-weathered granite	Client desperate for water and prepared to accept small yield.
5	42/57	30.1.58	82	2,400	14	21	476 p.p.m. F 1 p.p.m.	17,814 86	Public Works Department	Chunya, Southern Highlands	Clay, granite-gneiss, basic schist. Basement	For Chunya Water Supply.
6	43/57	21.1.58	215	960	153	165	532 p.p.m. F 0.8 p.p.m.	20,992 62	Karimjee Jivanjee Estates	Kisangara Estate, Lembeni, Same, Tanga	Sands, gravels, Sandy clay, decomposed gneiss. Basement	
7	1/58	14.3.58	235	150	82	110	1,540 p.p.m. F 0.6 p.p.m. NO ₃ 640 p.p.m.	13,916 63	Native Authority	Kurungu, Manyoni, Central	Clay, cements, gravels, quartzite, granite	Blasting failed to increase yield of 150 g.p.h. which however is acceptable to Native Authority
8	2/58	10.3.58	300	1,100	240	274	1,048 p.p.m. F 0.5 p.p.m.	15,516 60	Shadrack Kangero, Esq., Magan Cattle Ranch	Kisangara, Same, Tanga	Clays, gneiss schist. Basement	Drilled in fault zone
9	3/58	5.5.58	200	1,000	10	15 112 140 & 193	2,560 p.p.m. F 37 p.p.m.	19,330 11	Veterinary Department	Ndori, Arusha, Northern	Clays, limestone, sands. Quaternary	Borehole to be used for watering Trade Stock. High fluoride content acceptable.

APPENDIX II--(contd.)
DETAILS OF BOREHOLES DRILLED DURING 1958

Location No. Map II	Bore-hole No.	Date completed	Depth in feet	Yield per hour in gallons	Static Water Level in feet	Depth at which water was struck in feet	Total Solids	Total Cost		Applicant	Locality and Province	Formation	Remarks
								Shs.	Cts.				
10	4/58	25.10.58	266	240	56	70	564 p.p.m. F. 1 p.p.m.	20,018	61 approx.	Victoria Federation of Co-op. Unions, Ltd.	Ushashi Ginnery, Musoma, Lake	Sandy clays, decomposed and fresh granite	For new Cotton Ginnery.
11	5/58	18.10.58	57	1,500	20	23	412 p.p.m. F. 2 p.p.m.	15,489	87	Lutheran Church of Southern Tanganyika	Ilebula Mission, Njombe, Southern Highlands	Sands, cement, granite	For Mission Hospital.
12	6/58	5.4.58	200	270	5	23	220 p.p.m. F. 0.4 p.p.m.	16,234	48	Government	Tunduma, Southern Highlands	Clays, sand, muscovite schist. Basement	Yield disappointing but acceptable for new Customs Post.
13	7/58	31.3.58	235	270	31	65, 93 & 215	506 p.p.m. F. 1 p.p.m.	9,965	04	East African Tobacco Company	Tumbi, Tabora, Western	Clay, sand, cement, phyllite schist	
14	8/58	5.6.58	308	1,800	10	23	510 p.p.m. F. 1 p.p.m.	20,643	71	Native Authority	Kyela, Rungwe, Southern Highlands	Sandy clays, Waterworn sands and gravels. Quaternary	See also BH 13/58.
15	9/58	17.6.58	150	550	12	15, 54 to 76	1,460 p.p.m. F. 7 p.p.m.	14,296	47	Native Authority	Ibadakule School, Shinyanga	Cement, sand, gravels, granite	Fluoride content deemed too high for School supply.
16	10/58	6.9.58	600	60	208	230	1,320 p.p.m. F. 1.5 p.p.m.	31,984	31	Native Authority	Pandambili, Mpwapwa, Central	Clay, sand, marl, hornblende gneiss. Basement	Abandoned at 600' due to inadequate yield.
17	11/58	31.7.58	135	Nil	—	—	—	11,705	15	Native Authority	Tumuli, Kiomboi, Iramba, Central	Clay, unweathered granite	Abandoned at 135' due to hard granite. No water.
18	12/58	17.6.58	200	2,400	7	16	680 p.p.m. F. 8 p.p.m.	20,366	38	Government	Sanya Juu, Moshi	Tuff, agglomerate. Tertiary. Recent volcanics	Fluoride content too high for Minor Settlement.
19	13/58	21.6.58	75	1,800	20	25	120 p.p.m. F. 1 p.p.m.	10,262	62	Native Authority	Kyela, Rungwe, Southern Highlands	Sandy clay, Waterworn sands and gravels. Quaternary	See also B.H. 8/58.

APPENDIX II—(contd.)
DETAILS OF BOREHOLES DRILLED DURING 1958

Location No. Map II	Bore-hole No.	Date completed	Depth in feet	Yield per hour in gallons	Static Water Level in feet	Depth at which water was struck in feet	Total Solids	Total Cost		Applicant	Locality and Province	Formation	Remarks
								Shs.	Cts.				
20	14/58	—	—	—	—	—	—	—	—	Public Works Department	Kizumbi, Shinyanga Lake	—	Drilling began in December, 1958. Not yet completed.
21	15/58	22.11.58	187	1,200	56	80	1,960 p.p.m. F. 5 p.p.m.	20,590	84 approx.	Public Works Department	Bukene, Nzega, Western	Sandy clay, dolerite intrusion	Top saline water cased off, and resultant water quality now accepted by Public Works Department.
22	16/58	15.10.58	416	750	51	53	1,230 p.p.m. F. 0.3 p.p.m.	18,224	04	Public Works Department	Tongoni, Tanga, Tanga	Clay, coral limestone, gravels, shaley limestone. Tertiary	For School supply—nearby to B.H. 3/57.
23	17/58	9.10.58	202	12	33	82	—	23,887	14	Government (Masai Re-Settlement Scheme)	Kakessio N.W. Masailand, Northern	Granite/gneiss. Basement	Abandoned. Yield negligible. See B.H. 23/58.
24	18/58	2.10.58	200	Nil	—	—	—	7,238	09	Native Authority	Tumul, Iramba, Central	Clay, sandy clay, andalusite schist. (Nyanzian?) granite	Abandoned—no water.
25	19/58	25.10.58	100	50	32.5	40, 46-50, 59	8,060 p.p.m. F. 7 p.p.m.	3,988	74	Veterinary Department	Kindai, Singida, Central	Sandy clay, sand, acid granite	Abandoned—water saline and yield low. See B.H. 26/58.
	20/58	—	—	—	—	—	—	—	—	Public Works Department	Kimamba, Kilosa, Eastern	—	Postponed. Bore-hole to be drilled in 1959.
26	21/58	26.11.58	145	1,800	79	90	2,980 p.p.m. F. 24 p.p.m.	7,728	47	Government (Masai Re-Settlement Scheme)	Lemuta N. Masailand, Northern	Sandy clay (ashes), sand, gravel mica schist, gneiss. Basement overlain by Tertiary Recent Volcanics	Region of high Fluoride content

APPENDIX II—(contd.)
 DETAILS OF BOREHOLES DRILLED DURING 1958

Location No. Map II	Borehole No.	Date completed	Depth in feet	Yield per hour in gallons	Static Water Level in feet	Depth at which water was struck in feet	Total Solids	Total Cost		Applicant	Locality and Province	Formation	Remarks
								Shs.	Cts.				
27	22/58	26.11.58	350	1,800	104	178. 340-350	4,330 p.p.m. F. 15 p.p.m.	25,879	52 approx.	Government (Masai Re-Settlement Scheme)	Njureta, N. Masailand. Northern	Sandy clay (ashes), biotite schist, gneiss. Basement overlain by Tertiary-Recent volcanics	Dissolved solids high but water potable. Fluoride also high.
28	23/58	16.11.58	375	600	50	30, 105-300	2,200 p.p.m. F. 8 p.p.m.	13,366	53 approx.	Government (Masai Re-Settlement Scheme)	Kakessio, N.W. Masailand. Northern	Clay, conglomerate, hornblende gneiss, biotite schist. Basement	Successful borehole at second attempt. See B.H. 17/58.
29	24/58	—	464	—	—	—	—	9,880	76 approx.	Government (Masai Re-Settlement Scheme)	Oi Karien, N. Masailand. Northern	Ashes/tuffs. Tertiary-Recent Volcanics	To be abandoned. 6" casing being extracted.
30	25/58	12.12.58	203	—	—	—	—	5,234	77	Government (Masai Re-Settlement Scheme)	Angata Kiti N. Masailand. Northern	Ashes/tuffs, clays, sand. Tertiary-Recent volcanics	Abandoned. Drilling water lost in coarse basaltic sand. Borehole off vertical.
31	20/58	17.11.58	150	1,440	30	65	1,640 p.p.m. F. 2 p.p.m.	9,520	25	Veterinary Department	Kindai, Singida, Central	Cemented sands and gravels, decomposed granite	Successful. Second attempt at Kindai. See Borehole 19/58.
32	27/58	27.11.58	106	1,400	15	33	1,430 p.p.m. F. 4 p.p.m.	7,347	94	Veterinary Department	Ikungi, Singida, Central	Clay, sandy clay. Decomposed granite	For Stock Route supply.
33	28/58	—	150	900	—	—	—	—	—	Veterinary Department	Mkwesi, Manyoni, Central	Sandy clay, fine sands, and silts	Impossible exclude fine sand and silt. B.H. to be abandoned.
34	29/58	20.12.58	315	—	—	—	—	4,243	49 approx.	Government (Masai Re-Settlement Scheme)	Ngeju Seki N. Masailand. Northern	Ashes/tuffs. Tertiary-Recent Volcanics	Abandoned—no water.
35	29A/58	—	—	—	—	—	—	—	—	Government (Masai Re-Settlement Scheme)	Ngeju Seki N. Masailand. Northern	—	Second attempt near quartzite outcrop, started late December, 1958.

APPENDIX II—(contd.)
DETAILS OF BOREHOLES DRILLED DURING 1958

Location No. Map II	Bore-hole No.	Date completed	Depth in feet	Yield per hour in gallons	Static Water Level in feet	Depth at which water was struck in feet	Total Solids	Total Cost Shs. Cts.	Applicant	Locality and Province	Formation	Remarks
36	15/50	23.8.58	318	2,880	3.75	—	—	6,726 69 approx.	Government (Handeni Outstation Water Supply)	Nderema (Chanika) Handeni, Tanga	—	Cleaning and pump-testing of existing Veterinary Department Borehole.
37	3/57	6.9.58	304	1,375	49.5	—	—	686 12	Public Works Department	Mgwisha Tanga, Tanga	—	Pump-testing only
38	12/48	22.11.58	203	1,250	73	—	580 p.p.m. F. I p.p.m.	1,164 38	Veterinary Department	Makatupora, Dodoma, Central	—	Cleaning and pump-testing only.
39	B.H. ex O.F.C.	5.12.58	402	1,100	357.5	—	736 p.p.m. F. I p.p.m.	Costing by M. E.	Native Authority	Hogoro, N. Kongwa, Central	—	Cleaning and pump-testing only.

APPENDIX III
DETAILED WORK—GAUGING STATIONS

Station No.	Type of Gauge	River	Position on River		Date reading started	Recorded Minimum Flow to date Cusecs	Maximum Flow to date Cusecs
			Latitude	Longitude			
NORTHERN PROVINCE							
1 D 7	S.G. 0-10 ft.	Pangani	3° 48' S	37° 28' E	1.7.57	Check Station	
1 D 8	S.G. 0-10 ft.	Pangani	3° 48' S	37° 28' E	1.7.57	600	4,920
1 D 9	S.G. 0-10 ft.	Pangani	3° 48' S	37° 28' E	1.7.57	Check Station	
1 DC 1	S.G. 0-10 ft.	Ruvu	3° 33' S	37° 29' E	19.8.52	138	1,876
1 DC 2	S.G. 0-10 ft.	Ruvu	3° 31' S	37° 34' E	11.7.52	76	440
1 DC 3	S.G. 0-5 ft.	Rau	3° 30' S	37° 27' E	28.1.55	5	87
1 DC 5	S.G. 0-10 ft.	Rau	3° 21' S	37° 21' E	1.10.52	1-5	1,000
1 DC 6	S.G. 0-10 ft.	Mue	3° 29' S	37° 28' E	17.6.52	108	470
1 DC 7	S.G. 0-10 ft.	Mue	3° 02' S	37° 31' E	28.12.53	Dry	Insufficient Data
1 DC 8	S.G. 0-10 ft.	Nanga	3° 22' S	37° 25' E	1.6.56	Dry	Being Rated
1 DC 9	S.G. 0-5 ft.	Sholo	3° 23' S	37° 26' E	1.4.54	Dry	Being Rated
1 DC 10	S.G. 0-10 ft.	Uchira	3° 24' S	37° 30' E	14.4.54	Dry	Being Rated
1 DC 11	S.G. 0-10 ft.	Himo	3° 23' S	37° 33' E	20.11.52	Trace	2,870
1 DC 12	S.G. 0-5 ft.	Ivonokwa	3° 25' S	37° 41' E	25.8.52	Being Rated	
1 DC 13	S.G. 0-5 ft.	Njoro Tatu	3° 25' S	37° 41' E	25.8.52	3	226
1 DC 14	S.G. 0-5 ft.	Njoro Mbili	3° 25' S	37° 41' E	25.8.52	Insufficient Data	
1 DC 15	S.G. 0-5 ft.	Njoro Sayai	3° 25' S	37° 41' E	25.8.52	35	215
1 DC 15A	S.G. 0-5 ft.	Taveta Canal	3° 14' S	37° 48' E	1.6.54	Dry	90
1 DC 16	S.G. (Kenya Station)	Lake Chala	3° 18' 45" S	37° 41' 30" E	19.12.47	Lake Levels	
1 DC 17A	S.G. (Kenya Station)	Lumi	3° 24' S	37° 41' E	1.6.54	—	—
1 DC 18	S.G. (Kenya Station)	Lake Jipe	3° 32' 30" S	37° 45' 30" E	3.2.54	Lake Levels	
1 DC 30	S.G. 0-5 ft.	Soko	3° 30' S	37° 30' E	18.10.54	Insufficient Data	
1 DC 32	S.G. 0-10 ft.	Ruvu	3° 32' S	37° 34' E	16.7.55	Check Station	
1 DC 33	S.G. 0-5 ft.	Miwaleni Springs	3° 25' 00" S	37° 27' 30" E	16.1.58	108	340
1 DC 34	V-Notch	Hweni	3° 45' S	37° 42' E	3.7.54	Dry	2
1 DC 35	S.G. 0-5 ft.	Njoro Juu			Oct. 1958	New Station	
1 DD 1	Recorder	Kikuletwa	3° 30' 30" S	37° 25' 20" E	1.5.52	Insufficient Data	
1 DD 2	Recorder	Kikuletwa	3° 30' S	37° 17' E	3.3.53	Dry	1,522
1 DD 3	S.G. 0-20 ft.	Karanga	3° 18' 00" S	37° 18' 00" E	1.2.53	4	2,420

APPENDIX III—(contd.)
DETAILED WORK—GAUGING STATIONS

E=Estimated

Station No.	Type of Gauge	River	Position on River		Date reading started	Recorded Minimum Flow to date Cusecs	Maximum Flow to date Cusecs
			Latitude	Longitude			
NORTHERN PROVINCE (contd.)							
1 DD 4	Recorder ...	Weru Weru ...	3° 27' S	37° 18' E	13.10.52	72	5,523
1 DD 4B	S.G. 0-5 ft. ...	T.P. Co. Old Canal ...	3° 30' 00" S	37° 17' 30" E	25.9.55	0-4	225
1 DD 4C	Recorder ...	T.P. Co. New Canal ...	3° 27' S	37° 18' E	11.12.55	Dry	66
1 DD 4D	S.G. ...	Weru Weru ...	3° 28' 00" S	37° 17' 00" E	18.3.57	Shifting Control	
1 DD 5A	S.G. 0-5 ft. ...	Weru Weru ...	3° 20' S	37° 16' E	12.11.57	0-40	280
1 DD 6	S.G. 10-25 ft. ...	Weru Weru ...	3° 11' S	37° 15' E	12.3.53	Insufficient Data	
1 DD 7	S.G. 10-15 ft. ...	Nsere ...	3° 19' S	37° 15' E	11.2.53	0-7	643
1 DD 8	S.G. 10-15 ft. ...	Kikafu ...	3° 19' S	37° 13' E	1.12.52	7	16,000 E
1 DD 9	S.G. 10-20 ft. ...	Kware ...	3° 20' S	37° 10' E	11.11.52	Dry	666
1 DD 10	S.G. 0-10 ft. ...	Kware ...	3° 17' S	37° 09' E	24.2.53	Unable to Rate	
1 DD 12	S.G. 5-15 ft. ...	Sanya ...	3° 20' S	37° 07' E	1.10.52	Insufficient Data	
1 DD 13	S.G. 5-20 ft. ...	Sanya ...	3° 11' 20" S	37° 04' 20" E	1.1.53	Trace	228
1 DD 14	S.G. 0-5 ft. ...	Fuka ...	3° 12' S	37° 06' E	24.2.53	Dry	Unable to Rate
1 DD 15	S.G. 5-20 ft. ...	Lawati ...	3° 14' S	37° 07' E	1.1.53	0-3	356
1 DD 16	S.G. 5-10 ft. ...	Rundugai ...	3° 26' S	37° 16' E	31.11.53	0-5	Insufficient Data
1 DD 18	S.G. 0-5 ft. ...	Kikuletwa ...	3° 35' S	36° 57' E	16.11.56	49	3,462
1 DD 20	S.G. 0-5 ft. ...	Kikuletwa ...	3° 22' 30" S	36° 45' 30" E	1.12.53	Unable to Rate	
1 DD 22	S.G. 0-5 ft. ...	Mlala ...	3° 23' 30" S	36° 49' E	4.3.54	Unable to Rate	
1 DD 23	S.G. 5-10 ft. ...	Mlala ...	3° 22' 30" S	36° 47' 30" E	1.12.53	Unable to Rate	
1 DD 24	S.G. 0-5 ft. ...	Tengeru ...	3° 30' S	36° 49' 30" E	1.12.53	Insufficient Data	
1 DD 26	S.G. 0-5 ft. ...	Usa ...	3° 26' S	36° 51' E	1.4.54	Unable to Rate	
1 DD 27	S.G. 0-5 ft. ...	Usa ...	3° 24' S	36° 51' 30" E	1.12.53	Unable to Rate	
1 DD 28	S.G. 0-5 ft. ...	Maji Ya Chai ...	3° 22' 30" S	36° 52' 30" E	1.12.53	Unable to Rate	
1 DD 30	S.G. 0-5 ft. ...	Nduramanga ...	3° 22' 30" S	36° 51' 10" E	1.5.58	(Station re-opened)	Unable to Rate
1 DD 31	S.G. 0-10 ft. ...	Magdarisho ...	3° 22' 20" S	36° 51' 10" E	1.9.58	(Station re-opened)	

APPENDIX III—(contd.)
DETAILED WORK—GAUGING STATIONS

E=Estimated

Station No.	Type of Gauge	River	Position on River		Date reading started	Recorded Minimum Flow to date Cusecs	Maximum Flow to date Cusecs	
			Latitude	Longitude				
NORTHERN PROVINCE (contd.)								
1 DD 32	S.G. 0-5 ft.	...	Kigeri Kubwa	...	3° 22' 30" S	36° 50' E	1.12.53	Unable to Rate (Station reopened) Unable to Rate Insufficient Data New Station New Station New Station Unable to Rate Lake Levels New Station Unable to Rate Unable to Rate 0.25
1 DD 34	S.G. 0-5 ft.	...	Kigeri Kidogo	...	3° 22' 30" S	36° 51' 30" E	1.10.58	
1 DD 35	S.G. 0-5 ft.	...	Usa	...	3° 22' 30" S	36° 51' 15" E	1.3.54	
1 DD 38	S.G. 0-5 ft.	...	Gararagua	...	3° 04' S	37° 04' E	3.4.55	
1 DD 39	S.G. 0-5 ft.	...	Kikuletwa	...	3° 26' 20" S	36° 51' E	3.3.58	
1 DD 40	S.G. 0-5 ft.	...	Usa River Springs	...			24.2.58	
1 DD 41	S.G. 0-5 ft.	...	Maji Ya Chai	...	3° 18' S	36° 52' 06" E	14.3.58	
1 DE 1	S.G. 0-5 ft.	...	Burka	...	3° 25' 30" S	36° 41' 30" E	4.3.54	
1 DE 7	S.G. 0-5 ft.	...	Lake Daluti	...	3° 23' S	36° 47' E	16.10.56	
1 DE 8	S.G. 0-5 ft.	...	Ngare Olmotonyi	...	3° 17' 30" S	36° 39' 15" E	14.5.58	
2 C 2	S.G. 0-5 ft.	...	Ngare Nanyuki	...	3° 03' 15" S	36° 53' 15" E	23.7.55	
2 C 6	S.G. 0-10 ft.	...	Ngare Nairobi North	...	3° 01' S	37° 04' E	15.9.52	
2 C 7	S.G. 10-20 ft.	...	Ngare Nairobi South	...	3° 02' S	37° 03' E	25.2.54	
EASTERN PROVINCE								
1 G 1	S.G. 0-20 ft. Cableway	...	Wami	...	6° 26' S	37° 32' E	14.11.53	Unable to Rate Unable to Rate 1 E 1,303 E Water Levels only Water Levels only Unable to Rate New Station New Station New Station Insufficient Data
1 G 2	S.G. 0-15 ft.	...	Wami	...	6° 14' S	38° 24' E	9.6.54	
1 G 3	S.G. 0-20 ft.	...	Ilonga	...	6° 44' S	37° 04' E	10.9.54	
1 G 4	S.G. 0-20 ft.	...	Mkundi	...	6° 24' S	37° 19' E	23.3.55	
1 G 5	S.G. 0-15 ft.	...	Tami	...	6° 32' 30" S	37° 12' E	14.10.55	
1 G 6	S.G. 0-15 ft.	...	Kisangata	...	6° 37' S	37° 11' E	13.10.55	
1 G 7	S.G. 0-5 ft.	...	Kidete	...			1.5.58	
1 G 8	S.G. 0-5 ft.	...	Rudewa	...			22.7.58	
1 G 9	S.G. 0-15 ft.	...	Mkundi	...	6° 15' S	37° 20' E	13.11.58	
1 G 10	S.G. 0-15 ft.	...	Mkundi	...	6° 15' S	37° 20' E	14.11.58	
1 GB 1	S.G. 0-15 ft.	...	Diwale	...	6° 10' S	37° 37' E	27.8.53	

APPENDIX III—(contd.)
DETAILED WORK—GAUGING STATIONS

Station No.	Type of Gauge	River	Position on River		Date reading started	Recorded Minimum Flow to date Cusecs	Maximum Flow to date Cusecs
			Latitude	Longitude			
EASTERN PROVINCE (contd.)							
1 GB 2	S.G. 0-5 ft. ...	Mkindu	6° 15' S	37° 33' E	28.8.53	11	1,180
1 GB 3	Cipoletti Weir 0-1 ft. S.G. 0-5 ft. ...	Chazi	6° 12' S	37° 34' E	9.8.54	Date being re-assessed	
1 GB 4	S.G. 0-5 ft. ...	Mtowamawe	6° 16' S	37° 35' E	1.12.55	Water Levels only	
1 GD 1	S.G. 0-10 ft. ...	Myombo	6° 55' S	37° 04' E	11.11.51	Unable to Rate	
1 GD 2	S.G. 0-15 ft. ...	Mkondoa	6° 50' S	37° 00' E	13.3.52	Unable to Rate	
1 GD 5	S.G. 0-15 ft. ...	Mkombola	6° 31' S	36° 50' E	13.9.52	6	Above curve
1 GD 6	S.G. 0-10 ft. ...	Myombo	7° 04' S	36° 53' E	9.7.54	Unable to Rate	
1 GD 7	S.G. 0-10 ft. ...	Mkondoa	6° 00' S	36° 10' E	22.12.53	Unable to Rate	
1 GD 8	S.G. 0-10 ft. ...	Lumuma	6° 50' S	36° 38' 30" E	1.1.55	Unable to Rate	
1 H 2	S.G. 0-20 ft. ...	Ruvu	6° 48' S	38° 43' E	1.8.50	208	Above curve
1 H 3	S.G. 0-20 ft. ...	Ruvu	7° 16' S	38° 18' E	1.8.51	30	14,000
1 H 4	Cableway S.G. 0-20 ft. ...	Ruvu	7° 03' S	37° 58' E	28.6.50	102	Above curve
1 H 5	Recorder Cableway S.G. 0-15 ft. ...	Ruvu	7° 01' S	37° 48' E	8.10.52	59	Above curve
1 H 6	S.G. 0-15 ft. ...	Mbiki	6° 36' 26" S	38° 36' 11" E	16.5.58	New Station	
1 H 7	S.G. 0-10 ft. ...	Msua	6° 45' 49" S	38° 35' 34" E	26.5.58	New Station	
1 H 8	Recorder	Ruvu	6° 41' 20" S	38° 41' 55" E	11.12.58	New Station	
1 HA 1	S.G. 0-15 ft. ...	Ngerengere	7° 02' S	38° 22' E	22.8.50	Dry	
1 HA 2	S.G. 0-15 ft. ...	Ngerengere	6° 46' S	38° 08' E	1.1.51	Dry	
1 HA 3	S.G. 0-15 ft. ...	Ngerengere	6° 45' S	37° 48' E	23.8.50	6-6	1,215
1 HA 4	Cableway S.G. 0-14 ft. ...	Ngerengere	6° 46' S	37° 42' E	25.3.53	Unable to Rate	
1 HA 5	S.G. 0-15 ft. ...	Ngerengere	6° 44' S	38° 06' E	13.11.53	Insufficient Data	
1 HA 6	S.G. 0-15 ft. ...	Ngerengere	6° 46' 34" S	37° 39' 26" E	1.9.50	7	1,425
1 HA 7	Compound Weir 0-3-5 ft. S.G. 0-20 ft. ...	Mlali	6° 58' S	37° 32' E	13.9.53	Data being re-assessed	

APPENDIX III—(contd.)
DETAILED WORK—GAUGING STATIONS

Station No.	Type of Gauge	River	Position on River		Date reading started	Recorded Minimum Flow to date Cusecs	Maximum Flow to date Cusecs
			Latitude	Longitude			
EASTERN PROVINCE (contd.)							
1 HA 8	Cipoletti Weir 0-1.5 ft. S.G. 0-15 ft. ...	Morogoro	6°50' 55" S	37° 40' 18" E	27.3.54	Data being re-assessed	
1 HA 9	Cipoletti Weir 0-1.5 ft. S.G. 0-10 ft. ...	Ngerengere	6° 54' S	37° 35' E	25.3.54	Data being re-assessed	
1 HA 10	V-Notch S.G. 0-10 ft.	Mgera	6° 56' S	37° 34' E	21.3.54	Data being re-assessed	
1 HA 11	S.G. 0-10 ft. ...	Mlali	6° 56' 20" S	37° 31' 40" E	1.4.54	Water Levels only	
1 HB 1	S.G. 0-15 ft. Cableway ...	Mgeta	7° 28' S	37° 42' E	7.10.50	Insufficient Data	
1 HB 2	S.G. 0-10 ft. ...	Mgeta	7° 02' 14" S	37° 34' 10" E	1.6.54	Insufficient Data	
1 HB 3	S.G. 0-10 ft. ...	Mgeta	7° 01' 52" S	37° 37' 25" E	30.5.54	Insufficient Data	
1 HB 4	Cipoletti Weir 0-2 ft. S.G. 0-5 ft. ...	Mwarazi	7° 01' S	37° 38' E	12.8.54	Being re-assessed	
1 HC 1	S.G. 0-5 ft. ...	Mtombozi	7° 07' S	37° 46' E	2.9.53	Insufficient Data	
1 HC 2	S.G. 0-25 ft. Cableway ...	Mvuha... ..	7° 12' 10" S	37° 50' E	18.3.54	3-5	Above curve
1 HC 3	S.G. 0-15 ft. ...	Msonge	7° 06' 37" S	37° 52' 18" E	5.3.54	Insufficient Data	
1 J 2	S.G. 0-10 ft. ...	Sinza	6° 47' 16" S	39° 12' 26" E	10.1.57	Water Levels only	
1 J 3	S.G. 0-10 ft. ...	Mulalakuwa	6° 46' S	39° 12' E	6.12.57	Water Levels only	
1 J 4	S.G. 0-5 ft. ...	Togeta	6° 42' S	39° 12' E	10.12.57	Water Levels only	
CENTRAL PROVINCE							
1 GD 9	S.G. 0-15 ft. ...	Ikowa Dam	6° 9' 50" S	36° 14' 15" E	14.3.57	Dam Spillway	
1 GD 10	Recorder S.G. 0-15 ft.	Little Kinyasungwe	6° 03' 45" S	36° 09' 40" E	1.11.56	Water Levels only	
1 GD 12	S.G. 0-10 ft. ...	Kinyasungwe	5° 47' 30" S	36° 08' 05" E	12.7.56	Water Levels only	

APPENDIX III—(contd.)
DETAILED WORK—GAUGING STATIONS

Station No.	Type of Gauge	River	Position on River		Date reading started	Recorded Minimum Flow to date Cusecs	Maximum Flow to date Cusecs
			Latitude	Longitude			
CENTRAL PROVINCE (contd.)							
1 GD 14	S.G. 0-15 ft.	Kinyasungwe	6° 26' 45" S	36° 25' 40" E	29.11.56	Water Levels only	
1 GD 15	S.G. (0-10 ft.)	Chibukwe	5° 53' 20" S	35° 57' 20" E	20.11.56	Water Levels only	
1 GD 16	S.G. (0-10 ft.)	Kinyasungwe	6° 16' S	36° 18' E	24.2.58	Water Levels only	
2 H 6	S.G. 0-15 ft.	Filimo	4° 30' 10" S	36° 08' 00" E	14.10.56	Water Levels only	
2 K 6	S.G. 0-10 ft.	Kironda	4° 23' 00" S	34° 19' 00" E	2.11.56	Water Levels only	
2 O 1	S.G. 0-20 ft.	Bubu	5° 18' 50" S	35° 35' 00" E	16.12.56	Water Levels only	
2 O 3	S.G. 0-20 ft.	Maduma	4° 57' 50" S	34° 52' 40" E	1.1.56	Water Levels only	
2 O 4	S.G. 0-10 ft.	Bubu	5° 57' 00" S	35° 18' 00" E	28.12.56	Water Levels only	
2 O 5	S.G. 0-10 ft.	Bubu	4° 49' 10" S	35° 42' 07" E	3.3.56	Water Levels only	
2 O 6	S.G. 0-15 ft.	Bubu	5° 25' 20" S	35° 29' 00" E	6.11.56	Water Levels only	
2 O 7	S.G. 0-15 ft.	Bubu	5° 12' 35" S	35° 44' 50" E	1.12.56	Water Levels only	
2 O 10	S.G. 0-5 ft.	Mkondoa	4° 54' 00" S	35° 48' 15" E	16.12.56	Water Levels only	
2 O 11	S.G. 0-5 ft.	Karoma	5° 07' 15" S	35° 50' 15" E	16.11.56	Water Levels only	
2 O 12	S.G. 0-10 ft.	Mponde	5° 53' 00" S	35° 05' 05" E	16.11.56	Water Levels only	
2 O 14	(S.G. 0-10 ft.)	Mkinki			1.1.58	Water Levels only	
2 P 1	S.G. 0-5 ft.	Kolo	4° 44' 00" S	35° 51' 00" E	1.12.56	Water Levels only	
2 P 2	S.G. 0-10 ft.	Filimo	4° 35' S	36° 00' E	1.11.57	Water Levels only	
2 P 4	S.G. 0-5 ft.	Filimo	4° 40' S	36° 00' E	16.1.58	Water Levels only	
2 P 5	S.G. 0-5 ft.	Hururu	4° 40' S	36° 00' E	16.1.58	Water Levels only	
SOUTHERN HIGHLANDS PROVINCE							
1 R 1	S.G. 20-25 ft.	Lake Nyasa	9° 34' 42" S	35° 47' 50" E	2.5.53	Lake Levels	
1 R 2	S.G. 0-10 ft.	Lake Nyasa (Nyasaland Stn.)	11° 17' S	34° 49' E	6.6.53	Lake Levels	
1 R 3	S.G. 0-10 ft.	Lake Nyasa (Nyasaland Stn.)	10° 28' 45" S	34° 34' 40" E	11.10.54	Lake Levels	
1 RB 1	S.G. 0-15 ft.	Ruhuhu	10° 32' S	34° 36' E	21.9.53	1,488	18,217
1 RC 1	S.G. 0-10 ft.	Lufirio	9° 28' 40" S	33° 54' 25" E	28.5.54	Unable to rate	

APPENDIX III—(contd.)

DETAILED WORK—GAUGING STATIONS

E=Estimated

Station No.	Type of Gauge	River	Position on River		Date reading started	Recorded Minimum Flow to date Cusecs	Maximum Flow to date Cusecs
			Latitude	Longitude			
SOUTHERN HIGHLANDS PROVINCE (contd.)							
1 RC 2	S.T. 0-15 ft. ...	Kiwira... ..	9° 37' 30" S	33° 52' 25" E	20.8.54	Unable to rate	
1 RC 3	S.G. 0-15 ft. ...	Mbaka	9° 32' 30" S	33° 56' E	24.10.56	90	4,500
1 RC 4	S.G. 0-10 ft. Joint Stn. Balfour Beatty	Kiwira... ..	9° 13' 55" S	33° 31' 06" E	1.12.56	205	2,480
1 RC 5	S.G. 0-5 ft. ...	Kiwira... ..	9° 10' 10" S	33° 32' 00" E	2.3.57	7	59
1 RC 6	S.T. 0-5 ft. ...	Isaka	9° 08' 05" S	33° 33' 40" E	2.3.57	Being rated	
1 RD 1	Recorder Joint Stn. with Nyasaland	Songwe	9° 44' S	33° 55' E	28.7.53	102	7,930
3 A 2	S.G. 0-5 ft. ...	Songwe	8° 59' 25" S	33° 13' 20" E	12.10.55	Being rated	
3 A 3	S.G. 0-5 ft. Joint Stn. Balfour Beatty	Songwe	9° 01' 00" S	33° 13' 30" E	10.7.56	13	1,120
3 A 4	S.G. 0-10 ft. ...	Mbalizi	8° 06' 00" S	33° 31' 30" E	10.10.55	Being re-rated	
3 A 5	S.G. 0-10 ft. ...	Nzovwe	8° 51' 00" S	33° 20' 00" E	17.10.55	Being re-rated	
3 A 6	S.G. 0-5 ft. ...	Nzovwe	8° 55' 40" S	33° 25' 00" E	12.9.55	17.7	110
3 A 7	S.G. 0-5 ft. ...	Ruanda	8° 58' 15" S	33° 06' 20" E	30.9.55	—	600
3 A 8	S.G. 0-10 ft. ...	Myovisi	8° 58' 50" S	33° 03' 50" E	30.9.55	3	545
3 A 9	S.G. 0-10 ft. ...	Mlovi	8° 56' 30" S	33° 03' 20" E	23.11.55	1.9	800
3 A 10	S.G. 0-5 ft. ...	Imeta	8° 54' S	33° 26' E	6.7.56	2 E	Above curve
3 A 11	S.G. 0-5 ft. Joint Stn. Balfour Beatty	Nzovwe	8° 56' S	33° 17' 30" E	19.7.56	Balfour Beatty	
3 A 12	Cipoletti Weir 0-2 ft.	Mbeya Town Springs	8° 53' 15" S	33° 25' 50" E	1.9.56	0.86	45
3 A 14	S.G. 5-10 ft. ...	Mlovo	9° 12' S	33° 05' E	1.9.56	Unable to rate	
3 A 15	S.G. 0-5 ft. ...	Lupa	8° 27' S	33° 20' E	17.7.56	Dry	10,000 E
3 B 1	S.G. 3-10 ft. ...	Lake Rukwa	7° 50' S	31° 55' E	14.11.57	Lake Levels	
3 B 8	S.G. 0-10 ft. ...	Mpemba	9° 14' 15" S	32° 50' 07" E	1.9.56	Dry	Above curve
3 B 9	S.G. 5-10 ft. ...	Pande (Ihanda)	9° 09' 52" S	32° 52' 22" E	1.9.56	Unable to rate	
3 B 10	S.G. 5-10 ft. ...	Hanseketwa	9° 08' 34" S	32° 53' 01" E	1.9.56	0.20	22
3 B 11	S.G. 0-10 ft. ...	Kamera	9° 07' 52" S	32° 53' 50" E	1.9.56	0.04	55 E
3 B 12	S.G. 0-5 ft. ...	Vwawa	9° 08' 05" S	32° 55' 19" E	1.9.56	0.12	155 E

APPENDIX III—(contd.)
DETAILED WORK—GAUGING STATIONS

Station No.	Type of Gauge	River	Position on River		Date reading started	Recorded Minimum Flow to date Cusecs	Maximum Flow to date Cusecs
			Latitude	Longitude			
SOUTHERN HIGHLANDS PROVINCE (contd.)							
3 C 1	S.G. 0-15 ft.	Msaidia	7° 07' S	31° 10' E	13.11.57	Water Levels only	
3 C 2	S.G. 0-10 ft.	Kavu	7° 40' S	31° 50' E	11.11.57	Water Levels only	
3 C 3	S.G. 0-10 ft.	Katuma River Dam	6° 57' S	31° 15' E	12.11.57	Dam Levels	
3 C 4	S.G. 0-5 ft.	Milala Dam	6° 23' 00" S	31° 05' 00" E	9.1.57	Spillway Levels	
3 E 1	S.G. 0-10 ft.	Luika	8° 24' S	32° 55' E	23.2.57	Dry	Above curve
4/1	S.G. 0-8 ft.	Lake Tanganyika (Northern Rhodesia Station)	8° 47' S	31° 06' E	1.4.57	Lake Levels	
WESTERN PROVINCE							
4 A 1	S.G.	Malagarasi	5° 07' S	30° 22' E	3.5.57	Water Levels only	
4 A 2	S.G. 0-5 ft.	Igigwa Dam	5° 19' 00" S	32° 51' 00" E	13.12.57	Water Levels only	
4 B 1	S.G. 0-5 ft.	Luiche	4° 55' S	29° 40' E	1.10.52	—	1,439
4 B 3	S.G. 0-10 ft.	Luiche	4° 55' S	29° 40' E	12.1.54	Water Levels only	
4 B 4	S.G. 0-5 ft.	Luiche	4° 55' S	29° 40' E	18.1.54	Water Levels only	
4 B 5	S.G. 0-5 ft.	Luiche	4° 55' S	29° 40' E	29.12.53	Water Levels only	
4 B 6	S.G. 0-5 ft.	Luiche	4° 55' S	29° 40' E	1.1.54	Water Levels only	
4 B 7	S.G. 0-10 ft.	Luiche	4° 55' S	29° 40' E	29.12.53	Water Levels only	
4 B 8	S.G. 0-10 ft.	Luiche	4° 55' S	29° 40' E	2.1.54	Water Levels only	
4 BA 2	S.G. 0-10 ft.	Mungonya	4° 55' S	29° 40' E	11.1.54	Water Levels only	
4 BB 1	S.G. 0-10 ft.	Kaseke	4° 55' S	29° 40' E	11.1.54	Water Levels only	
LAKE PROVINCE							
5 A 1	S.G. 0-20 ft.	Ngono	1° 17' S	31° 37' E	9.11.57	Water Levels only	
5 A 2	S.G. 0-20 ft.	Ngono	1° 34' S	31° 41' E	1.1.58	New Station	
5 A 3	S.G. 0-20 ft.	Ngono	1° 27' S	31° 40' E	20.1.58	New Station	

APPENDIX III—(contd.)
DETAILED WORK—GAUGING STATIONS

Station No.	Type of Gauge	River	Position on River		Date reading started	Recorded Minimum Flow to date Cusecs	Maximum Flow to date Cusecs
			Latitude	Longitude			
LAKE PROVINCE (contd.)							
5 A 4	S.G. 0-5 ft.	Mpanyura	2° 41' S	30° 49' E	8.4.58	New Station	
5 A 5	S.G. 0-5 ft.	Kanoni	1° 18' S	31° 48' E	30.4.58	New Station	
5 C 1	Recorder	Lake Victoria...	2° 31' S	32° 53' 35" E	12.6.54	Lake Levels	
TANGA PROVINCE							
1 B 1	S.G. 0-10 ft.	Umba	4° 30' 40" S	38° 24' 48" E	9.7.52	8	1,030
1 B 3	S.G. 0-10 ft.	Umba	4° 31' 20" S	38° 22' 30" E	19.7.58	New Station	
1 C 1	S.G. 0-12 ft.	Sigi	5° 00' 55" S	38° 47' 40" E	1.5.57	Insufficient Data	
1 D 2	S.G. 0-15 ft.	Pangani	5° 08' 20" S	38° 23' 20" E	10.7.51	440	2,230
1 D 3	S.G. 0-10 ft.	Pangani	4° 56' 20" S	38° 03' 50" E	12.3.52	350	1,876
1 D 4	S.G. 0-5 ft.	Lembeni	3° 48' 00" S	37° 37' 30" E	29.1.53	Water Levels only	
1 D 5	S.G. 0-5 ft.	Mnyusi	5° 19' 40" S	38° 19' 15" E	5.4.55	Water Levels only	
1 D 10	S.G. 0-10 ft.	Pangani	4° 39' S	38° 02' E	15.4.58	New Station	
1 D 11	S.G.	Pangani			7.5.58	New Station	
1 DA 1	S.G. 0-15 ft.	Luengera	5° 08' 10" S	38° 30' 35" E	12.5.53	Dry	974
1 DA 2	S.G. 0-10 ft.	Luengera	5° 02' 10" S	38° 32' 50" E	12.7.51	Trace	590
1 DA 3	S.G. 0-10 ft.	Luengera	4° 52' 40" S	38° 34' 20" E	11.7.51	1	522
1 DA 4	S.G. 0-10 ft.	Bululu	5° 02' 00" S	38° 32' 00" E	11.7.51	—	873
1 DA 5	S.G. 0-5 ft.	Mashewa Swamp	4° 48' 10" S	38° 38' 00" E	6.4.55	Water Levels only	
1 DA 7	S.G. 0-5 ft.	Mangole	4° 45' 20" S	38° 38' 45" E	5.7.56	Unable to Rate	
1 DB 1	S.G. 0-15 ft.	Mkomasi	4° 30' 15" S	38° 05' 00" E	19.4.52	—	2,707
1 DB 2	S.G. 0-10 ft.	Sesseni	4° 28' 00" S	38° 05' 00" E	4.2.52	Unable to Rate	
1 DB 3	S.G. 0-10 ft.	Ndungu	4° 22' 00" S	38° 03' 00" E	12.7.52	Unable to Rate	
1 DB 4	S.G. 0-10 ft.	Gonja South	4° 17' 20" S	38° 02' 40" E	12.7.52	Trace	519
1 DB 5	S.G. 0-10 ft.	Gonja North	4° 17' 20" S	38° 02' 40" E	12.7.52	Unable to Rate	
1 DB 6	S.G. 0-10 ft.	Mombo	4° 53' 20" S	38° 15' 17" E	31.7.51	Unable to Rate	
1 DB 7	S.G. 0-10 ft.	Mkusi	4° 45' 50" S	38° 20' 30" E	12.4.52	Unable to Rate	
1 DB 8	S.G. 10-15 ft.	Mkomazi	4° 25' 00" S	38° 05' 07" E	(21.6.58, Kalimawe Dam)	Water Levels only	

APPENDIX III—(contd.)
DETAILED WORK—GAUGING STATIONS

Station No.	Type of Gauge	River	Position on River		Date reading started	Recorded Minimum Flow to date Cusecs	Maximum Flow to date Cusecs
			Latitude	Longitude			
TANGA PROVINCE (contd.)							
1 DB 9	S.G. 0-5 ft. ...	Mkomazi	4° 25' 00" S	38° 05' 07" E	(16.10.58 Kalimawe Dam)	Water Levels only	
1 DB 10	S.G. 0-5 ft. ...	Kiswani	4° 07' 00" S	38° 00' 00" E	4.7.56	Water Levels only	
1 DB 11	S.G. 0-5 ft. ...	Mombo	4° 53' 00" S	38° 22' 00" E	1.10.57	Water Levels only	
1 DB 12A	S.G. 0-10 ft. ...	Mkomazi	4° 44' 12" S	38° 07' 10" E	2.10.58	New Station	
1 DB 13	S.G. 0-5 ft. ...	Kalimawe Dam	4° 25' 00" S	38° 05' 07" E	1.8.58	New Station (Spillway)	
1 DC 20	S.G. 0-5 ft. ...	Hweni	3° 45' 10" S	37° 42' 40" E	10.4.53	Dry	Being Rated
1 DC 22	V-Notch	Vureni	3° 44' 15" S	37° 42' 50" E	10.4.53	Dry	Being Rated
1 DC 24	V-Notch	Butu	3° 40' S	37° 42' E	10.4.53	Dry	Unable to Rate
RUFJI BASIN SURVEY							
1 K 1	S.G. Griffin Gauge...	Rufiji	8° 02' S	39° 02' E	17.10.54	Being Rated	
1 K 2	S.G. G.G., G.W.O., and Met. Station	Rufiji	7° 52' S	38° 23' E	1.12.54	Being Rated	
1 K 3	S.G., G.G., Recorder, Cableway & Met. Stn.	Rufiji	7° 48' S	37° 55' E	19.10.54	2,900	251,200
1 K 4	S.G.	Rufiji	8° 00' S	38° 45' E	19.12.53	Water Levels only	
1 K 5	S.G.	Rufiji	7° 49' S	38° 19' E	11.1.44	Water Levels only	
1 K 6	S.G.	Rufiji	7° 52' S	37° 54' E	16.4.57	Water Levels only	
1 KA 1	S.G. 0-10 ft. ...	Yovi	7° 12' S	36° 45' E	10.11.51	31	417
1 KA 2	S.G. 0-15 ft. ...	Little Ruaha	7° 47' S	35° 41' E	9.11.54	13	5,110
1 KA 3	S.G. Recorder Cable- way and Met. Station	Great Ruaha	7° 42' S	37° 00' E	28.10.54	454	35,800
1 KA 4	S.G. Cableway R.G.	Great Ruaha	7° 27' S	36° 32' E	7.11.54	Being rated	
1 KA 5	S.G. Recorder R.G.	Great Ruaha	7° 05' S	35° 56' E	11.11.54	37	31,069
1 KA 7	S.G. Recorder ...	Chimala	8° 50' S	34° 02' E	1.11.54	18	3,100

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APPENDIX III—(contd.)
DETAILED WORK—GAUGING STATIONS

Station No.	Type of Gauge	River	Position on River		Date reading started	Recorded Minimum Flow to date Cusecs	Maximum Flow to date Cusecs
			Latitude	Longitude			
RUFJI BASIN SURVEY (contd.)							
1 KA 8	S.G. Recorder ...	Great Ruaha ...	8° 50' S	34° 06' E	1.11.54	51	5,280
1 KA 9	S.G. Recorder R.G.	Kimani ...	8° 50' S	34° 10' E	1.11.54	14	3,960
1 KA 10	S.G. Recorder ...	Mlombosi ...	8° 46' S	34° 20' E	1.11.54	Being Rated	
1 KA 11	S.G. 0-20 ft. Recorder Met. ...	Mbarali (Igawa) ...	8° 46' S	34° 23' E	1.11.54	68	9,300
1 KA 12	S.G. 0-15 ft. ...	Halali (Iyayi)...	8° 51' S	34° 34' E	1.11.54	Being Rated	
1 KA 14	S.G. 0-15 ft. ...	Lukosi (Mbuyuni) ...	7° 28' S	36° 33' E	16.11.55	Being Rated	
1 KA 15	S.G. 0-10 ft. 2 No.	Ndembera (Ilongo) ...	8° 17' S	35° 12' E	12.2.56	3.5	5,530
1 KA 16	S.G. 0-10 ft. ...	Liosi (Lunwa) (Igurusi) ...	8° 50' S	33° 52' E	4.3.56	0.7	Uncertain
1 KA 17	S.G. 0-10 ft. ...	Mambi (Kakanzi) ...	8° 48' S	33° 50' E	14.3.56	3.4	Uncertain
1 KA 18	S.G. 0-10 ft. ...	Mswiswi (G. North Road) ...	8° 52' S	33° 45' E	14.4.56	5.7	Uncertain
1 KA 19	S.G. 0-15 ft. G.W.O. Soil Therm and Met. Stn. ...	Mbarali (Trial Farm) ...	8° 37' S	34° 22' E	1.9.56	98	6,000
1 KA 20	S.G. 0-20 ft. ...	Little Ruaha (Tosamanga) ...	7° 52' S	35° 26' E	10.9.56	86	5,440
1 KA 21	S.G. 0-20 ft. ...	Little Ruaha (Ibimbu) ...	7° 53' S	35° 47' E	10.9.56	Not computed	
1 KA 22	S.G. 0-5 ft. ...	Mtitu ...	8° 02' S	35° 46' E	10.9.56	Not computed	
1 KA 23	S.G. 0-10 ft. ...	Hukuni ...	8° 51' S	34° 34' E	1.12.56	Being rated	
1 KA 25	S.G. 0-10 ft. ...	Mhulwa ...	6° 59' S	36° 15' 45" E	1.1.57	Being rated	
1 KA 26	S.G. 0-25 ft. ...	Great Ruaha (Kisilwa) ...	7° 14' S	35° 33' E	1.11.56	Being rated	
1 KA 27	S.G. 0-20 ft. ...	Great Ruaha (Mkopole) ...	7° 58' S	34° 40' E	1.11.56	81	10,900
1 KA 28	G.G....	Great Ruaha (Utengule) ...	8° 13' S	34° 32' E	1.11.56	Griffin Gauge only	
1 KA 29	S.G. 0-20 ft. R.G. ...	Njombe (Ifumbe) ...	6° 55' 40" S	35° 05' E	9.2.57	Dry	8,425
1 KA 30	S.G. 0-20 ft. R.G. ...	Kisigo (Mlazo) ...	7° 03' S	35° 42' E	10.12.56	Water Levels only	
1 KA 31	S.G. 0-20 ft. ...	Little Ruaha (Mawande) ...	7° 30' S	35° 30' E	1.11.56	136	5,740
1 KA 32	S.G. 0-15 ft. ...	Little Ruaha (S. High.) ...	8° 20' S	35° 20' E	26.6.57	Being rated	
1 KA 33	S.G. 0-10 ft. 2 No.	Ndembera (Madibera) ...	8° 13' S	34° 47' E	1.12.56	Being rated	
1 KA 34	S.G. 0-15 ft. ...	Halali (Tunduma) ...	8° 33' S	34° 22' E	27.1.57	Being rated	
1 KA 36	S.G. 0-15 ft. ...	Halali (Majojolo) ...	8° 38' S	34° 28' E	27.1.58	Being rated	
1 KA 37	S.G. 0-15 ft. ...	Lukosi (Mtandika) ...	7° 34' S	36° 26' E	14.4.57	Being rated	

APPENDIX III—(contd.)
DETAILED WORK—GAUGING STATIONS

Station No.	Type of Gauge	River	Position on River		Date reading started	Recorded Minimum Flow to date Cusecs	Maximum Flow to date Cusecs
			Latitude	Longitude			
RUFJI BASIN SURVEY (contd.)							
1 KA 38	S.G. 0-15 ft. ...	Yovi (G. Ruaha Confl.) ...	7° 33' S	36° 46' E	1.1.57	Being rated	
1 KA 39	S.G. 0-15 ft. ...	Little Ruaha (Iwawa) ...	8° 3' S	35° 4' 30" E	12.4.57	Not computed	
1 KA 40	S.G. 0-5 ft. ...	Chimala (Chosi Furrow) ...	8° 52' S	34° 2' E	15.10.57	Not computed	
1 KA 41	S.G. 0-15 ft. Met. Stn. ...	Kisigo (Ilangali) ...	6° 52' S	35° 06' E	15.11.57	—	2,910
1 KA 42	S.G. 0-15 ft. ...	Kisigo (Kinunguru) ...	6° 57' S	35° 25' E	15.11.57	Being rated	
1 KA 43	S.G. 0-15 ft. 2 No. ...	Njombe ...	7° 24' S	34° 15' E	6.12.57	Being rated	
1 KA 44	S.G. 0-10 ft. ...	Bubu ...	6° 30' S	36° 00' E	1.11.57	Not rated	
1 KA 45	S.G. 0-10 ft. ...	Ipatagwa ...				New Station	Not rated
1 KA 46	S.G. 0-10 ft. ...	Halali ...				New Station	Not rated
1 KA 47	S.G. 0-10 ft. ...	Masukhunde ...	6° 20' S	35° 40' E	14.2.58	Not rated	
1 KB 1	S.G. 0-10 ft. ...	Msoiwa ...	7° 47' S	36° 59' E	1.8.55	Dry	331
1 KB 2	S.G. 0-25 ft. R.G., G.G. ...	Kilombero (Ifakara) ...	8° 09' S	36° 38' E	1.11.54	3,289	97,800
1 KB 3	S.G. 0-15 ft. Recorder Met. Station ...	Lumemo (Ifakara) ...	8° 10' S	36° 40' E	12.8.55	70	8,230
1 KB 4	S.G. 0-15 ft. ...	Kilombero (Ifwema) ...	8° 56' S	36° 00' E	2.1.55	4,210	36,250
1 KB 5	S.G. 0-15 ft. ...	Luhombero ...	9° 03' S	36° 52' E	13.1.55	Being rated	
1 KB 6	S.G. 0-20 ft. ...	Kigogo-Ruaha (Fricks Brd.)	8° 45' 30" S	35° 09' 30" E	20.2.56	77	3,570
1 KB 7	S.G. 0-10 ft. 2 No. ...	Fuagi (Idege) ...	8° 42' S	35° 12' E	24.2.56	Not computed	
1 KB 8	S.G. 0-15 ft. ...	Mpanga ...	8° 55' S	35° 43' E	10.12.56	Being rated	
1 KB 9	Slope Gauges 2 No. ...	Mnyera ...	9° 01' S	35° 31' E	8.12.56	1,143	8,170
1 KB 10	S.G. 0-20 ft. ...	Ruhudji ...	8° 57' S	35° 59' E	12.12.56	1,233	15,230
1 KB 11	S.G. 0-15 ft. ...	Sofi ...	8° 51' S	36° 15' E	17.12.56	Being rated	
1 KB 12	S.G. 2. 30-25 ft. R.G. ...	Mchilipa ...	8° 40' S	36° 20' E	19.12.56	Being rated	
1 KB 13	S.G. 0-18 ft. ...	Lumemo (T.A.C. Farm) ...	8° 10' S	36° 40' E	14.3.57	Water Levels only	
1 KB 14	S.G. 0-20 ft. ...	Lumemo (Kibaoni) ...	8° 08' S	36° 40' E	1.12.57	70	8,230
1 KB 15	S.G. 0-20 ft. ...	Mgeta ...	8° 20' S	36° 07' E	20.11.57	Being rated	
1 KB 16	S.G. 0-15 ft. ...	Furua ...	8° 56' S	36° 05' E	25.11.57	Being rated	
1 KB 17	S.G. 0-20 ft. ...	Kilombero (Swero) ...	8° 12' S	37° 00' E	27.11.57	Being rated	
1 KB 18	S.G. ...	Ruhudji ...				New Station	Not rated

APPENDIX IV
DEPARTMENTAL TRANSPORT,
PLANT AND EARTH-MOVING EQUIPMENT

1. Petrol Vehicles	...	...	Bedford Pick-up	...	...	...	...	16
			Bedford 30 cwt....	...	...	...	...	8
			Bedford 2-3 ton	...	...	...	...	9
			Bedford 3-4 ton	...	...	...	...	8
			Bedford 5 ton	...	...	...	...	30
			Bedford 5-ton Tipper	...	...	...	...	25
			Bedford 7 ton	...	...	...	...	4
			Bedford Scammell with 8 ton Platform Trailer	...	...	...	...	8
			Ford Workshop	...	...	...	...	2
			Dodge Workshop	...	...	...	...	1
			Ford/B/Down	...	...	...	...	1
			Land Rover S.W.B.	...	...	...	...	20
			Land Rover L.W.B.	...	...	...	...	29
			Motor Cycle B.S.A. 500 c.c.	...	...	...	...	1
2. Diesel Vehicles...	...	...	Thornycroft "Nubian" 5 ton	...	...	...	...	12
			Scammell Medium Duty Tractor	...	...	...	...	1
			Bedford 2 ton	...	...	...	...	4
3. Caravans	...	...	All Types	...	...	...	...	39
4. Trailers	...	...	Low Loader 24 ton	...	...	...	...	1
			Low Loader 18 ton	...	...	...	...	1
			Low Loader 15 ton	...	...	...	...	1
			Low Loader 8 ton	...	...	...	...	2
			Water Tank 200 gallon	...	...	...	...	14
			Water Tank 800 gallon	...	...	...	...	2
			Fuel Oil Tanker 1,500 gallon	...	...	...	...	3
			Land Rover Trailers	...	...	...	...	12
			Load Carrying 4 ton	...	...	...	...	1
5. Drilling Rigs	...	...	Ruston Bucyrus 22 W	...	...	...	...	9
			Banka Drill	...	...	...	...	7
			Diamond Drill Craelius XC. 42	...	...	...	...	1
6. Tractors Wheeled	...	...	Fordson Major	...	...	...	...	1
			Latil	...	...	...	...	4
			Tournapull Model "D" Roadster	...	...	...	...	9
			Tournatractor	...	...	...	...	1
			Caterpillar D.W. 15	...	...	...	...	3
7. Tractors—Tracked	...	...	Caterpillar D.2	...	...	...	...	8
			Caterpillar D.4	...	...	...	...	21
			Caterpillar D.7	...	...	...	...	5
			International TD.18	...	...	...	...	2
8. Scrapers	...	...	La-Plante Choate, 4 cubic yard	...	...	...	...	3
			Le Tourneau, 4 cubic yard	...	...	...	...	4
			Landsborough/Findlay, 4 cubic yard...	...	...	...	...	2
			Onion 7/9 cubic yard	...	...	...	...	1
			Killefer Rotary	...	...	...	...	4
			Le Tourneau, 8-11 cubic yard...	...	...	...	...	4
			Bartles 2-3 cubic yard	...	...	...	...	5
			Bartles 4 cubic yard	...	...	...	...	3
			Le Tourneau, 7 cubic yard	...	...	...	...	9
			Caterpillar No. 40, 4 cubic yard	...	...	...	...	7
			Caterpillar No. 42S, 14/17 cubic yard	...	...	...	...	3
9. Rippers	...	...	Killefer	...	...	...	...	1
			Landsborough/Findlay	...	...	...	...	2
			Onion	...	...	...	...	1
			Blaw Knox	...	...	...	...	1
			Le Tourneau	...	...	...	...	1
			Bartles Series 20 S.H.	...	...	...	...	3

APPENDIX IV (contd.)
**DEPARTMENTAL TRANSPORT,
 PLANT AND EARTH-MOVING EQUIPMENT**

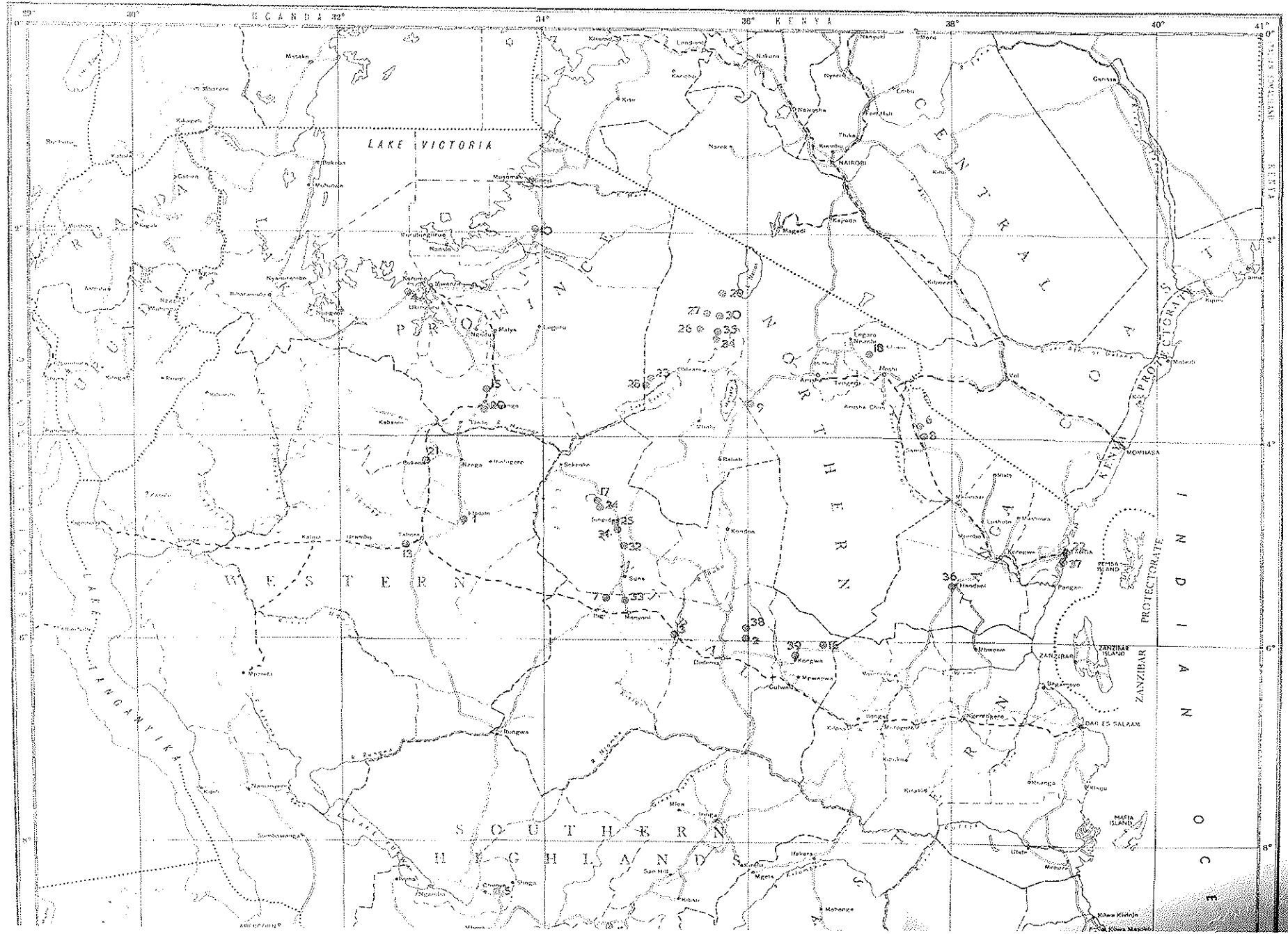
10. Tool Bars	...	...	...	Caterpillar D.2	...	...	...	...	...	1
11. Compressors	...	...	...	Holman ATH 8	...	...	...	...	...	7
				Broome and Wade SV.78	...	...	...	...	...	1
12. Rock Drills	...	...	...	Warsop	...	...	...	...	...	2
13. Winches	Pillion Double Drum with Lister Engine and Orange Peel Grab						...	1
			
14. Concrete Mixers	...	...	...	Goodwin	...	...	...	...	...	6
				Winget	...	...	...	...	...	10
				Millar	...	...	...	...	...	1
				Benford	...	...	...	...	...	1
				Parker	...	...	...	...	...	4
15. Trench Pumps	Winget—Engine Driven						...	5
				Pegson	...	...	...	...	...	13
				Broome-Wade "Air Operated"						...	1
				Dando Diaphragm						...	2
16. Rock Crushers	...	...	...	Baxter	...	...	...	...	...	1
				Pegson	...	...	...	...	...	5
17. Mobile Welding Sets	...	...	...	Quasi-Arc	...	...	...	...	...	7
18. Excavators	...	...	...	Ruston Bucyrus 10 R.B.	...	...	...	...	...	2
19. Dumpers	...	...	...	Muir Hill	...	...	...	...	...	3
20. Tile Machine	...	...	...	Pegson	...	...	...	...	...	1
21. Vibrating Pokers	...	...	...	Pegson	...	...	...	...	...	2
22. Power Mast	...	...	...	Local Built	...	...	...	...	...	2
23. Terracer	...	...	...	Terracer	...	...	...	...	...	1

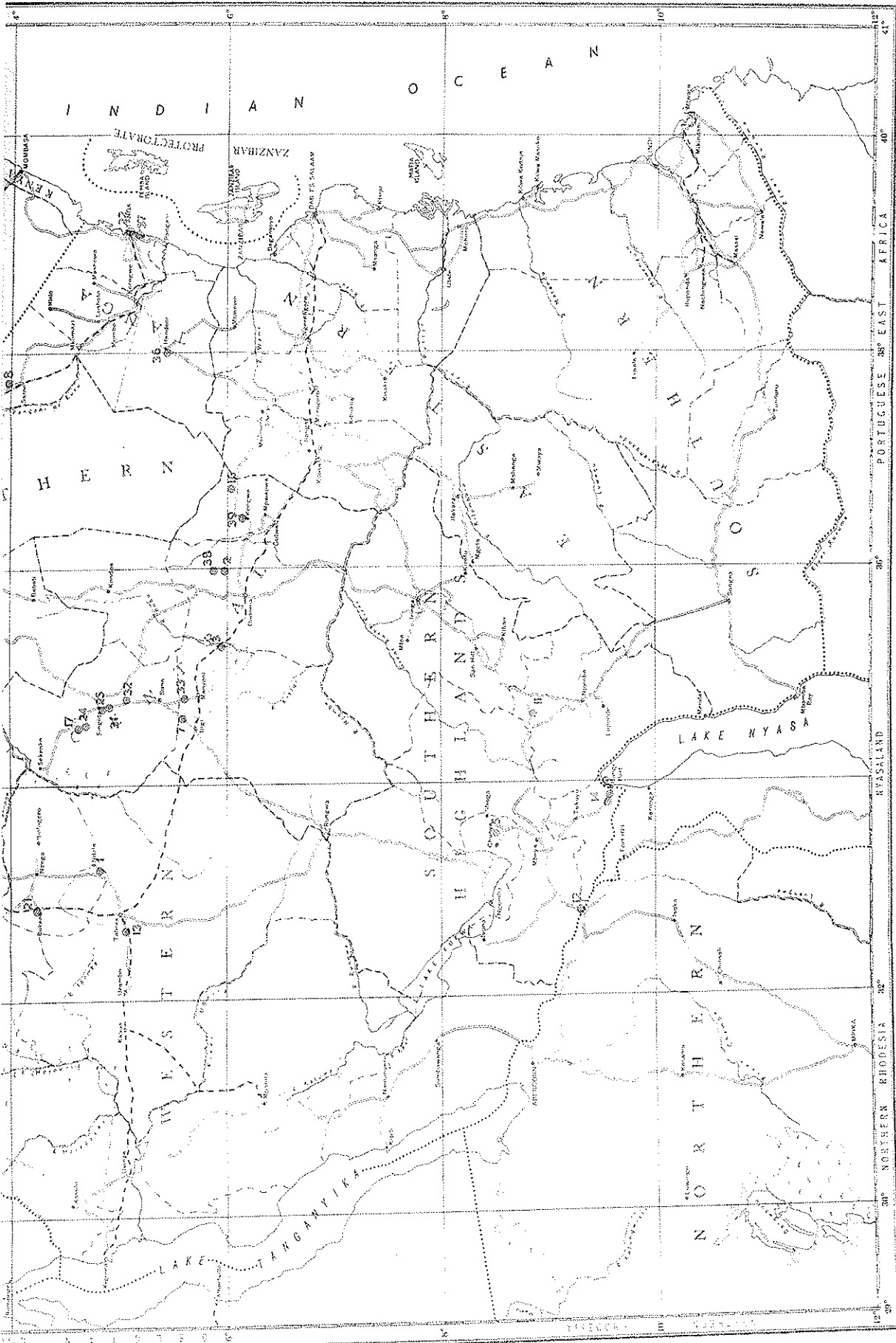
APPENDIX V
SUMMARY OF COMPLETED WATER DEVELOPMENT WORKS

Item	Description	Completed during 1958
1.	Earth dams and hafirs (20 acre/feet capacity and above)	18
2.	Total storage capacity at full supply level of Item 1 in acre/feet	42,500
3.	Gravity pipeline and pumped supplies for domestic purposes and cattle (excluding borehole and well supplies)	20
4.	Total delivery from Item 3 in thousands of gallons per day	328
5.	Boreholes successfully drilled	23
6.	Total footage of Item 5	4,850
7.	Total test yield of Item 5 in thousands of gallons per hour	29
8.	Total acreage of irrigable land opened up	300

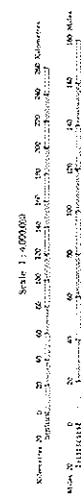
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WATER DEVELOPMENT AND IRRIGATION DEPARTMENT
 TANGANYIKA





Continental Drainage and Political Map of East Africa, 1958
 Director General, Geography, 1958



REFERENCE

- Terminal Boreholes
- Intermediate Boreholes
- Shallow Boreholes
- Wells
- Waterfalls
- Swamps
- Marshes
- Coastal Lagoons
- Coastal Lagoons
- Coastal Lagoons

250-4/59 21247
 BOREHOLES COMPLETED OR IN HAND 1958
 (APPENDIX II)