A. The Central Part of the Catchment Areas to the Atlantic

The biggest part of the Atlantic drainage area covers the river systems of the Kuiseb, Swakop, Omaruru and Ugab. These form — on account of their sandy and groundwater-bearing river-beds — the most densely populated portion of South West Africa, with the exception of Ovamboland (where 45% of the country's total population lives).

In accordance with the rainfall conditions, of this area the most densely populated portion is the highland, with an average rainfall from 300 to 500 mm; then follows the escarpment area, with an average of 50 to 100 mm; and finally the coastal Namib desert (100 to 150 km wide), with a rainfall from 0 to 50 mm.

For a detailed description of this part of the central drainage area, the part I of the present series of articles (dealing with the Swakop and Kuiseb rivers) should be consulted*.

The size of the catchment areas, lengths of the rivers, relation of the Namib area to the total catchment area, etc., are tabulated below.

The southern section of the Atlantic run-off area, reaching from the Orange river northwards to the Kuiseb delta, is covered in its entirety by big sandy dunes. Consequently the three local major rivers of this territory, viz. Koichab, Tsauchab (Sossus) and Tsondab, no longer reach the sea, as their beds are entirely covered by wind-borne sand deposits. Originating in the highlands and the escarpment, they end abruptly in vleis, viz. large, flat, dry lakes which are encircled by big dunes and bordered by scattered Acacia trees.

The central section, which is dealt with in parts I and II of the present article series, consists of the rivers Kuiseb, Swakop (with Khan), Ugab and Omaruru.

The northern section of this run-off area spreads from the Ugab to the Kunene. The rivers crossing this portion of the Namib are all episodic and the major ones bear the names Huab, Khowarib (Hoanib) and Hoarusib. Only the Kunene, forming the border, is a perennial river, with a yearly discharge capacity of about 5×10^6 m³ water. There are some more dry rivers on the Angolan side of the Namib desert.

Each of these three run-off sections covers approximately an area of 80,000 sq.km.

Supplementary diagram fig. 2 shows the size of the catchment areas of the central section.

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* Cf. Scientific Papers Namib Desert Research Station, No. 22.

** At present, all these three rivers are apparently funnel-shaped. This, however, does not preclude from forming a delta in years of big sand-bearing floods.

River	Size of the catchment area sq.km.	Total length of river km.	Size in the Namib area sq.km.	Namib area in % of the total catchment area	In the Namib area length of the river km.	Mouth
Kuiseb	16,200	440	3,350	20.5	140	Delta
Swakop with Khan	31,000	420	5,000	16.0	120	funnel** shaped
Omaruru	14,050	315	3,200	23.0	115	funnel** shaped
Ugab	15,400	486	2,000	13.0	110	funnel** shaped

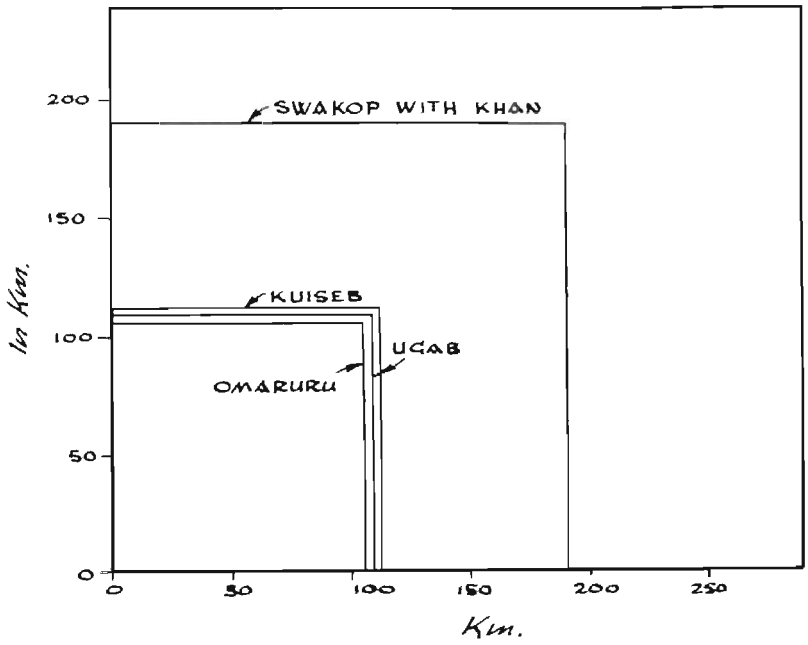
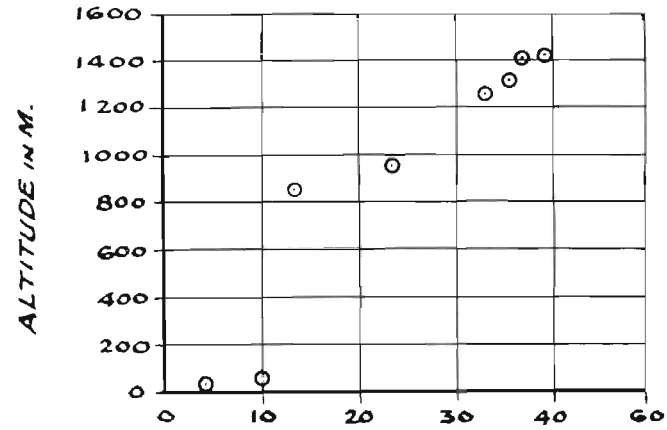


Fig. 2. Catchment areas of the cental section (about one third of the total surface area contributing to the run-off into the Atlantic, consists of the northern, central and southern run-off areas).



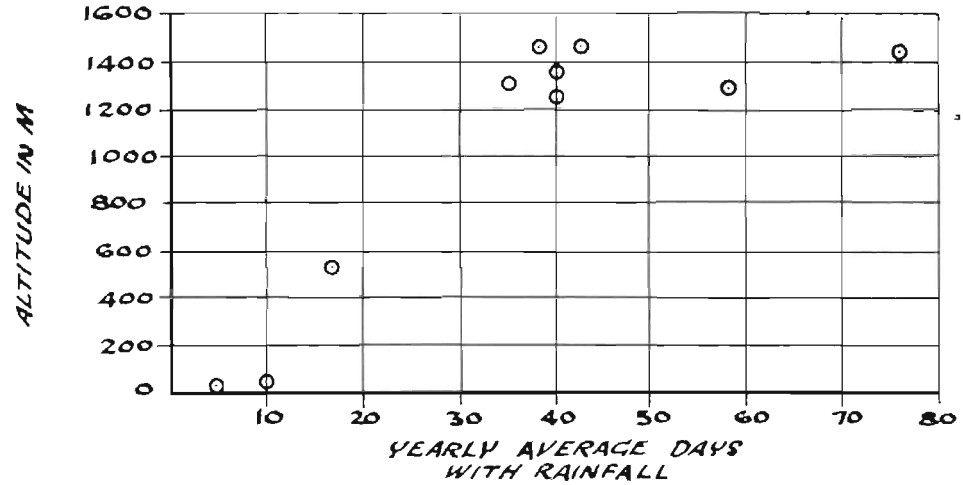


Fig. 3 Altitude of the Omaruru (above) and Ugab (below) areas and rainfall days recorded.

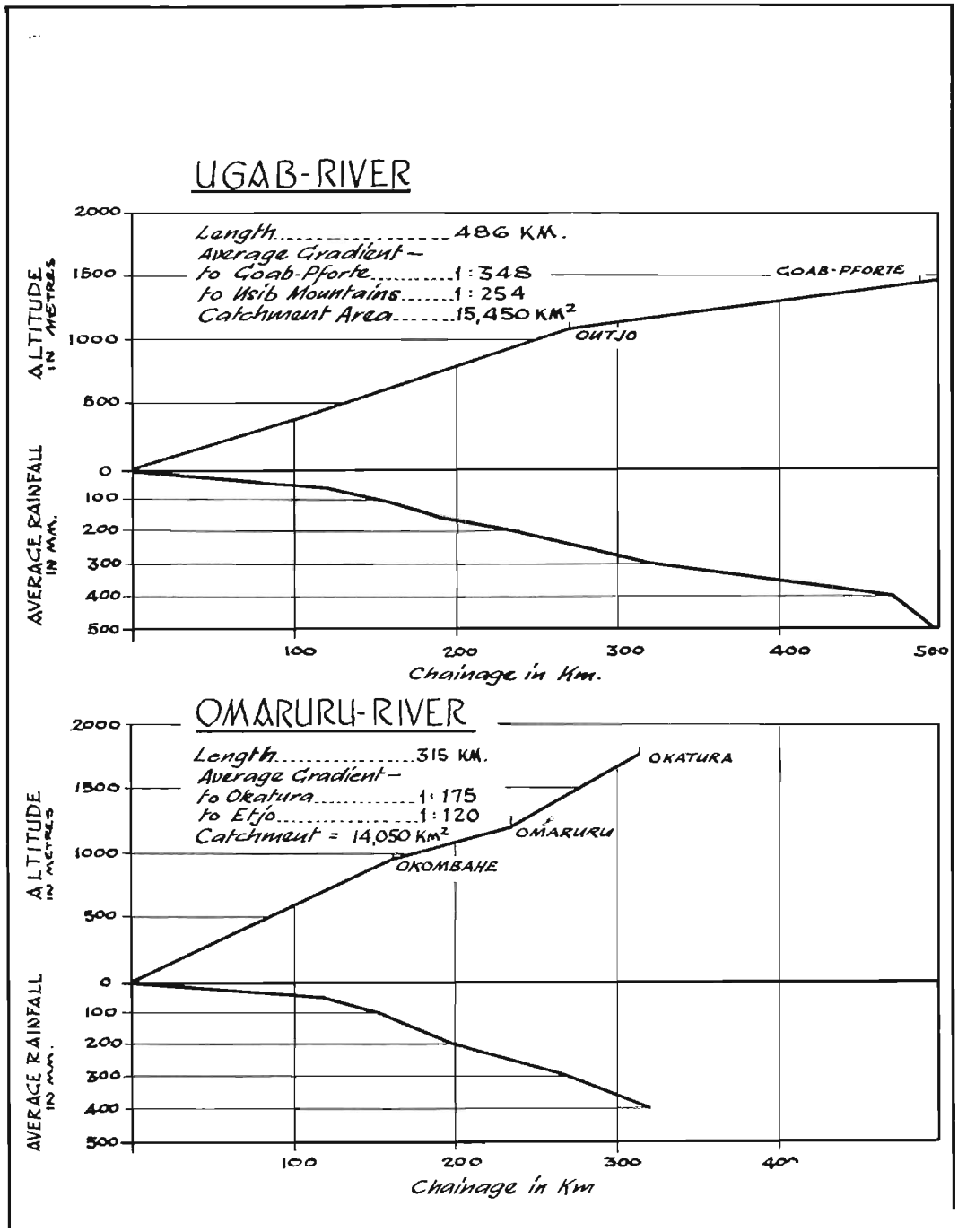


Fig. 4. Altitude of the rivers of the central section, Omaruru and Ugab, and average rainfall of the area.

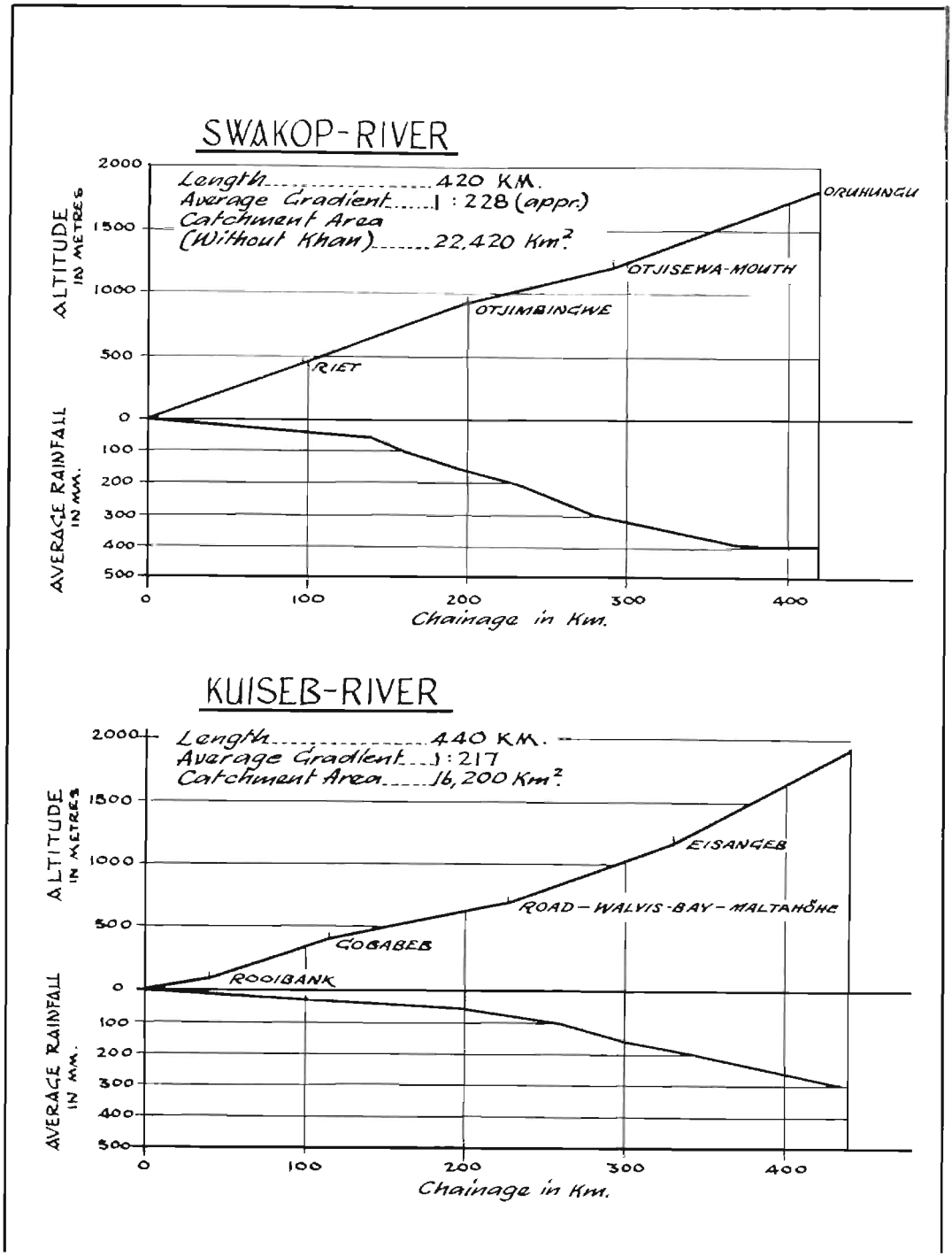


Fig. 5. Altitude of the rivers of the central section, Swakop and Kuiseb, and average rainfall of the area.

B. The Omaruru River

1. The rainfall in the catchment area.

It is generally known that the increase of the rainfall in South West Africa is from south to north and from west to east; precipitation figures therefore increase from the coast towards the highlands.

Fig. 3 shows the relation in altitude and rainfall days of the Omaruru and Ugab areas, while diagrams figs. 4 and 5 indicate the correlation in the increase of altitude and that of rainfall for both these rivers, as well as for the Swakop and Kuiseb rivers.

The following tables explain the rainfall in the river basin of the Omaruru, in relation to various localities situated on different altitudes above sea level, and the floods over a given period of years.

2. The flow of the river to the Atlantic.

The only records on the flows of the Omaruru which reached the Atlantic were given by the people who transport salt. Salt has been mined for years on the coast northwards from Swakopmund to the Ugab river mouth and has been transported along the coast by lorries to the railway station in Swakopmund. This salt transport takes place over the whole of the year and the only obstacles the drivers of these lorries meet are the rivers when carrying water in the rainy season.

Though no detailed reports are available, a certain amount of data was obtained from Mrs. Bitter, Swakopmund, from entries made on calendars. These are the following:—

1943/44 In full flood during the night of January 1st, 1944; river flowed until the 20th of January.

1944/45 Not in flood.

1945/46 River came down in full spate on December 5th, 1945, and flowed until December 13th.

1946/47 Flowing from December 19th, 1946, to December 24th, from February 5th. 1947, to February 10th, and twice in flood again after March 12th, 1947.

1947/48 Not in flood.

1948/49 Flowing from March 21st, 1949, to March 26th.

1949/50 Flowing from February 3rd, 1950, to February 9th.

1950/51 Not in flood.

1951/52 Not in flood.

1952/53 Flowing from February 22nd, 1953, to March 4th.

1953/54 Flowing from February, 16th, 1954, to March 22nd.

1954/55 Not in flood.

Observation site	Uis Mine	Okombahe	Omajette	Omaruru	Omburo South
Altitude above sea level, in m	875	945	1250	1211	1400
Average yearly rainfall, in mm	93.2	169.7	289.5	305.8	310
Periods in years	5—7	40—42	13—15	31—34	18—21
Number of days with rain	14.8	24	31.3	33.6	39.7
Rainfalls when the flow did not reach the Atlantic					
1944/45	?	—	—	145.5	—
1951/52	?	155.3	259.0	213.2	121.6
1955/56	?	230.6	281.6	316.0	454.2
1959/60	?	89.2	149.2	321.1	260.6
1963/64	?	102.5	185.7	222.2	253.7
Rainfalls when the flow reached the Atlantic					
1933/34	?	761.0	720.0	841.0	745.0
1949/50	?	663.0	392.0	245.6	—
1962/63	?	427.8	396.7	355.5	563.6

1955/56 Not in flood.
1956/57 Small streamlets on road; no break-through to the coast; river passable.
1957/58 Like 1956/57.
1958/59 Like 1956/57.
1959/60 Like 1956/57.
1960/61 River flowing a full month without interruption.
1961/62 During Christmas week flowing continuously, but river passable.
1962/63 In flood from middle of January 1963 to the end of April; river flowed in small rivulets up to May.
1963/64 Not in flood.

Diagram fig. 6 is based on the above notes.

With regard to the floods of the rainy season 1962/63, the Omaruru, after abnormally heavy rains in the Black Spitzkopjie area, came down at a width of over one mile, in several strong arms flowing for 1 to 1½ days. During three months of continuous flow, the floods varied so much that from time to time and only for some hours the river was passable on the road to Cape Cross. At a distance of about 150 km. (between Okombahe and the road crossing between Swakopmund and Cape Cross) the velocity amounted to 1.8 m/s (altogether 36 hours). This velocity figure, however, may be considered only an average, as the observations on flood took place in Okombahe and were reported to Swakopmund only for the sake of the salt transport.

Some scanty and incomplete information on earlier floods was drawn from old newspapers preserved in the Swakopmund Museum. All these notes refer to the Omaruru; the Ugab is not mentioned:—

March, 13th, 1902. — (Windhoeker Anzeiger) Omaruru flowed at Omaruru from February 21st to 27th, at Okombahe for 14 days; slight damage to gardens at Okombahe.

February 3rd, 1909. — (Deutsch Südwestafrikanischer Anzeiger) Strong rains fell south and north of Tsumeb. The same is reported from Omaruru. It was a very strong rain, like the rain in 1904, when the pasture was excellent. The Omaruru river came down in full flood; the schoolchildren were not allowed to cross the river on the small bridge leading to the school.

February 6th, 1912. — (Deutsch Südwestafrikanischer Anzeiger) Omaruru in heavy flood.

March 5th, 1912. — (Deutsch Südwestafrikanischer Anzeiger) The excessive rains of the last couple of weeks, apart from the fact that the pasture is threatened with the danger of rot, caused several upsets. As, for example, the court session had to be cancelled as the officials were cut off by the Omaruru in flood.

February 11th, 1921. — (Swakopmunder Zeitung und Handelsblatt) In Omaruru the rain was very good during the last few days, the river is flowing.

1923. — Of this year of heavy rains, no mention in the newspapers examined.

February 3rd, 1925. — (Swakopmunder Zeitung und Handelsblatt) Omaruru river in full flood since Thursday (January 29th, 1925). Gardens in the town severely damaged and much valuable garden soil washed away.

January 15th, 1931. — (Swakopmunder Zeitung und Handelsblatt) According to telephonic information, the Omaruru river came down in flood 3 to 4 m high. The river eroded back its northern bank to about 50 m; all the gardens on this side were heavily damaged and 'Ana'-trees washed out and swept away.

March 28th, 1931. — (Swakopmunder Zeitung und Handelsblatt) Omaruru flowing in full width.

February 13th, 1934. — Among other items it is reported that one of the bridges near Etiro is heavily damaged and the railway bridge at Omaruru is completely destroyed . . .

3. The mouth of the river.

A superficial observer of the mouth of the Omaruru river receives the impression that the mouth forms a funnel. Its discharge directly into the Ocean is checked by the surf, so that the flowing water of the river is deflected in southerly and northerly directions along the coast before it flows over the sand barrier of the shore into the sea (cf. map fig. 8 and diagram fig. 10).

Along these two branches of the mouth Tamarisks have sprung up and drift wood has been deposited. Future heavy floods will probably flow directly into the sea at the mouth, but as the flood decreases the action of the surf will form a new sand barrier which will force the flood water to flow in southerly and northerly directions from the mouth. In such a case the sandy barrier of the shore keeps back a large amount of flood water which forms a big pond fed also by sea waves breaking over the sandy barrier.

As with the Kuiseb river in January 1963, a flood of long duration took place in the lower Omaruru, the waves of which caused deep erosion in the river-bed, up to 6 m. in depth (cf. plate I, photo a). The sandy plateau of the steep coast is situated about 20 m. above level of the river-bed. Towards the interior, this difference in height gradually decreases, and about 6 km. inland the river-bed shows a width of about 2 km., but is only 1.5 m. deep. About 3 km. to the south of the mouth there is a valley-like indentation of the steep sandy coast line, a few hundred metres long, which, further inland, changes into a shallow channel and gradually approaches the river-bed of the Omaruru for some kilometres from the coast. In this valley there is a small swamp with rush, which feeds some shallow wells with freshwater; a few hundred metres north of this site, freshwater springs are situated directly on the beach.

In the same valley, and later also on the sandy plateau, the anglers' village Henties Bay came into

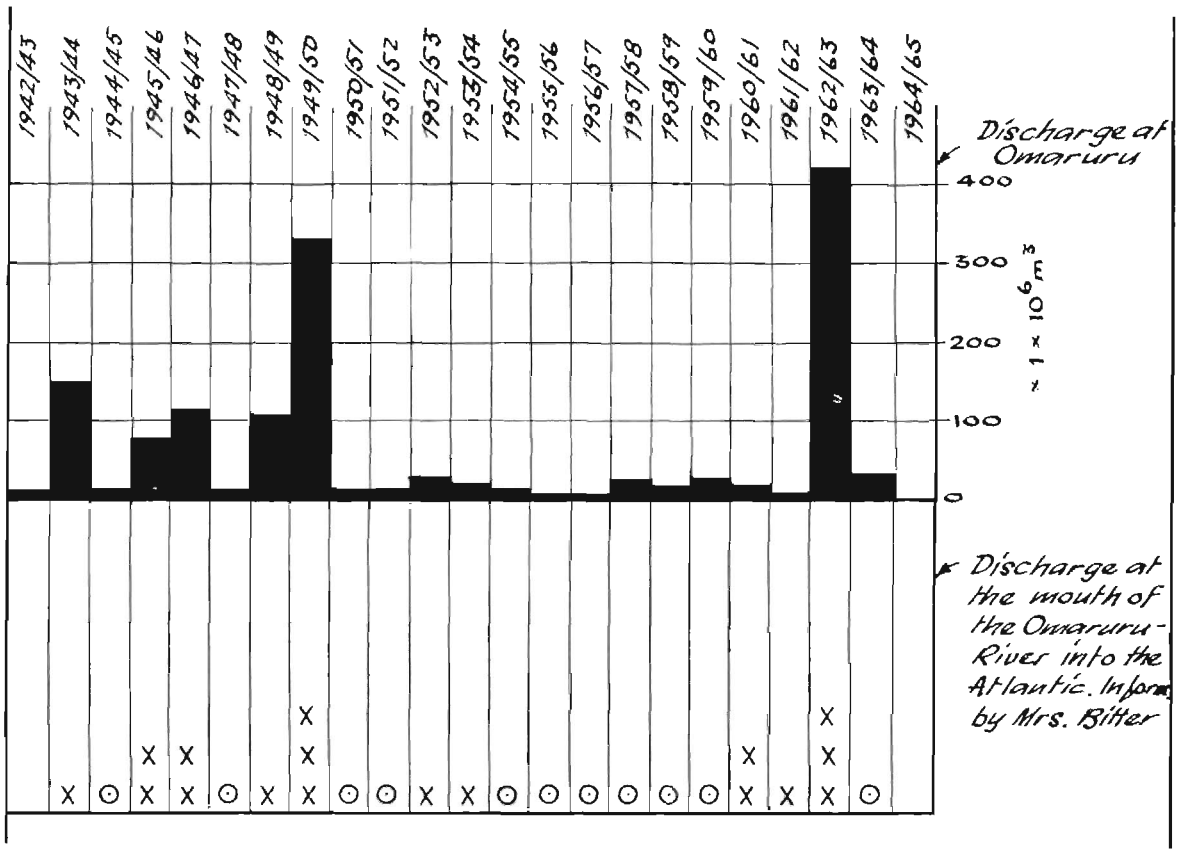


Fig. 6. Discharges of the Omaruru into the Atlantic (1942—1964).

being. At present it consists of about 80 houses, and is frequented by many holiday makers during the summer season (November to March).

In the course of the development of the water supply for this village test borings and investigations for water were undertaken by the South African Council for Scientific and Industrial Research, with the result that a second and smaller underground branch of the Omaruru river mouth was identified. This branch was gradually covered by drifting sand, with the result that, only when the bed of the main river has been raised by sand masses, can episodic floods fill the channel. The exact site of the branching off of the channel has not yet been found, but respective investigations are in progress through further test boreholes and seismic survey.

The preliminary results of these investigations can be gathered from figs. 8 and 10. The map also shows the existing bore sites as well as the test sites investigated by seismic methods; existing clay layers and gravel banks are not shown in the cross sections. The section, which shows two or more deeper channels, indicates clearly that the conclusion that there is a second mouth to the Omaruru, is justified. To test the seismic survey a borehole (close to peg no. 10) on the line B was drilled at a distance of about 3 km. from the coast on the sandy plateau and 1 km. south of the Omaruru. This showed a borehole depth of 20 m. to rock, but at a depth of 14 m. good potable water was discovered.

4. The quality of groundwater in the lower river.

The sandy river-bed of the Omaruru may be considered of good groundwater-bearing capacity. After good rainy seasons with resultant heavy floods, the sand up to the top layer is saturated with water. Here evaporation takes place to such an extent that it causes mineralisation of the water, while the deeper water-layers are of good quality because little evaporation takes place.

The attached sketch of a cross section of the river at Okombahe down to the deepest sand layer at 10 m. (see diagram fig. 11), shows the average TDS content as ± 500 p.p.m. Although the mineral content of the water rises towards the coast, it remains within the limits for potable water.

The TDS content is at Neineis about 687 at a distance of 110 km. from the mouth, at Leeuwater 1804 and 1030 at about 80 km. from the mouth (see map fig. 9).

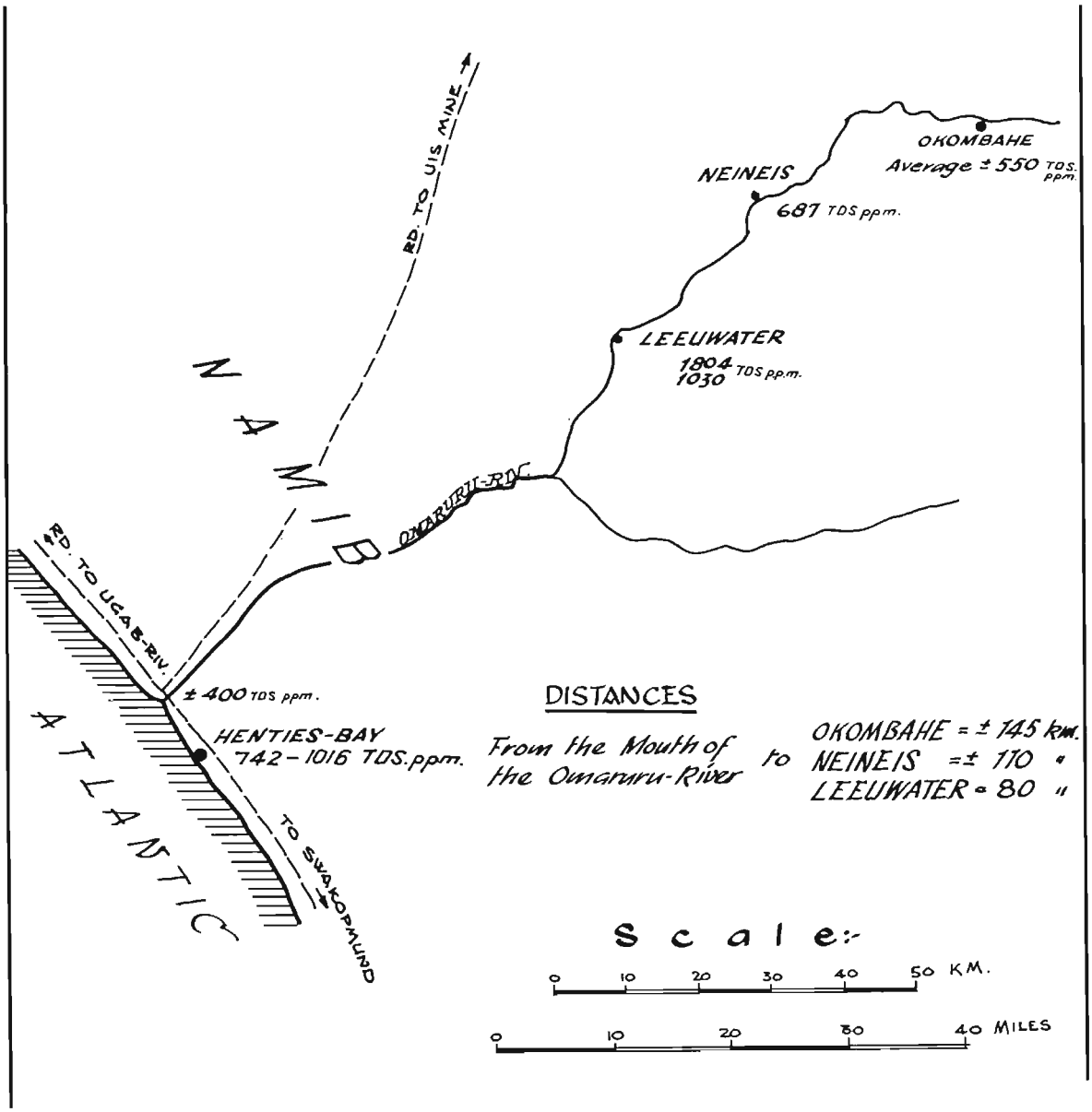


Fig. 7. Lower part of the Omaruru River, with sites where water analyses are available. (TDS. ppm. = Total dissolved solid parts per million)

For the mouth area itself refer to fig. 6. Here the quality of water is excellent. In section A 1: 374 TDS p.p.m. in the river-bed; B 2: 362 TDS p.p.m. in the river-bed; B 1: 477 TDS p.p.m. in the river-bed, B 10: 436 TDS p.p.m. on the sandy plateau; C: 349 TDS p.p.m. on the sandy plateau.

A number of boreholes drilled in the upper course of the branch to Hentjies Bay showed qualities from 1440 to 1505 TDS p.p.m. The four boreholes gave a pump capacity during 70 hours of 1990 gall/h to 5605 gall/h (9 m^3/h to 25.5 m^3/h).

In connection with the water supply development at Henties Bay, already in 1950 Dr. O. Wipplinger pointed out that sufficient and usable water may be expected in the sandy sediments of the Omaruru river. At that time the water drawn from a shallow well surrounded by rush was found to be unsuitable for human consumption; at 940 TDS p.p.m. the fluorine content was 4.5 p.p.m. It is understood, however, that since this time the water quality has been improving, according to the following data:—

1950: 940 TDS p.p.m.; Nov. 12, 1956: 1014 TDS p.p.m.; Nov. 28, 1957: 803 TDS p.p.m. at a depth of 6', and 735 p.p.m. at a depth of 12'; Jan. 23rd, 1959: 742 TDS p.p.m. (from tap of distributing pipe). No records available from 1959 to 1964.

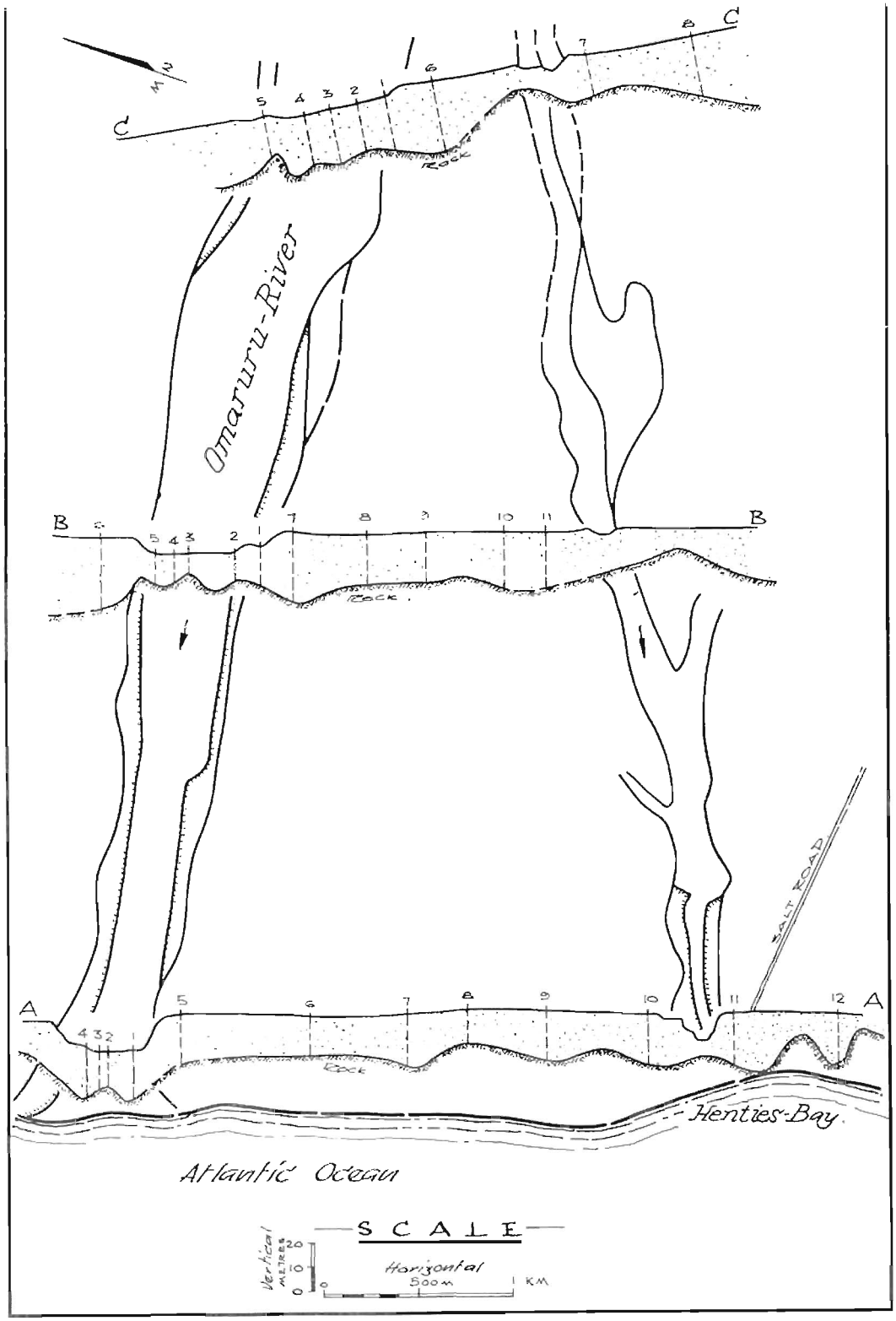


Fig. 8. Map of the delta of the Omaruru river (based on the detailed map of Progress Report No. 18 of the C.S.I.R. Regional Laboratory, South West Africa; published with permission from the Director of C.S.I.R.).

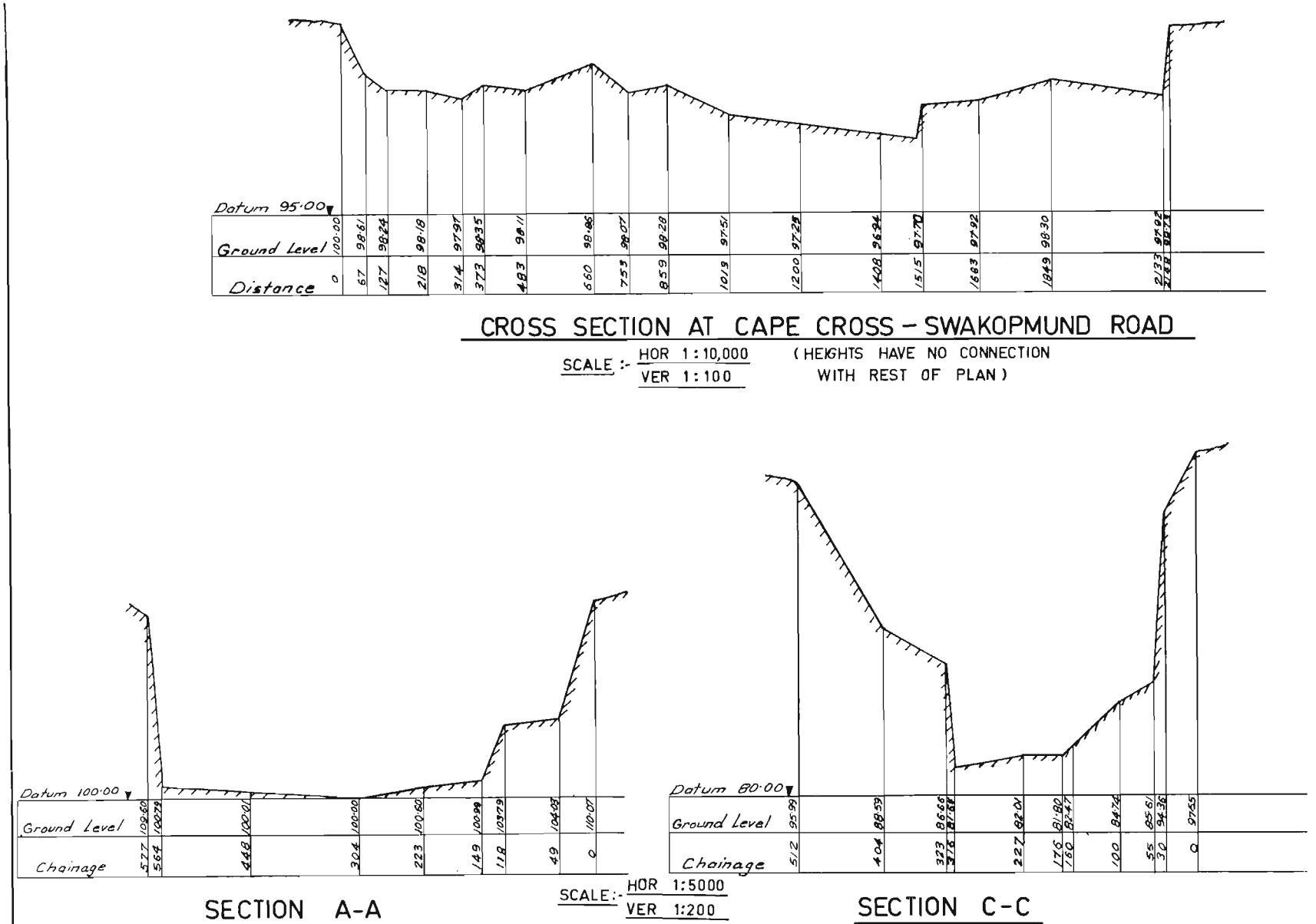
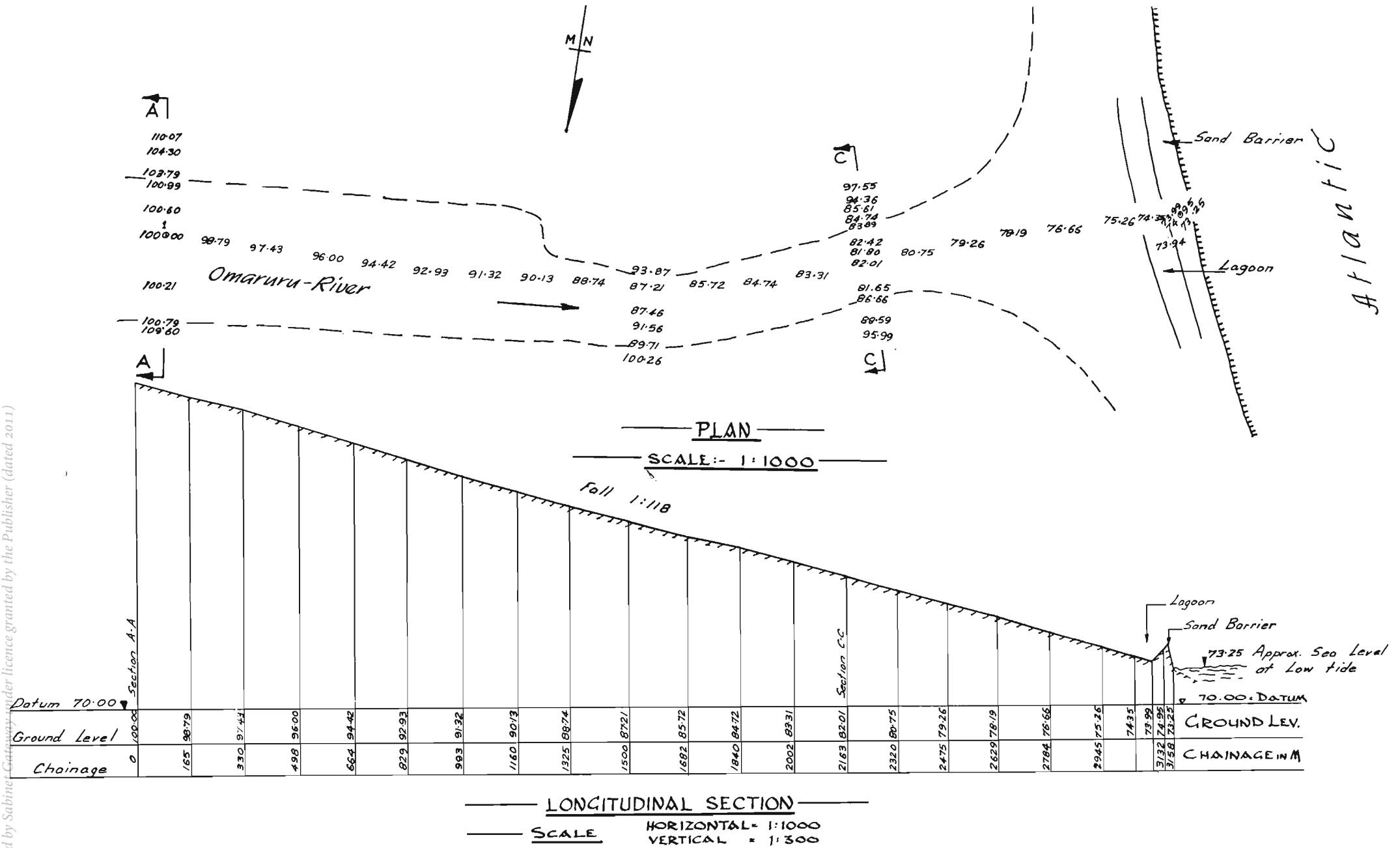


Fig. 9. Omaruru river. — Cross sections.



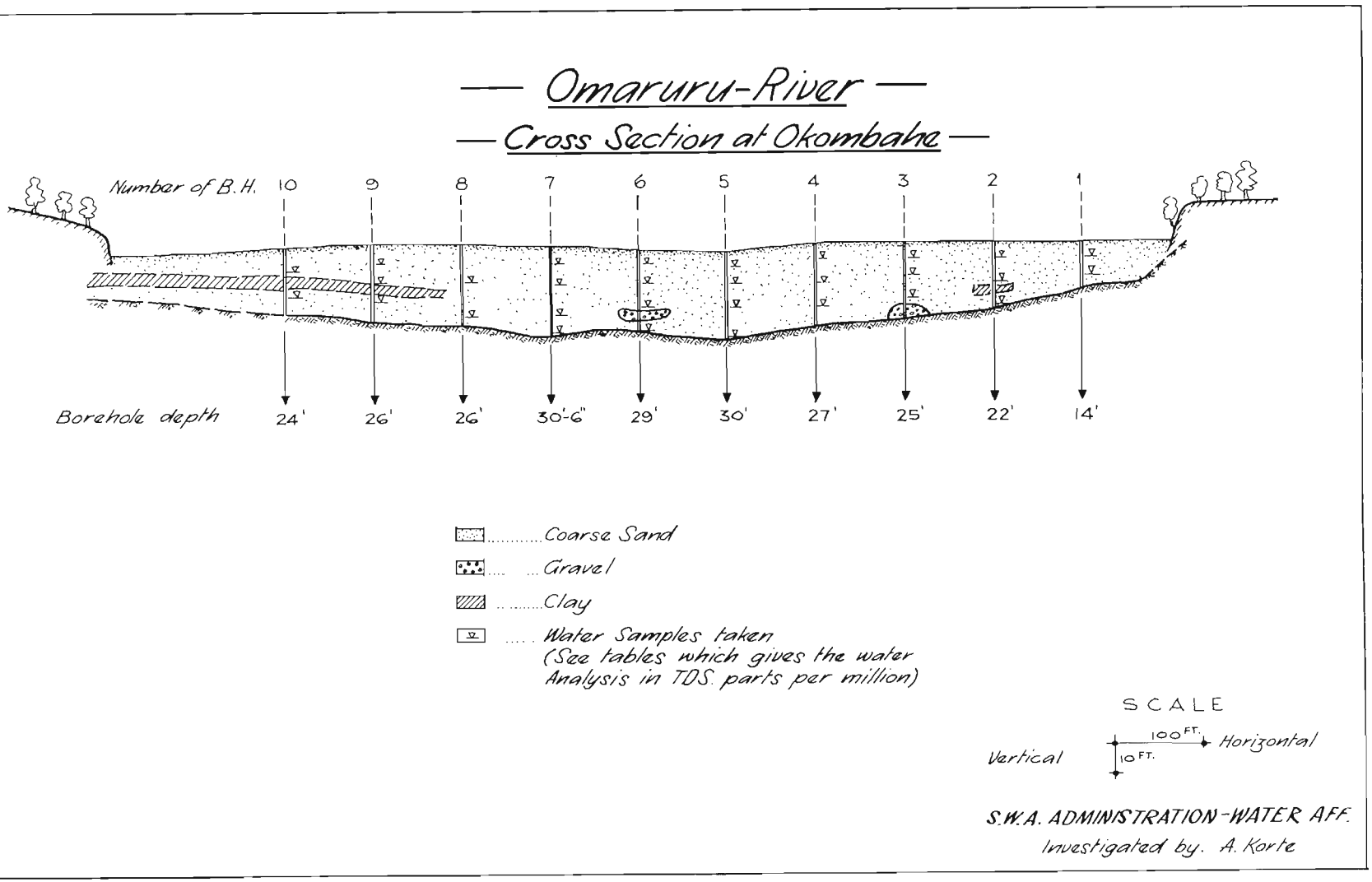


Fig. 11. Omaruru river. — Cross section at Okombahe.