



**BASIC PHYSICAL GEOGRAPHY/HYDRO
DATA FOR
NATAL "ESTUARIES"**

SEDIMENT DYNAMICS DIVISION
COASTAL ENGINEERING AND HYDRAULICS
NATIONAL RESEARCH INSTITUTE FOR OCEANOLOGY
COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH

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FOREWORD

Basic physical geography, simulated run-off and sediment yield data provide an important background for NRIO's Natal Estuary Study.

It has become evident that these data, which in many cases have been difficult and/or time-consuming to obtain and process, would be useful to other scientists. In this report, therefore, these data are presented in concise, tabular form with brief explanatory notes as to their origin and/or derivation.

As the necessary processing work is completed, further data reports similar to this one are planned for the various groups of Cape estuaries (i.e. Cape South East, Cape Middle South, Cape South West and Cape West).

J E Perry

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ABBREVIATIONS USED

DWA	Department of Water Affairs
HRU	Hydrological Research Unit
MAP	Mean Annual Precipitation
MAR	Mean Annual Run-off
NR	No Record
NRIO	National Research Institute for Oceanology

BRIEF NOTES

1. Introduction

Most of the lower reaches of Natal rivers are not estuaries, sensu stricto, hence the use of inverted commas with this term.

Two of the "estuaries" listed have not been processed in full

- (i) Natal Bay (NS 53) because this is an embayment fed by several rivers
- (ii) St. Lucia (NN 19) because this system has been the subject of many comprehensive studies from which far more detailed data may be obtained than are contained herein.

Four "estuary" systems have changed in the recent past. The Mlazi (NS 52), which is now a concrete-lined canal, flowed into the Sipingo (NS 51) until 1952. The Nyoni (NN 12) was captured by the Matigulu (NN 13) in 1971.

2. Locality: Table I

This table gives a list of Natal "estuaries" with reference numbers NS 1-53 (Natal South 1-53) and NN 1-21 (Natal North 1-21). The latter form part of an index system for "estuaries" around the coast of South Africa from the Orange river to Kosi Bay which was drawn up by the writer in 1978 for use within NRIO. In several cases, a river may be known by various names with a multiplicity of spellings. Therefore, for ease of reference and consistency, it was decided to adopt the name and spelling for each of the rivers as printed in blue, nearest the mouth, on the 1:50 000 series of topographical maps available at the time.

The latitudes and longitudes given are the positions of the river mouths. They are part of a list drawn up for the whole South African coast by M van Niekerk (NRIO) and the writer in 1978, using 1:50 000 topographical maps. The same basis was used by M van Niekerk in 1978 to compile a list of distance intervals between "estuaries" and harbour sites around the South

African coast. The coastal distance intervals in Table I were taken from this list.

3. Basic Physical Geography Data: Table II

The basis for river lengths, often an average of several quoted, is Begg (1978). The 1:50 000 topographical series of maps were used to estimate the elevation of the sources of the rivers.

Catchment areas are based upon tertiary and quaternary catchment data in Volumes V and VI of the "Surface Water Resources of South Africa" (Middleton et al., 1981 and Pitman et al., 1981). This basis was used to tie in with our source of run-off data (see Section 4, below). Several of the Natal estuary catchments form only part of the aforementioned tertiary and quaternary catchments. In these cases, cognizance was taken of the smaller catchment areas measured by Begg (1978) and some areas were measured from 1:50 000 maps or 1:10 000 orthophotos using a flat-bed digitizer. By weighted averaging, care was taken to ensure that totals agreed with the relevant basic tertiary and quaternary catchment areas.

4. Simulated Run-off Data

4.1 Background

At present, only very limited use can be made of actual discharge and run-off data from DWA because (a) 59 of the 74 rivers feeding the estuaries of Natal are not gauged at all; (b) only nine of the rivers have gauging stations anywhere near the mouth and (c) the few relevant records are of relatively short duration and contain many gaps - particularly at the all important high flow stages.

Volumes V and VI of the "Surface Water Resources of South Africa" (Middleton et al., 1981 and Pitman et al., 1981) became available in 1982. These HRU 12 & 9/81 reports from Prof. Midgley's former Hydrological Research Unit of the University of the

Witwatersrand contain simulated monthly run-off data for all Natal tertiary catchments except the Mgobezeleni and Kosi Bay systems from 1921 to 1975/76 with some additional MAR information for quaternary catchments. To obtain much needed hydro data for Natal "estuary" studies a method was evolved to derive simulated run-off for each "estuary" from the HRU 12 & 9/81 report data.

4.2 Modus Operandi

1. Each "estuary" was located in relation to tertiary and quaternary catchments according to HRU 12 & 9/81 reports.
2. In the few cases where the "estuary" is fed by whole tertiary catchment areas (that is, where no other coastal river is involved) the relevant tertiary catchment run-off data were simply summed.
3. In most cases, however, allowance had to be made for smaller coastal catchments which comprise part of the basic tertiary and/or quaternary catchments. In these cases, "estuary sub-catchment" areas were obtained as described in Section 3 above. Multiplying factors were then derived for use with the simulated monthly run-off data for tertiary catchments to obtain the best estimate of run-off for these "sub-catchments". Sometimes, for lack of any other information, the multiplying factors were directly proportional to the "sub-catchment" areas. Where the quaternary catchment MAR data indicated that run-off is not directly proportional to area, multiplying factors were derived which were based upon this additional hydro information.
4. A table was then drawn up indicating which of the run-off data for tertiary catchments and/or part of these catchments had to be used for each "estuary" and stating how they were to be used (e.g. summed and/or multiplying factors to be applied).

5. Based upon the latter item "4", J Serdyn (NRIO) wrote a computer program which allows the simulated run-off for each "estuary" to be shown in
 - (i) tabular form - giving monthly and annual totals, means, standard deviations, coefficients of variation and median values and
 - (ii) graphical form - giving annual, monthly and cumulative run-off.

An example of each of the above for Mpenjati (NS 7) is given in the appendix.

4.3 Notes for Potential Users

1. Original "estuary" run-off assessments were revised in 1984 in the light of new quaternary catchment hydro information (Midgley et al., 1983).
2. Copies of individual tables and graphs of simulated run-off from the 69 Natal "estuaries" processed may be obtained from NRIO.
3. Despite some shortcomings, these simulated data are believed to be the best available assessment of run-off into the "estuaries" (a view upheld by Prof. R Schulze during consultations in 1984) and are likely to remain so for many years.
4. NRIO hopes that the invaluable basic tertiary catchment run-off data will be revised and updated to 1986, in the near future. Furthermore, assessments are needed for the Mgobezeleni (NN 20) and Kosi Bay (NN 21) catchments.

4.4 Tables III and IV

Table III gives a synopsis of the processed simulated MAR (m^3) values for Natal "estuaries" together with average annual and monthly coefficients of variation (%). Median annual run-off (m^3) and median/MAR (%) values are also listed.

For some studies, MAR expressed in catchment millimetres is preferred. This is given in Table IV together with MAP (mm) and MAR/MAP (%) values. The data source for precipitation is also HRU 12 & 9/81 reports (Middleton et al., 1981 and Pitman et al., 1981).

5. Sediment Yield: Table V

Catchment sediment yields are given in average annual totals (tons) and in average rates (tons/km²/yr).

The basis for these data is a sediment yield map (Rooseboom, 1975). Although this map is being updated, Prof. Rooseboom confirmed with the writer in 1985 that there were no areas in Natal affected by the revision.

6. Conclusion

It is hoped that the data in this report will be of practical use to various people involved in studies of the lower reaches of Natal rivers.

REFERENCES

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TABLE I

LOCALITY

NATAL ESTUARIES

Ref.	River	Latitude			Longitude			Coastal distance (km)	
		°	'	"	°	'	"	interval	cumulative
NS 1	MTAMVUNA	31	04	50	30	11	40		0
NS 2	ZOLWANE	31	04	30	30	12	20	1,3	1,3
NS 3	SANDLUNDLU	31	02	35	30	13	45	6,1	7,4
NS 4	KU-BOBOYI	31	02	05	30	14	10	1,3	8,7
NS 5	TONGAZI	31	00	40	30	15	30	4,0	12,7
NS 6	KANDANDLOVU	30	59	50	30	16	10	2,2	14,9
NS 7	MPENJATI	30	58	30	30	16	55	3,4	18,3
NS 8	UMHLANGANKULU	30	56	45	30	18	10	4,1	22,4
NS 9	KABA	30	56	05	30	18	30	1,6	24,0
NS 10	MBIZANA	30	54	40	30	20	00	4,0	28,0
NS 11	MVUTSHINI	30	53	40	30	20	50	2,7	30,7
NS 12	BILANHLOLO	30	53	20	30	21	00	0,7	31,4
NS 13	UVUZANA	30	52	40	30	21	30	1,9	33,3
NS 14	KONGWENI	30	51	30	30	22	20	3,3	36,6
NS 15	VUNGU	30	50	10	30	23	45	3,9	40,5
NS 16	uMHLANGA	30	49	05	30	24	20	2,6	43,1
NS 17	ZOTSHA	30	47	20	30	25	25	4,5	47,6
NS 18	BOBOYI	30	46	10	30	26	25	2,8	50,4
NS 19	MBANGO	30	45	25	30	26	50	1,8	52,2
NS 20	MZIMKULU	30	44	20	30	27	30	2,7	54,9
NS 21	MTENTWENI	30	42	35	30	28	55	4,4	59,3
NS 22	MHLANGAMKULU	30	41	20	30	29	55	3,1	62,4
NS 23	DAMBA	30	40	20	30	30	40	2,3	64,7
NS 24	KOSHWANA	30	39	35	30	31	05	1,8	66,5
NS 25	INTSHAMBILI	30	38	15	30	32	15	3,7	70,2
NS 26	MZUMBE	30	36	45	30	32	55	3,4	73,6
NS 27	MZIMAYI (South)	30	35	05	30	34	20	4,3	77,9
NS 28	MHLUNGWA	30	33	35	30	35	05	3,2	81,1
NS 29	MFAZAZANA	30	31	55	30	36	30	4,3	85,4
NS 30	KWA-MAKOSI	30	31	30	30	36	40	0,9	86,3
NS 31	MNAMFU	30	30	30	30	37	35	2,7	89,0
NS 32	MTWALUME	30	29	05	30	38	10	3,2	92,2
NS 33	MVUZI	30	28	10	30	38	45	2,1	94,3
NS 34	FAPA	30	27	00	30	39	20	2,0	96,3
NS 35	MDESINGANE	30	25	30	30	40	20	4,2	100,5
NS 36	SEZELA	30	24	50	30	40	40	1,5	102,0
NS 37	MKUMBANE	30	24	20	30	41	00	1,2	103,2
NS 38	MZINTO	30	22	00	30	42	35	5,5	108,7
NS 39	MZIMAYI (North)	30	20	45	30	43	40	3,5	112,2
NS 40	MPAMBANYONI	30	16	45	30	45	30	9,8	122,0
NS 41	MAHLONGWA	30	16	05	30	45	50	1,3	123,3
NS 42	MAHLONGWANA	30	13	30	30	47	40	6,2	129,5
NS 43	MKOMAZI	30	12	00	30	48	05	3,2	132,7
NS 44	NGANE	30	10	45	30	49	00	3,0	135,7
NS 45	uMGABABA	30	09	20	30	49	30	3,0	138,7
NS 46	MSIMBAZI	30	07	45	30	50	50	3,5	142,2
NS 47	LOVU	30	06	45	30	51	15	2,1	144,3
NS 48	LITTLE MANZIMTOTI	30	04	40	30	52	20	4,6	148,9
NS 49	MANZIMTOTI	30	03	35	30	53	00	2,4	151,3
NS 50	MBOKODWENI	30	00	40	30	56	05	7,5	158,8
NS 51	SIPINGO	29	59	40	30	57	10	2,9	161,7
NS 52	MLAZI	29	58	10	30	58	45	3,7	165,4
NS 53	NATAL BAY	29	52	15	31	03	30	13,6	169,0
NN 1	MGENI	29	48	40	31	02	30	9,0	178,0
NN 2	OHLANGA	29	42	25	31	05	55	13,6	191,6
NN 3	MDLOTI	29	39	05	31	07	40	7,5	199,1
NN 4	TONGATI	29	34	25	31	11	10	10,8	209,9
NN 5	MHLALI	29	27	40	31	16	40	16,0	225,9
NN 6	SETENI	29	25	45	31	17	10	4,7	230,6
NN 7	MVOTI	29	23	30	31	20	10	5,8	236,4
NN 8	MDLOTANE	29	21	10	31	22	30	6,2	242,6
NN 9	NONOTI	29	19	00	31	24	35	5,4	248,0
NN 10	ZINKWASI	29	16	50	31	26	40	6,5	254,5
NN 11	TUGELA	29	13	25	31	29	55	8,5	263,0
NN 12	NYONI								
NN 13	MATIGULU	29	05	05	31	38	25	21,9	284,9
NN 14	SIYAYA	28	58	00	31	45	40	17,4	302,3
NN 15	MLALAZI	28	56	45	31	48	40	5,6	307,9
NN 16	RICHARDS BAY								
	MHLATUZE	28	50	40	32	03	00	26,5	334,4
NN 17	NHLABANE	28	39	40	32	15	30	29,4	363,8
NN 18	MFOLOZI	28	24	05	32	25	25	36,2	400,0
NN 19	ST. LUCIA	28	23	05	32	25	20	1,8	401,8
NN 20	MGOBEZELENI	27	32	20	32	40	45	55,5	457,3
NN 21	KOSI	26	53	40	32	52	50	125,6	582,9

TABLE II

BASIC PHYSICAL GEOGRAPHY

NATAL ESTUARIES

Ref.	River	Catchment Area (km ²)	River Length (km)	Elevation of Source (m above MSL)	River Gradient (1:)
NS 1	MTAMVUNA	1 553	162	1 920	84
NS 2	ZOLWANE	7	6,5	259	25
NS 3	SANDLUNDLU	16	7,5	282	27
NS 4	KU-BOBOYI	3	4	107	37
NS 5	TONGAZI	17	8,5	385	22
NS 6	KANDANDLOVU	9	8	290	28
NS 7	MPENJATI	100	18	480	38
NS 8	UMHLANGANKULU	9	6,5	180	36
NS 9	KABA	11	9	220	41
NS 10	MBIZANA	145	26	480	54
NS 11	MVUTSHINI	7	6,5	180	36
NS 12	BILANHLOLO	21	12	240	50
NS 13	UVUZANA	8	2,5	130	19
NS 14	KONGWENI	20	6	180	33
NS 15	VUNGU	124	24	610	39
NS 16	UMHLANGA	38	12,5	340	37
NS 17	ZOTSHA	57	20	415	48
NS 18	BOBOYI	32	14	370	38
NS 19	MBANGO	13	8	139	58
NS 20	MZIMKULU	6 745	329	2 440	135
NS 21	MTENTWENI	50	20	340	59
NS 22	MHLANGAMKULU	11	7	185	38
NS 23	DAMBA	25	11	300	37
NS 24	KOSHWANA	11	6,3	200	32
NS 25	INTSHAMBLI	33	12,5	210	60
NS 26	MZUMBE	536	84	933	90
NS 27	MZIMAYI (South)	47	16	240	67
NS 28	MHLUNGWA	32	18	222	81
NS 29	MFAZAZANA	16	10,5	278	38
NS 30	KWA-MAKOSI	16	7	183	38
NS 31	MNAMFU	16	9	233	39
NS 32	MTWALUME	565	85	985	86
NS 33	MVUZI	8	6,5	178	37
NS 34	FAFA	231	66	918	72
NS 35	MDESINGANE	6	5,2	76	68
NS 36	SEZELA	20	12	180	67
NS 37	MKUMBANE	28	14	300	47
NS 38	MZINTO	149	37	520	71
NS 39	MZIMAYI (North)	31	20	178	112
NS 40	MPAMBANYONI	562	100	962	104
NS 41	MAHLONGWA	92	23	430	53
NS 42	MAHLONGWANA	15	6	218	27
NS 43	MKOMAZI	4 310	298	2 650	112
NS 44	NGANE	16	8	219	37
NS 45	UMGABABA	37	14,5	244	59
NS 46	MSIMBAZI	35	16	244	66
NS 47	LOVU	893	135	1 280	105
NS 48	LITTLE MANZIMTOTI	18	15	165	91
NS 49	MANZIMTOTI	39	11,6	274	42
NS 50	MBOKODWENI	283	59	732	81
NS 51	SIPINGO	51	27	328	82
NS 52	MLAZI	972	82	914	90
NS 53	NATAL BAY				
NN 1	MGENI	4 432	232	1 829	127
NN 2	OHLANGA	118	28	324	86
NN 3	MDLOTI	527	81	854	95
NN 4	TONGATI	436	50	747	67
NN 5	MHLALI	304	46,5	580	80
NN 6	SETENI	16	5	61	82
NN 7	MVOTI	2 829	197	1 479	133
NN 8	MDLOTANE	43	13	122	107
NN 9	NONOTI	210	37,5	488	77
NN 10	ZINKWASI	73	22	229	96
NN 11	TUGELA	29 101	405	3 109	130
NN 12	NYONI				
NN 13	MATIGULU	995	96	762	126
NN 14	SIYAYA	18	8	59	136
NN 15	MLALAZI	492	54	549	98
NN 16	RICHARDS BAY				
NN 17	MHLATUZE	3 670	209	1 265	165
NN 18	NHLABANE	104	12	43	279
NN 19	MFOLOZI	10 075	395	1 646	240
NN 20	ST. LUCIA				
NN 20	MGOBEZELENI	33	6	15	400
NN 21	KOSI	≈ 500	30	75	≈ 400

TABLE III

SIMULATED RUN-OFF

NATAL ESTUARIES

Ref.	River	M A R (m ³ × 10 ⁶)	Coefficients of Variation $\bar{V}\%$		Median Annual Run-off (m ³ × 10 ⁶)	Median/Mean (%)
			Annual	Monthly		
NS 1	MTAMVUNA	303,78	43,4	96,4	264,36	87
NS 2	ZOLWANE	1,73	43,4	96,4	1,51	87
NS 3	SANDLUNDLO	6,40	51,9	125,6	5,65	88
NS 4	KU-BOBOYI	1,20	51,9	125,6	1,06	88
NS 5	TONGAZI	6,80	51,9	125,6	6,00	88
NS 6	KANDANDLOVU	3,60	51,9	125,6	3,18	88
NS 7	MPENJATI	25,52	51,9	125,6	22,51	88
NS 8	UMHLANGANKULU	2,00	51,9	125,6	1,76	88
NS 9	KABA	2,44	51,9	125,6	2,15	88
NS 10	MBIZANA	29,56	51,9	125,6	26,08	88
NS 11	MVUTSHINI	1,82	51,9	125,6	1,61	88
NS 12	BILANHLILO	5,46	51,9	125,6	4,82	88
NS 13	UVUZANA	2,08	51,9	125,6	1,83	88
NS 14	KONGWENI	5,20	51,9	125,6	4,59	88
NS 15	VUNGU	26,44	51,9	125,6	23,32	88
NS 16	UMHLANCA	9,60	51,9	125,6	8,47	88
NS 17	ZOTSHA	14,40	51,9	125,6	12,70	88
NS 18	BOBOYI	8,53	51,9	125,6	7,52	88
NS 19	MBANGO	3,47	51,9	125,6	3,06	88
NS 20	MZIMKULU	1 478,21	38,8	80,0	1 345,60	91
NS 21	MTENTWENI	14,62	68,0	149,3	11,65	80
NS 22	MHLANGANKULU	3,22	68,0	149,3	2,57	80
NS 23	DAMBA	7,31	68,0	149,3	5,82	80
NS 24	KOSHWANA	3,22	68,0	149,3	2,57	80
NS 25	INTSHAMBI'I	9,65	68,0	149,3	7,69	80
NS 26	MZUMBE	71,03	68,0	149,3	56,60	80
NS 27	MZIMAYI (South)	8,14	68,0	149,3	6,49	80
NS 28	MHLUNGWA	5,55	68,0	149,3	4,42	80
NS 29	MFAZAZANA	2,77	68,0	149,3	2,21	80
NS 30	KWA-MAKOSI	2,77	68,0	149,3	2,21	80
NS 31	MNAMFU	2,77	68,0	149,3	2,21	80
NS 32	MTWALUME	60,02	68,0	149,3	47,82	80
NS 33	MVUZI	0,84	68,0	149,3	0,67	80
NS 34	FAFA	24,17	68,0	149,3	19,26	80
NS 35	MDESINGANE	0,90	68,0	149,3	0,72	80
NS 36	SEZELA	2,99	68,0	149,3	2,38	80
NS 37	MKUMBANE	4,18	68,0	149,3	3,34	80
NS 38	MZINTO	22,29	68,0	149,3	17,76	80
NS 39	MZIMAYI (North)	4,64	68,0	149,3	3,70	80
NS 40	MPAMBANYONI	52,02	68,0	149,3	41,45	80
NS 41	MAHLONGWA	12,04	68,0	149,3	9,59	80
NS 42	MAHLONGWANA	1,96	68,0	149,3	1,56	80
NS 43	MKOMAZI	1 036,17	42,8	84,0	954,45	92
NS 44	NGANE	2,90	63,8	124,1	2,31	80
NS 45	UMGABABA	6,71	63,8	124,1	5,34	80
NS 46	MSIMBAZI	6,35	63,8	124,1	5,05	80
NS 47	LOVU	111,78	63,8	124,1	88,91	80
NS 48	LITTLE MANZIMTOTI	3,78	63,8	124,1	3,01	80
NS 49	MANZIMTOPI	8,20	63,8	124,1	6,52	80
NS 50	MOKODWENI	35,58	71,2	146,0	27,89	78
NS 51	SIPINGO	6,41	71,2	146,0	5,03	78
NS 52	MLAZI	91,00	71,2	146,0	71,34	78
NS 53	NATAL BAY					
NN 1	MGENI	682,88	57,0	107,1	561,45	82
NN 2	OHLANGA	26,00	71,3	160,6	19,82	76
NN 3	MDLOTI	116,99	71,3	160,6	89,16	76
NN 4	TONGATI	74,99	71,3	160,6	57,15	76
NN 5	MHLALI	49,40	71,3	160,6	37,65	76
NN 6	SETENI	2,60	71,3	160,6	1,98	76
NN 7	MVOTI	468,19	85,6	146,4	335,90	72
NN 8	MDLOTANE	9,10	85,6	146,4	6,53	72
NN 9	NONOTI	44,47	85,6	146,4	31,90	72
NN 10	ZINKWASI	15,46	85,6	146,4	11,09	72
NN 11	TUGELA	4 594,94	48,8	122,3	4 045,79	88
NN 12	NYONI					
NN 13	MATIGULU	201,07	77,1	156,5	149,22	74
NN 14	SIYAYA	5,25	87,8	160,5	3,83	73
NN 15	MLLAZI	117,01	87,8	160,5	85,37	73
NN 16	RICHARDS BAY					
	MHLATUZE	467,50	84,8	142,3	352,90	76
NN 17	NHLABANE	30,75	87,1	158,4	21,66	70
NN 18	MFOLOZI	887,28	123,9	218,7	565,79	64
NN 19	ST. LUCIA					
NN 20	MGOBEZELENI	NR	NR	NR	NR	NR
NN 21	KOSI	NR	NR	NR	NR	NR

TABLE IV

SIMULATED RUN-OFF/PRECIPITATION

NATAL ESTUARIES

Ref.	River	MAR (mm)	MAP (mm)	MAR/MAP (%)
NS 1	MTAMVUNA	196	956	20,5
NS 2	ZOLWANE	247	1 019	24,2
NS 3	SANGLUNDLU	400	1 194	33,5
NS 4	KU-BOBOYI	400	1 194	33,5
NS 5	TONGAZI	400	1 194	33,5
NS 6	KANDANDLOVU	400	1 194	33,5
NS 7	MPENJATI	255	1 074	23,7
NS 8	UMHLANGANKULU	222	1 040	21,3
NS 9	KABA	222	1 040	21,3
NS 10	MBIZANA	204	1 019	20,0
NS 11	MVUTSHINI	260	1 091	23,8
NS 12	BILANHLOLO	260	1 091	23,8
NS 13	UVUZANA	260	1 091	23,8
NS 14	KONGWENI	260	1 091	23,8
NS 15	VUNGU	213	1 031	20,7
NS 16	UMHLANGA	253	1 073	23,6
NS 17	ZOTSHA	253	1 073	23,6
NS 18	BOBOYI	267	1 080	24,7
NS 19	MBANGO	267	1 080	24,7
NS 20	MZIMKULU	219	960	22,8
NS 21	MTENTWENI	292	1 030	28,3
NS 22	MHLANGAMKULU	292	1 030	28,3
NS 23	DAMBA	292	1 030	28,3
NS 24	KOSHWANA	292	1 030	28,3
NS 25	INTSHAMBILI	292	1 030	28,3
NS 26	MZUMBE	133	903	14,7
NS 27	MZIMAYI (South)	173	1 038	16,7
NS 28	MHLUNGWA	173	1 038	16,7
NS 29	MFAZAZANA	173	1 038	16,7
NS 30	KWA-MAKOSI	173	1 038	16,7
NS 31	MNAMFU	173	1 038	16,7
NS 32	MTWALUME	106	932	11,4
NS 33	MVUZI	105	920	11,4
NS 34	FAPA	105	920	11,4
NS 35	MDESINGANE	150	985	15,2
NS 36	SEZELA	150	985	15,2
NS 37	MKUMBANE	150	985	15,2
NS 38	MZINTO	150	985	15,2
NS 39	MZIMAYI (North)	150	985	15,2
NS 40	MPAMBANYONI	93	895	10,4
NS 41	MAHLONGWA	131	1 004	13,0
NS 42	MAHLONGWANA	131	1 004	13,0
NS 43	MKOMAZI	240	982	24,4
NS 44	NGANE	181	1 040	17,4
NS 45	UMGABABA	181	1 040	17,4
NS 46	MSIMBAZI	181	1 040	17,4
NS 47	LOVU	125	936	13,4
NS 48	LITTLE MANZIMTOTI	210	1 079	19,5
NS 49	MANZIMTOTI	210	1 079	19,5
NS 50	MBOKODWENI	126	961	13,1
NS 51	SIPINGO	126	961	13,1
NS 52	MLAZI	94	861	10,9
NS 53	NATAL BAY			
NN 1	MGENI	154	945	16,3
NN 2	OHLANGA	220	1 028	21,4
NN 3	MDLOTI	222	1 104	20,1
NN 4	TONGATI	172	1 087	15,8
NN 5	MHLALI	163	1 085	15,0
NN 6	SETENI	163	1 085	15,0
NN 7	MVOTI	166	1 035	16,0
NN 8	MDLOTANE	212	1 100	19,3
NN 9	NONOTI	212	1 100	19,3
NN 10	ZINKWASI	212	1 100	19,3
NN 11	TUGELA	158	894	17,7
NN 12	NYONI			
NN 13	MATIGULU	202	1 129	17,9
NN 14	SIYAYA	292	1 286	22,7
NN 15	MLALAZI	238	1 209	19,7
NN 16	RICHARDS BAY			
NN 17	MHLATUZE	127	876	14,5
NN 18	NHLABANE	296	1 256	23,6
NN 19	MFOLOZI	88	849	10,4
NN 19	ST. LUCIA			
NN 20	MGOBEZELENI	NR	NR	NR
NN 21	KOSI	NR	NR	NR

TABLE V

SEDIMENT YIELD

NATAL ESTUARIES

Ref.	River	Average Catchment Sediment Yield	
		(tons/year)	(tons/km ² /yr)
NS 1	MTAMVUNA	434 290	280
NS 2	ZOLWANE	4 200	600
NS 3	SANDLUNDLU	9 600	600
NS 4	KU-BOBOYI	1 800	600
NS 5	TONGAZI	10 200	600
NS 6	KANDANDLOVU	5 400	600
NS 7	MPENJATI	60 000	600
NS 8	UMHLANGANKULU	3 600	400
NS 9	KABA	4 400	400
NS 10	MBIZANA	72 500	500
NS 11	MVUTSHINI	2 800	400
NS 12	BILANHLOLO	8 400	400
NS 13	UVUZANA	3 200	400
NS 14	KONGWENI	8 000	400
NS 15	VUNGU	85 200	400
NS 16	uMHLANGA	15 200	400
NS 17	ZOTSHA	22 800	400
NS 18	BOBOYI	12 800	400
NS 19	MBANGO	5 200	400
NS 20	MZIMKULU	2 170 020	322
NS 21	MTENTWENI	20 000	400
NS 22	MHLANGAMKULU	4 400	400
NS 23	DAMBA	10 000	400
NS 24	KOSHWANA	4 400	400
NS 25	INTSHAMBILI	13 200	400
NS 26	MZUMBE	214 400	400
NS 27	MZIMAYI (South)	18 800	400
NS 28	MHLUNGWA	12 800	400
NS 29	MFAZAZANA	6 400	400
NS 30	KWA-MAKOSI	6 400	400
NS 31	MNAMFU	6 400	400
NS 32	MTWALUME	226 000	400
NS 33	MVUZI	3 200	400
NS 34	FAPA	88 150	382
NS 35	MDESINGANE	2 400	400
NS 36	SEZELA	8 000	400
NS 37	MKUMBANE	11 200	400
NS 38	MZINTO	59 600	400
NS 39	MZIMAYI (North)	12 400	400
NS 40	MPAMBANYONI	184 550	328
NS 41	MAHLONGWA	36 800	400
NS 42	MAHLONGWANA	6 000	400
NS 43	MKOMAZI	1 616 360	375
NS 44	NGANE	6 400	400
NS 45	uMGABABA	14 800	400
NS 46	MSIMBAZI	14 000	400
NS 47	LOVU	398 900	447
NS 48	LITTLE MANZIMTOTI	7 200	400
NS 49	MANZIMTOTI	15 600	400
NS 50	MBOKODWENI	113 200	400
NS 51	SIPINGO	20 400	400
NS 52	MLAZI	426 800	439
NS 53	NATAL BAY		
NN 1	MGENI	1 657 670	374
NN 2	OHLANGA	47 200	400
NN 3	MDLOTI	210 800	400
NN 4	TONGATI	174 400	400
NN 5	MHLALI	121 600	400
NN 6	SETENI	6 400	400
NN 7	MVOTI	813 850	288
NN 8	MDLOTANE	17 200	400
NN 9	NONOTI	84 000	400
NN 10	ZINKWASI	29 200	400
NN 11	TUGELA	8 798 000	302
NN 12	NYONI	41 280	359
NN 13	MATIGULU	224 440	255
NN 14	SIYAYA	1 800	100
NN 15	MLALAZI	49 200	100
NN 16	RICHARDS BAY		
	MHLATUZE	1 055 470	288
NN 17	NHLABANE	10 400	100
NN 18	MFOLOZI	2 364 240	235
NN 19	ST. LUCIA		
NN 20	MGOBEZELENI	3 300	100
NN 21	KOSI	50 000	100

APPENDIX

TABLE NS 7/I SIMULATED RUN-OFF (MILLION CU.M.) FOR MPENJATI NS. 7 CATCHMENT AREA= 100.0 SQ.KM.

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL	MM.A.R.
1921	1.31	8.47	3.72	1.10	7.6	.62	.99	.99	1.14	.85	.65	.74	21.19	83.04
1922	6.39	5.91	2.14	1.17	7.59	3.98	1.38	.66	.41	.87	1.10	.90	32.50	127.35
1923	.94	1.23	1.91	2.01	1.63	.94	.56	.97	.31	.24	.25	.42	10.86	42.55
1924	.67	.97	1.32	1.71	1.65	12.22	5.05	.97	.64	.53	.42	.67	26.81	105.05
1925	1.23	1.32	.97	.70	.83	4.65	2.41	.86	1.04	1.07	.71	.66	16.44	64.43
1926	1.25	1.58	1.31	.80	.57	14.62	5.93	.82	.40	.27	.34	.47	28.37	111.15
1927	.76	.74	.85	1.28	1.42	1.08	.61	.43	.39	.30	.34	.41	8.58	33.62
1928	.61	.81	.70	.76	.75	1.37	2.04	1.77	15.59	10.17	3.15	4.01	41.72	163.47
1929	6.43	6.45	2.64	2.28	1.61	.75	.40	.35	.54	.68	.77	1.48	24.38	95.51
1930	2.20	2.05	1.98	2.07	1.96	5.13	2.74	.98	.49	19.48	7.93	1.52	48.54	190.19
1931	1.62	1.55	1.11	.86	1.26	2.77	1.90	1.39	1.23	.91	.68	3.57	18.85	73.86
1932	4.95	10.00	8.22	2.75	.83	1.04	1.19	.88	.60	.47	.37	.38	31.68	124.14
1933	.49	5.90	4.85	6.46	3.06	1.27	1.11	.94	.61	.76	.84	.59	26.86	105.27
1934	.45	.77	9.39	4.07	1.09	1.13	1.39	5.28	10.51	4.43	1.72	1.34	41.58	162.92
1935	.96	.81	.53	.54	6.84	4.10	1.53	2.26	1.94	1.27	.81	.85	22.44	87.92
1936	1.40	19.98	7.79	2.89	6.31	3.10	1.16	.63	.38	.52	.69	.64	45.47	178.16
1937	.84	1.02	3.61	3.01	2.94	1.72	4.65	2.65	1.21	1.14	1.10	.79	24.67	96.67
1938	.69	.96	2.12	1.87	4.88	2.95	1.44	.96	.68	.65	.70	1.37	19.28	75.56
1939	2.06	1.77	3.35	1.85	.68	.45	.49	4.90	2.90	1.13	.65	.61	20.84	81.68
1940	.70	1.30	1.45	.90	.44	.42	.49	.37	.30	.33	.47	.72	7.90	30.94
1941	1.16	1.30	1.04	6.30	3.10	1.55	1.64	1.47	1.05	.61	.67	.90	20.79	81.46
1942	1.42	12.99	11.87	3.60	1.01	5.77	6.47	2.89	1.32	1.01	1.38	1.46	51.18	200.55
1943	3.13	2.51	2.62	1.79	1.26	.99	.82	.66	.59	.59	.46	1.30	16.72	65.51
1944	4.41	2.45	.85	.47	.81	1.55	1.38	.81	.51	.42	.36	.33	14.33	56.16
1945	6.76	3.27	.70	.40	.62	.99	1.25	1.05	.63	.39	.27	.26	16.58	64.95
1946	.55	3.00	2.25	1.41	1.27	4.97	3.16	3.19	6.63	3.27	1.23	.82	31.76	124.44
1947	.72	9.11	4.63	1.94	2.55	6.07	3.16	1.22	.63	.36	.33	.37	31.10	121.85
1948	5.05	2.91	1.06	.59	.82	1.41	1.42	1.01	.62	.41	.34	.48	16.10	63.10
1949	1.05	6.55	3.32	2.64	1.91	1.18	1.48	2.34	1.87	1.32	1.64	1.70	26.99	105.75
1950	1.36	1.13	1.42	1.61	1.15	.87	.64	.40	.32	.27	.31	.45	9.92	38.89
1951	2.96	1.91	1.41	4.97	2.70	1.01	.75	.90	.83	.64	.47	.72	19.26	75.48
1952	.88	.92	1.08	5.83	10.41	3.80	.78	.45	.27	.20	.35	.72	25.68	100.61
1953	1.32	5.67	3.15	1.27	.92	1.26	1.14	.99	.81	.62	.20	.87	18.41	72.16
1954	20.97	8.33	1.05	8.53	4.30	3.27	1.94	.85	.58	.50	.37	.85	51.54	201.96
1955	1.44	1.75	1.43	.69	.64	8.12	7.45	2.74	1.19	.92	.87	1.05	28.27	110.79
1956	3.22	6.65	10.59	4.02	1.12	1.50	7.44	3.50	.99	.62	.49	1.31	41.44	162.40
1957	5.96	4.62	1.92	1.51	7.69	4.10	4.54	3.05	.81	.62	.62	.60	38.04	149.14
1958	1.00	1.92	1.84	1.26	.98	.75	.57	16.15	6.68	1.20	1.05	1.04	34.48	135.11
1959	1.46	1.53	1.22	1.03	1.02	1.42	1.77	1.75	1.27	.78	.56	.65	14.45	56.64
1960	.91	1.37	1.83	1.59	.95	2.01	9.89	4.32	1.13	1.45	1.48	1.35	28.28	110.83
1961	1.49	3.87	2.25	1.33	1.08	7.17	3.42	1.00	.61	.39	.43	.55	23.59	92.43
1962	1.38	1.83	1.32	6.00	2.83	25.04	9.54	1.12	.87	2.97	2.22	1.27	56.37	220.90
1963	2.16	2.27	13.56	15.64	5.22	1.48	1.14	.86	10.65	4.93	1.26	.89	60.06	235.33
1964	11.25	5.08	1.18	.94	.91	.55	.30	.36	1.26	1.94	1.95	2.51	28.25	110.68
1965	5.84	3.77	1.93	1.72	1.41	.74	.50	.92	1.31	1.11	.77	.73	20.75	81.33
1966	.80	1.00	1.13	1.60	1.61	2.16	7.25	3.34	1.06	1.01	.91	.62	22.51	88.21
1967	.66	1.22	1.34	.94	.62	1.10	.83	.46	.46	.31	.51	1.05	9.89	38.75
1968	1.53	1.53	1.26	.81	.88	1.55	1.74	4.27	2.49	1.09	.75	.82	18.83	73.80
1969	1.45	2.04	1.88	1.16	.68	.39	.22	.28	.70	.86	1.11	1.49	12.24	47.98
1970	14.96	8.31	3.85	2.36	1.48	.97	.84	1.40	1.43	1.41	5.74	3.15	45.91	179.88
1971	6.49	3.53	1.65	.98	1.26	1.27	.69	.40	.42	.51	.51	.44	18.15	71.13
1972	.42	1.15	1.59	1.14	.63	.42	.37	.28	.18	.16	.29	.78	7.43	28.11
1973	.98	.75	.48	.27	.41	.58	.78	1.58	1.88	1.30	.76	.54	10.33	40.47
1974	.47	.72	2.71	2.02	1.20	.62	.62	.40	.31	.25	.20	1.05	10.44	42.48
1975	1.55	1.03	1.16	1.43	1.64	8.26	4.10	1.79	1.32	.95	.77	.61	24.50	96.38
1976	1.01	1.06	.63	.38	.34	.28	.18	.17	.23	.23	.23	.35	5.08	19.89

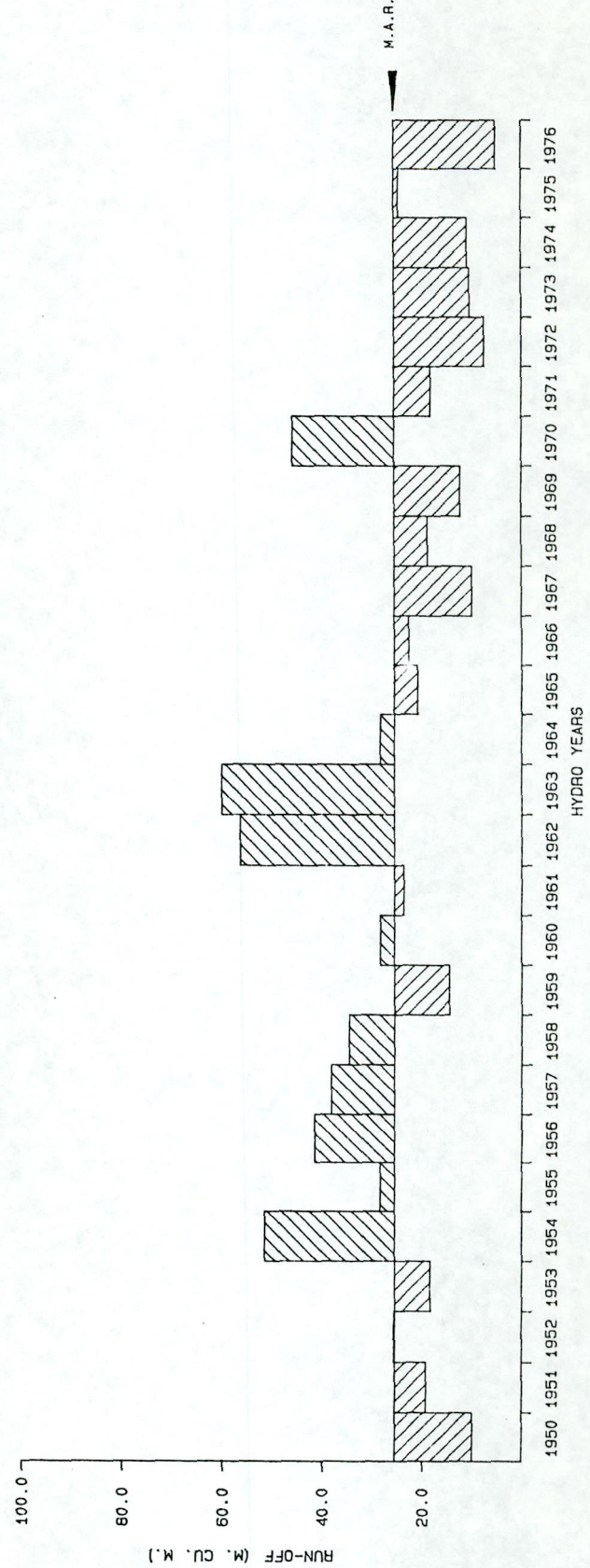
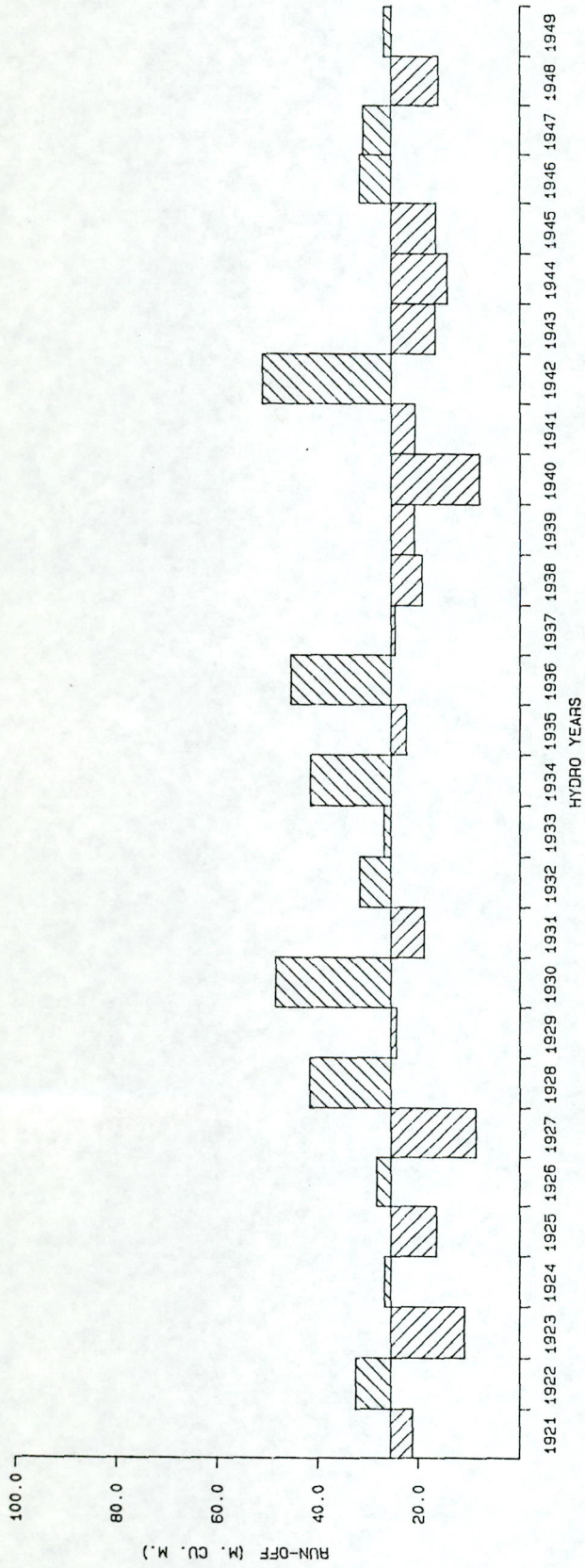
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S 3.73 3.57 2.98 2.53 2.13 4.17 2.46 2.32 2.86 2.90 1.28 .75 13.25

V% 135.87 107.66 105.64 107.33 103.70 137.44 106.25 133.78 168.27 198.64 128.01 74.79 51.92

MEDIAN 1.36 1.77 1.65 1.59 1.20 1.41 1.38 .97 .81 .68 .67 .78 22.51

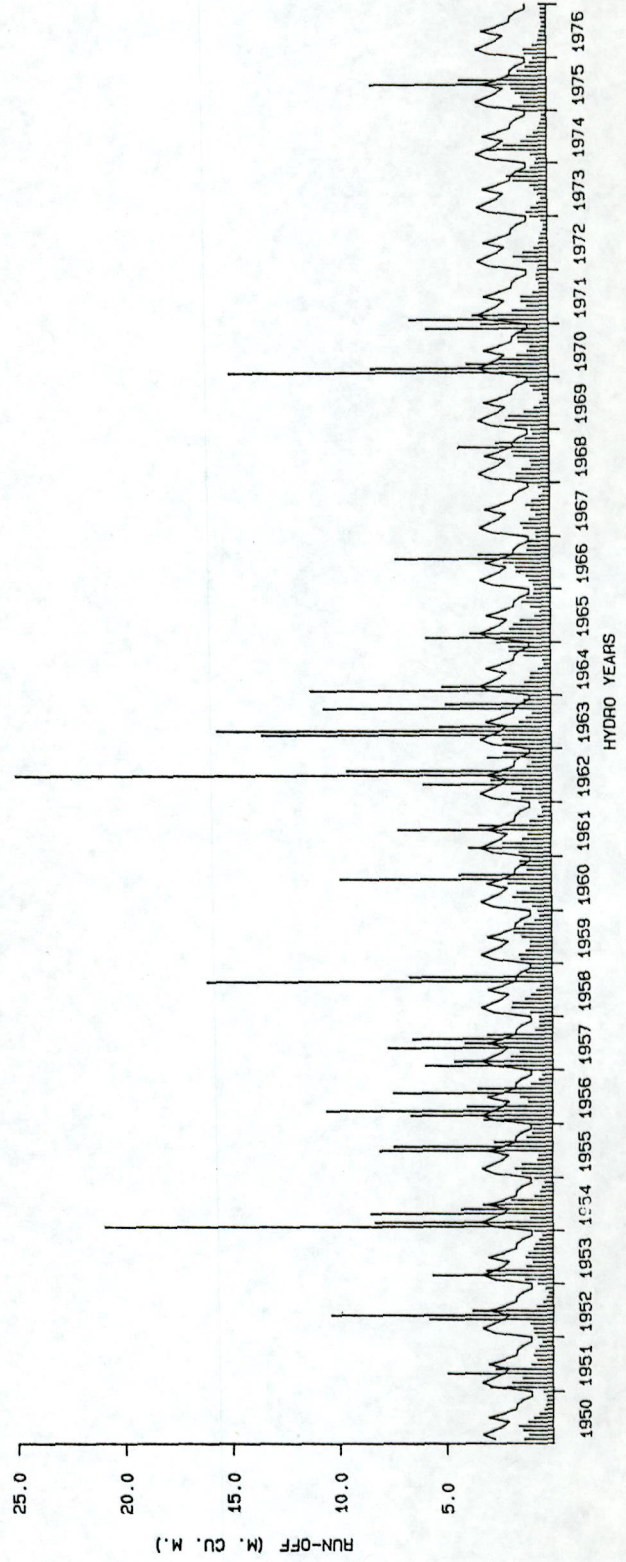
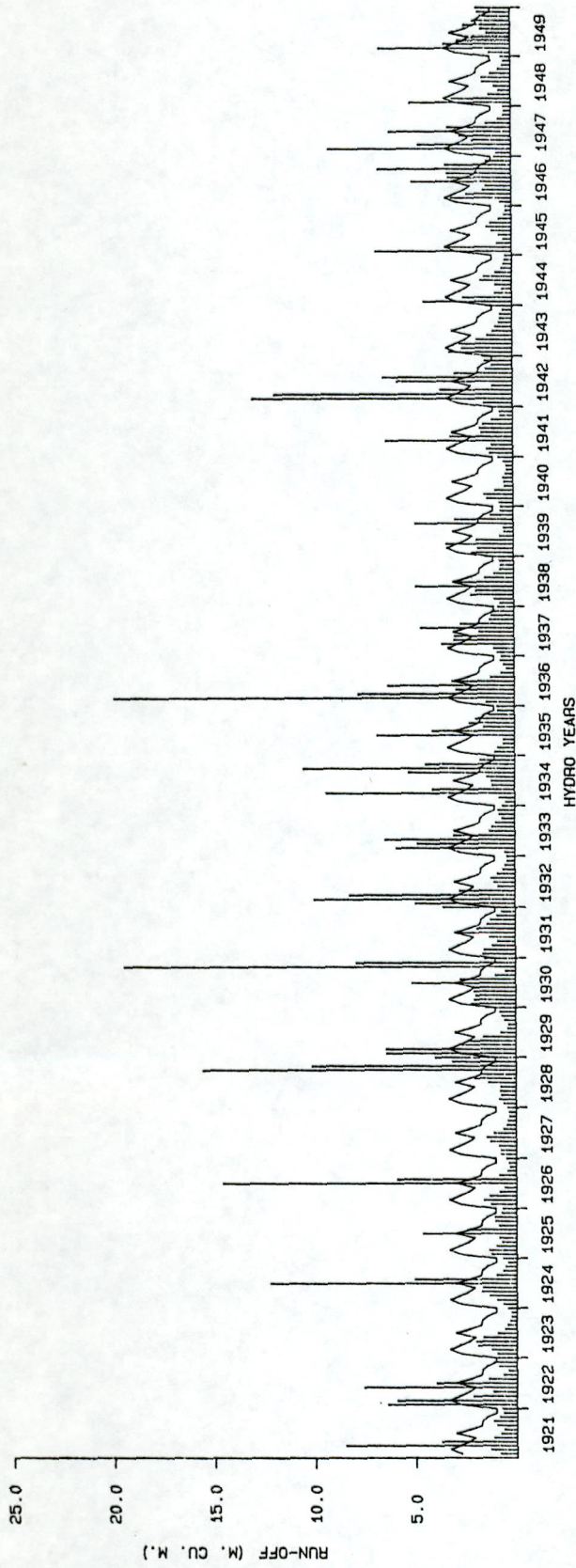
MEAN ANNUAL RUN-OFF= 25.52 MILLION CUBIC METRES. COMPILED FROM HAU REPORT NO.12/31 DATA



TRACED : RAIN
 CHECKED: H.J.A.D.
 DATE : AUG. 1986
 REF. : 720 41064

NATAL ESTUARIES : MPENJATI
 SIMULATED ANNUAL RUN-OFF
 1921-1976

FIGURE
 NS7/1

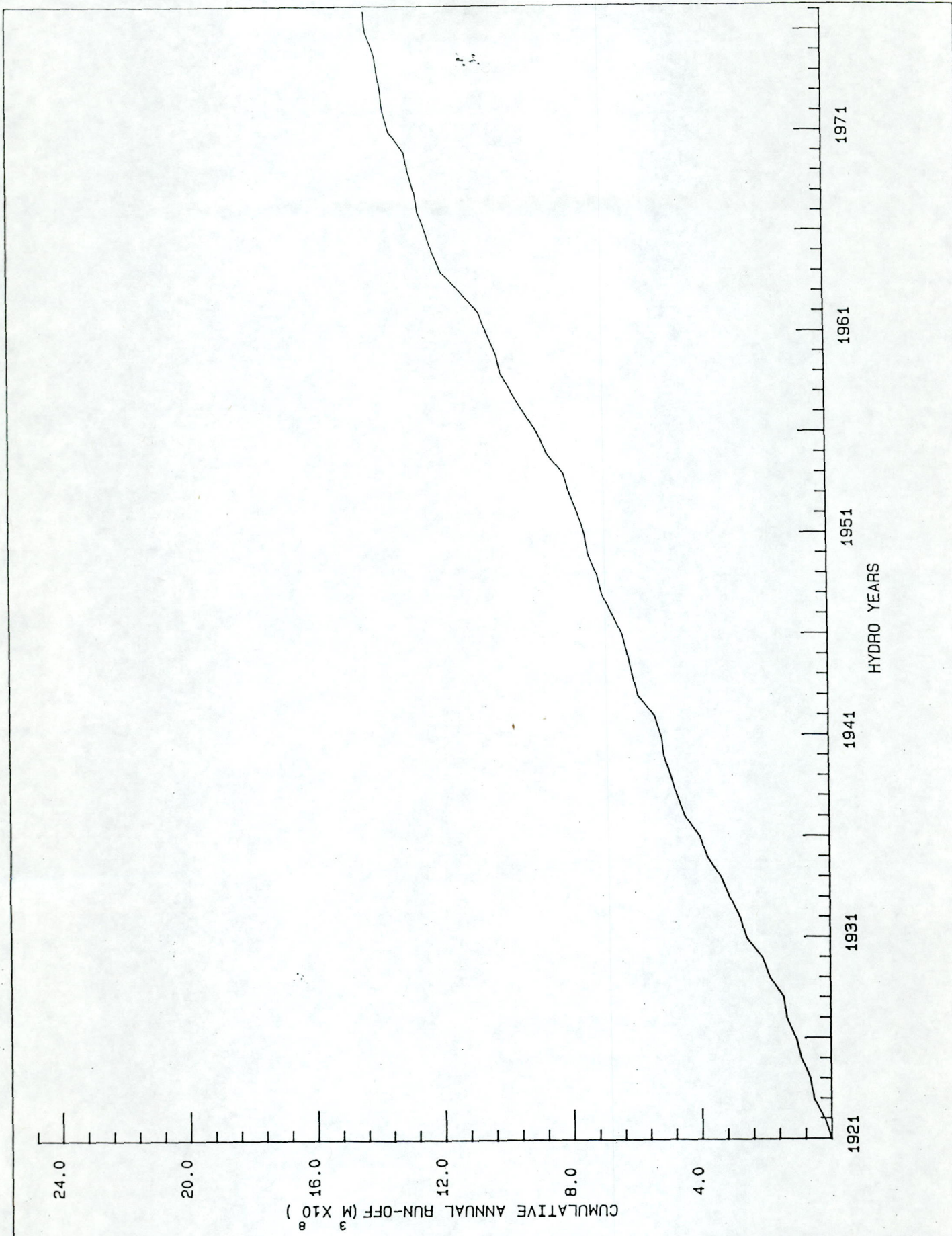


MONTHLY MEANS

FIGURE
NS7/2

NATAL ESTUARIES : MPENJATI
SIMULATED MONTHLY RUN-OFF
1921-1976

TRACED : RAIN
CHECKED : H. J. A. D.
DATE : AUG. 1986
REF. : 720 41064



TRACED : RAIN
 CHECKED: H.J.A.D.
 DATE : AUG. 1986
 REF. : 720 41064

NATAL ESTUARIES: MPENJATI
CUMULATIVE ANNUAL RUN-OFF

FIGURE
 NS7/3