The Wetlands of Natal (Part 2)

The distribution, extent and status of wetlands in the

Mfolozi catchment

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The distribution, extent and status of wetlands in the Mfolozi catchment

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with the assistance of
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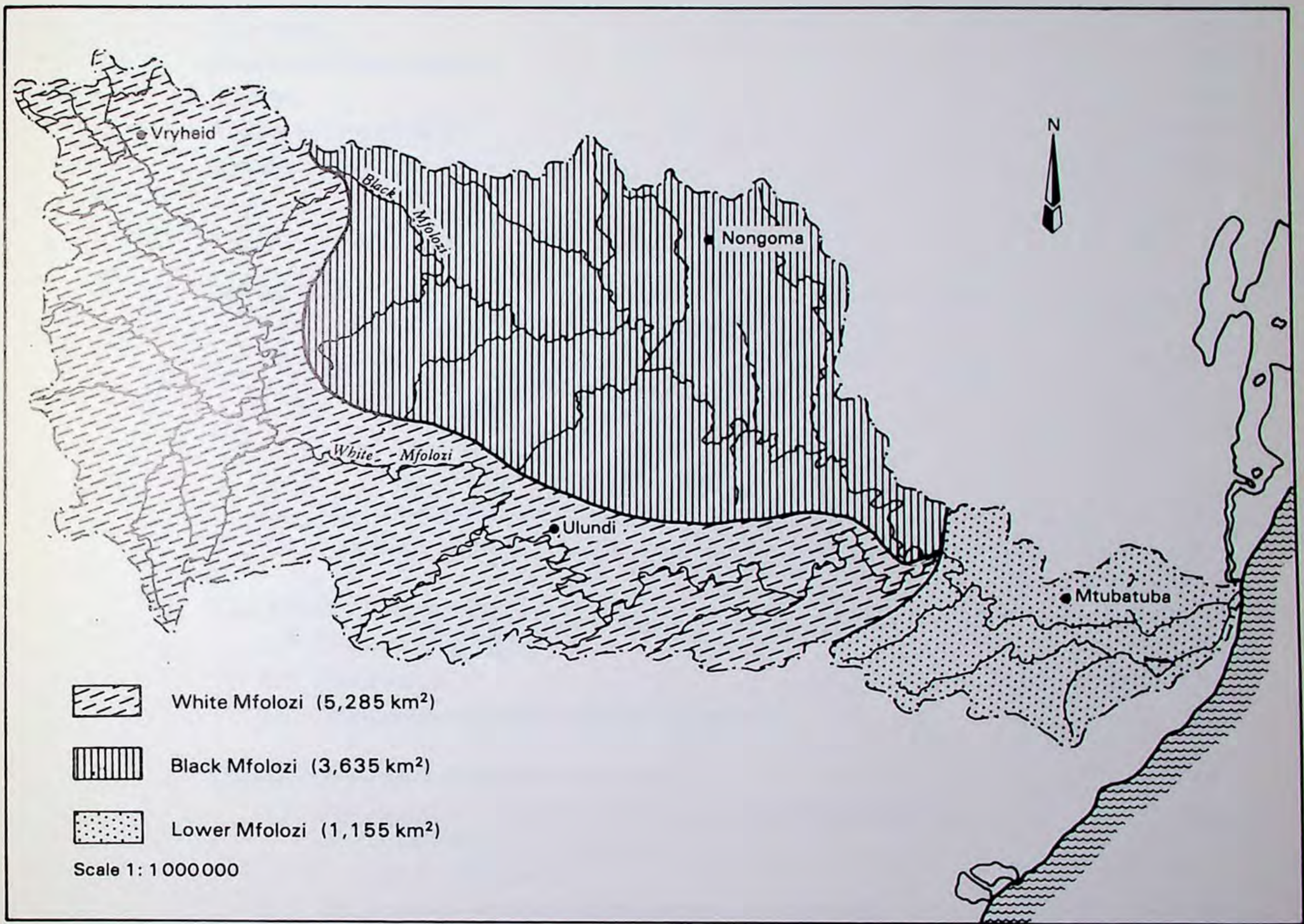

The Mfolozi Catchment

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Foreword

In 1948 General Smuts brought out to this country, from America, the "father of modern soil conservation", Dr Hugh Hammond Bennett. He described our soil erosion problem as being the worst in the world, and wrote these words: "These dongas, creeping down from the slopes in the valley, are new graves in which the nation's future will be buried", and he left S.A. with this startling message, "South Africa, I pity you!" This report does little to alleviate these fears.

This study is the first of its kind in S.A., and the NTRPC have every reason to be proud of its initiative in having called for an assessment of one of the most valuable, but abused, resources in the Province, namely its wetlands. Ever since 1970 urgent requests have been made "to pool all existing knowledge (about wetlands) and to provide at least a reasonable guide, or *modus operandi*, for land use planners". This report is a step in this direction, and begins to make such information available.

In Natal and KwaZulu, people are becoming more aware of the value of wetlands than ever before, and it is hoped that this awareness will result in official agreement over a protection policy strongly orientated towards the conservation of existing wetlands. 58% of the wetlands in the Mfolozi catchment have already been lost, and thus, all those in authority must work together to protect the remaining wetlands and their resource values.

As population increases, and the need continues for private landowners to obtain a desirable financial return from their land, pressure for wetland conversion will continue unless economic incentives for protection and improved management are provided. Serious consideration must be given as to how this can be achieved. More funds must be found to meet the needs of inventory work in other catchments, and to support investigations aimed at understanding the best possible use of these potentially invaluable ecosystems.

There are some individual landowners who still do not recognise the right of "authority" to have a say in how they should manage, *inter alia*, their wetlands. The fact is, however, that the time has come (indeed, is long past) when we can no longer accept that a land owner is entitled to "use or abuse" his land holding.

Our environment is generally at risk through man's mismanagement not least from his abuse of wetlands. The issues now at stake, and highlighted by Dr Begg, far outweigh personal interests. The threat to our very continued existence is no longer hypothetical, it is real and immediate.

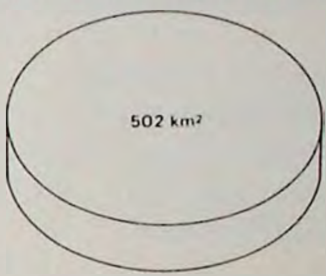
D V HARRIS

Chairman, Natal Town and Regional Planning Commission

Executive Summary

This report is the end product of a 18-month long study aimed at compiling an inventory of wetlands in the Mfolozi catchment, and is the second in a series of reports on "The Wetlands of Natal".

The primary aim of a wetland inventory is to provide a catchment wide appraisal of wetland resources for broad planning purposes, to serve as a guide to land capability, to identify further information needs for management, and to evaluate the functions and values of wetlands in particular situations. Thus, the location of each wetland in the Mfolozi catchment has been plotted on 1:50 000 maps, and data relevant to their management needs has been assembled. These data are contained either in this report, or in a data bank housed at the Institute of Natural Resources, University of Natal.



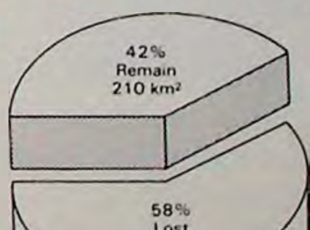
Original extent of wetlands

The Mfolozi catchment is 10 075 km^2 in size, and used to contain 1 485 wetlands occupying 50 244 ha (5%) of the catchment. These wetlands ranged in size from 1 - 21 322 ha, but most have been altered to the extent that only 42% of this resource remains. This means that over 29 000 ha of wetlands has been lost, and that the extent of wetland in the Mfolozi catchment has been reduced to 2,1%.

The extent of these losses has varied from one region to another, in accordance with different land use pressures, and differences in susceptibility to disturbance of the various wetlands encountered.

However, it is suggested that the following consequences have materialised. These are an increased incidence of and severity of

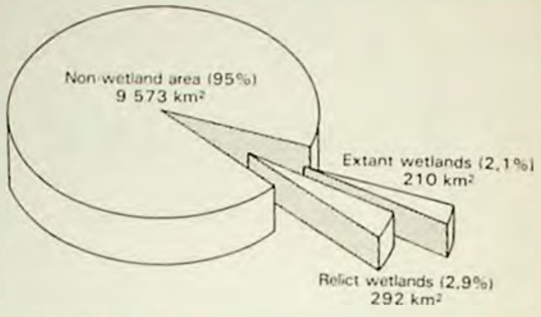
- downstream flooding
- river flow cessation
- reduced winter flows
- lowering of the water table
- higher sediment loads
- poorer water quality
- bank erosion
- habitat deterioration
- species extinction
- threatened wildlife resources
- lower agricultural productivity, and
- a lower quality of life for rural communities.



Present extent of wetlands

Evidence is presented to support all of these allegations, to suggest that the downstream consequences were entirely predictable, and that the process of deterioration has yet to be halted.

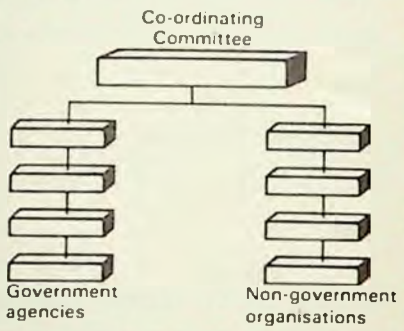
Although some of the losses incurred were initiated several hundred years ago, factors such as overgrazing and crop cultivation have contributed significantly to the destruction of wetlands. These losses bear witness to poor land use decisions, and emphasize the need to limit any further destruction of wetlands. A strong plea is made for improved conservation of these resources, through the enforcement of legislation, the implementation of integrated land use plans, and for co-ordination between the government agencies charged with the regulation of wetland development and management.



Mfolozi catchment

Specific problems such as the private ownership of wetlands which qualify as State assets, deeply entrenched attitudes regarding how wetlands should be used, expanding populations and overgrazing by cattle, are all threats to wetlands that should be receiving far more attention than is the case at present. Possible solutions to these problems have been offered in the concluding chapter of this report. Furthermore, if the full range of benefits of wetlands in the catchment (as specified in our previous report) are to be realised, serious consideration must be given to the prospect of wetland rehabilitation. For this reason, several relict wetlands which could warrant reclamation have been identified.

Under the variable conditions prevalent in the Mfolozi catchment many forms of wetland were encountered. As the functions and values, and the management needs of these wetlands will differ in each case, further research on the classification of wetlands in the Mfolozi catchment is recommended.



The attention of land use authorities is drawn to the fact that, in the face of expanding populations and economic pressures for urban expansion, agricultural production and other economic uses, 58% of the wetlands in the Mfolozi catchment no longer exist. It is postulated that the future of wetlands in the Mfolozi catchment, and for that matter, in Natal and KwaZulu, therefore seems to depend on trends in economic, social and political development, rather than on processes operative in Nature. The study concludes that if mankind persists in converting wetlands to economic uses that they are not consistent with their natural functions, then it is not just wetlands that face continued destruction, but the welfare of mankind itself.

Preface

(a guide to the use of this report)

We have tried to ensure that this report is of value to as many people as possible. However, uppermost in our mind has been the Agricultural Extension Officer, who not only has to deal with wetland-related management issues on a more regular basis than anyone else, but also, when called upon to inspect wetlands for which development applications have been made, has the responsibility of acting as the Executive Officer of the Department of Agriculture and Water Supply.

Taking heed therefore, of the Procedural Manual that extension officers use when reporting on such cases, we have attempted to provide as much as possible of the relevant information needed about each wetland in the Mfolozi catchment. Since it was not possible to incorporate in this report all of the data collected during the inventory, the attention of readers, and extension officers in particular, is drawn to the existence of a data bank which contains all of the data collected during the study period. These data are presently housed at the Institute of Natural Resources, University of Natal, and should be used, and added to, at every opportunity in the future.

Secondly, we recognise that division of the Mfolozi catchment into 43 quaternary sub-catchments may be logical from the point of view of a hydrologist or an ecologist, but it may not be satisfactory for persons accustomed to using 1:50 000 maps of the area. For this reason, an overlay of Fig. 2 has been provided in a sleeve at the back of this report, and sepias are being prepared showing the distribution of wetlands for each of the 26 map sheets that cover the Mfolozi catchment. These sepias will soon be available from the offices of the Natal Town and Regional Planning Commission.

Thirdly, the maps that have been drawn of wetland distribution in each sub-catchment do not provide directions for users that may wish to visit some of the wetlands described in this report. This omission is deliberate, since we chose not to complicate these maps with too much information. Instead, we have provided a map, contained in a pocket on the back cover of this report, which shows the locations of towns and major roads in the Mfolozi catchment, in relation to the 43 sub-catchments mentioned above. We hope that this will help to orientate people unfamiliar with the area, and assist in providing sufficient information regarding possible access routes.

Although we believe that most of the wetland losses referred to have been incurred within the last 50 years, it is important to realise that in many instances the onset of wetland degradation can date back to the Iron Age, i.e. to about 400 A.D. Thus throughout this report the term "Pre Iron Age wetland distribution" is used, as distinct from the "present amount" of wetland occupying a particular area. The reason for this is because it is generally recognised that the initiation of soil erosion in wetland sites coincided with the first appearance of the black agriculturalists and pastoralists who spread into southern Africa from north of the Zambezi, arriving in this area about 1600 years ago (Watson *et al.*, 1984). They brought with them the knowledge of iron working, pottery making, animal and crop domestication and, as a result, settlement.

To avoid confusion in interpretation of the tables that appear in the report the following explanations are offered :

- The figures that appear beneath the column headed "catchment size" denote the size of the catchment upstream of the wetland specified.
- The figures that appear in the column headed "Percentage of the catchment under wetland" denote the amount of extant wetland in the catchment upstream of the wetland specified. These data are derived in the following way and are expressed as a percentage :

  $$\frac{\text{Area of extant wetland}}{\text{Area of catchment upstream}} \times 100$$

  Where more than one wetland occurs in the catchment upstream of the wetland specified, an asterisk is used to indicate that these have been added into the calculation.
- The figures that appear in the column headed "Perimeter" denote the edge length of extant portions of the wetland specified.

Finally, it has been impossible to avoid technical terms in this report, and thus a glossary explaining these has been included at the back of the document.

Acknowledgements

Numerous organisations and people have assisted us in accomplishing this survey. However, above all, we are grateful for the financial support forthcoming from the Department of Environment Affairs and the Natal Town & Regional Planning Commission.

The University of Natal played an important role in this study, with assistance coming from many quarters. We are grateful to Prof. C. Breen for his guidance throughout the study; to Prof. J. de Villiers for his advice on the interpretation of aerial photographs and the mapping of wetlands; to Dr. F. Getcliff-Norris for the identification of plant material; and to M. Berjak, M. Webster and Miss M. Gorven for their invaluable help in the field of computer programming.

The real "work horse" behind the scenes was Mr. Alan Carser, who was specifically engaged in order to assist us in the task of mapping wetlands. This involved the scanning of hundreds of aerial photographs, field verification and the transfer of these data onto maps, and to his everlasting credit all of these tasks, together with that of storing the wetland data collected, were meticulously performed. Much of the credit due for this study is owed to him.

The Drawing Office of the Natal Town and Regional Planning Commission were responsible for the reproduction of all the figures in their final form, and to this end Gwen Frayne deserves special thanks for the care and the pride that she took in her work. Although ably assisted by Heather Young and Diana Matheson whenever possible, the fact that Gwen worked under great pressure to complete the task on time, is much appreciated.

We are indebted to the Surveyor General's Office for access to aerial photography; to Mr Wolmarans of the Department of Geological Survey for the use of mapping apparatus and for access to unpublished geological maps of Natal; to Messrs. G. Lagerwall and R. Dicks of the Department of Agriculture and Water Supply for information on the land ownership of wetlands; to S. de Jager and G. Davies of the Natal Parks Board for assistance in the field; to Mrs. M. Jordaan of the Botanical Research Institute for the identification of plant material; and to Mr. D. Beswick of "Entocon" for the extended loan of their planimeter.

Lastly, but by no means least, we owe our thanks to Sue Lombard and Loraine Tribe who were responsible for typing this manuscript. Their tolerance of one set of corrections after another, without complaint, is greatly appreciated.

G W Begg
Ecologist

List of Acronyms

INR	Institute of Natural Resources
HL&H	Hunt, Leuchars and Hepburn Ltd.
NTE	Natal Tanning Extract Co.
NTRPC	Natal Town and Regional Planning Commission
SAICCOR	South African Industrial Cellulose Corporation
UGR	Umfolozi Game Reserve

Chapter 1

Introduction

1.1 Background to the wetland inventory

During the last two decades attention has been drawn, more and more urgently and throughout the world, to the vital importance of wetlands (Maltby, 1986). Thus it was recently proposed that if government and society alike are to continue to reap benefits from wetlands in Natal and KwaZulu, then the first thing that should be done was to conduct a thorough inventory of wetlands to take stock of the situation (Begg, 1986). This was seen to be "the most pressing research requirement of all", and could be initiated by systematically documenting, on a "drainage region by drainage region" basis, the present distribution, extent and status of wetlands throughout the Province.

1.2 Methodology

1.2.1 Air photo interpretation

Although the standard 1:50 000 topocadastral maps of South Africa commonly show the location of "marshes, swamps and vleis", experience has shown that these maps cannot be relied upon for locating every wetland in the landscape (Begg, 1985).

Air photo interpretation has been used successfully for wetland surveys in Zambia by Verboom (1965), in Australia by Pressey (1984) and in Zimbabwe by Whitlow (1985). Thus, photo-interpretation utilizing the black and white aerial photography available from the offices of the Surveyor General was adopted as a suitable method for determining the distribution of wetlands in Natal and KwaZulu.

In essence the approach used involved searching aerial photographs for any of the signs (geology, vegetation, relief, position in landscape, soil types etc.) that are known to characterise wetlands. Since wetlands are known to occupy a characteristic position in the landscape air photos were studied with the aid of a mirror stereoscope, and those areas which reveal the tone and relief known to characterize wetlands were outlined in pencil.

The interpretation of soil boundaries using aerial photography is a skill that takes practice and time to acquire (Scotney, 1970). However, due to the experience of Prof J de Villiers (Faculty of Agriculture, University of Natal) in mapping the soils of the Tugela Basin (van der Eyk *et al.*, 1969), Mr A Carser was appointed in February 1986 to work under his direction, and to learn the necessary technique.

The decision was made to ignore any wetlands smaller than 1 ha in extent, and to disregard the thin (c. 1m wide) strips of riparian wetland that often border low order stream.

1.2.2 Field verification

Field verification is vital if the person interpreting the aerial photography is to gain the necessary experience and confidence to map wetlands accurately from a remote source. Hence, inspections were regularly undertaken in the field to verify the interpretations mentioned in Chap. 1.2.1 above.

Generally, the form of the vegetation and the surrounding terrain (topography and geomorphology) will confirm the presence of wetland, but where surface indications of this nature were lacking, soil profiles were examined, using existing exposures or auger borings, if necessary. These revealed the morphology of the soils underlying the site, and enabled a decision to be taken regarding whether or not they were hydromorphic in origin.

1.2.3 Mapping

Once satisfied that the areas demarcated on the aerial photos were wetland, (or were originally wetland) these data were transferred from the photographs to a 1:50 000 map using either a monocular "Universal Sketchmaster", or a "Stereo-sketch" apparatus. However, in the near future this process should become computer-assisted (Berjak, pers. comm.).

1.2.4 The description of wetlands

Once located on a map, inventorization becomes possible, but this calls for a description of each site, because each wetland is influenced by different controlling factors (physiography, geology, soils, rainfall etc.), has different functional values (water storage, stream flow regulation, flood attenuation, water purification, etc.), has different biotic characteristics (Downing, 1970) and exhibits different degrees of disturbance.

In recent years a number of schemes have been prepared for the purpose of inventorization, and some of these have been designed specifically for wetlands. In this instance, the approach used was similar to that adopted by Pressey (1984) and by Adamus *et al.*, (1983), but to a far larger extent, was influenced by the information required in terms of Part 3 of the Procedural Manual (Anon, 1984), used by members of staff of the Department of Agriculture and Water Supply when reviewing applications for permission to cultivate vleis. The study approach was also influenced by the following constraints :

- the time by which the inventory must be completed (July 1987)
- the high incidence of wetlands, approaching as many as 150 per 1:50 000 sheet
- the lack of field assistance
- the terrain, which tended to preclude assessments based on direct observations and field inspections of each and every wetland
- delays caused over plant identification
- the expense of travelling between and to each wetland
- variance in the availability and date of aerial photography.

For inventory purposes the following attributes were therefore selected to describe and evaluate wetlands:

Background data

- geographical position
- topographical position
- slope
- elevation
- bedrock type
- wetland size
- wetland perimeter
- bioclimatic region
- physiographic region

Catchment data

- wetland catchment size
- proportion of wetland cover
- attenuation rating
- catchment land use
- stream order
- drainage pattern
- mean annual precipitation
- mean annual run-off

Ecological data

- vegetation cover type
- interspersion rating
- condition of marginal vegetation
- soil form
- saturation status

Land use data (within the wetland)

- land tenure
- type of alteration/disruption evident
- special values

Certain of these attributes were recorded in the field, whilst others were recorded in the office, and some were evaluations as opposed to descriptions.

A computer compatible pro-forma was designed to record these data (Appendix 1) using a CONDOR data base package made available by the Institute of Natural Resources (University of Natal). Storage of these data on an IBM computer and the use of various analysis routines written by the INR, then facilitated the extraction of these data as specified subsets of information in the form of listings, tabulations or graphic displays.

1.3 Study area selection

In 1985 the decision was taken by the Natal Town and Regional Planning Commission to start the wetland inventory in the Mfolozi catchment (Fig. 1), because economic, social and political demands upon the environment in this region of Natal and KwaZulu have been such that significant efforts are now needed to improve catchment management (NTRPC, 1984).

In light of this decision, therefore, and the methodology adopted (Chap. 2.1 above), a chronological inventory of aerial photography for the Mfolozi catchment (Appendix 2) was compiled. For ease of reference the relationship between the twenty-six 1:50 000 map sheets which cover the Mfolozi catchment (Fig. 2) and the information contained in Appendix 2 were then superimposed, to derive the data appearing in Appendix 3. The aerial photography that was finally used for mapping the wetlands of the Mfolozi catchment, was drawn from four surveys (Jobs 608 and 672 of 1970, Job 773 of 1976 and Job 849 of 1981), and the coverage of the catchment provided by each of these surveys is shown in Fig. 3.

1.4 Study Objectives

These were defined as follows:

a. The mapping of wetlands in the Mfolozi catchment

   - where are wetlands presently located in the Mfolozi catchment?
   - where were wetlands formerly located?

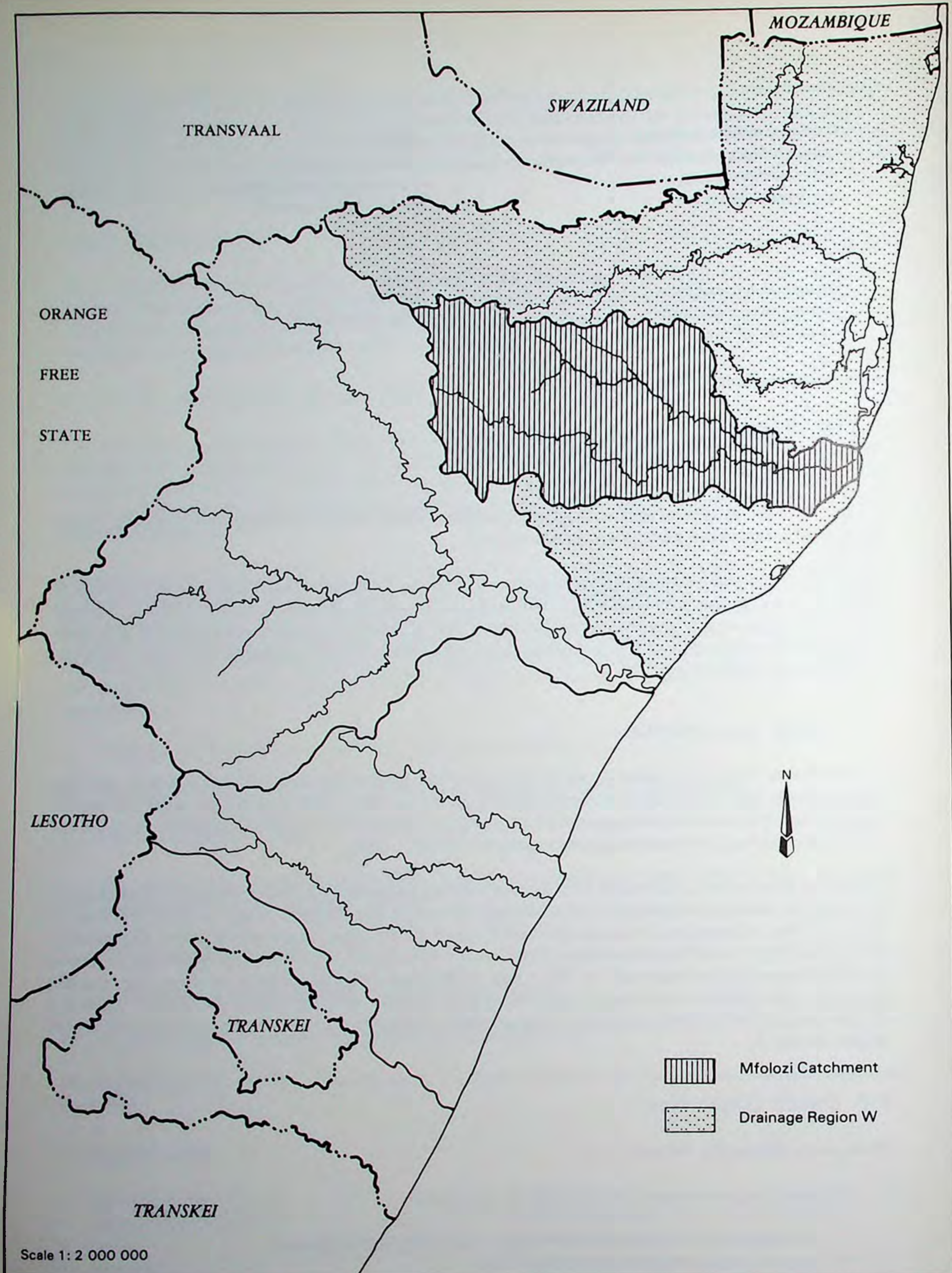


Fig. 1: The position of the Mfolozi catchment within the province of Natal, and its location within drainage region W

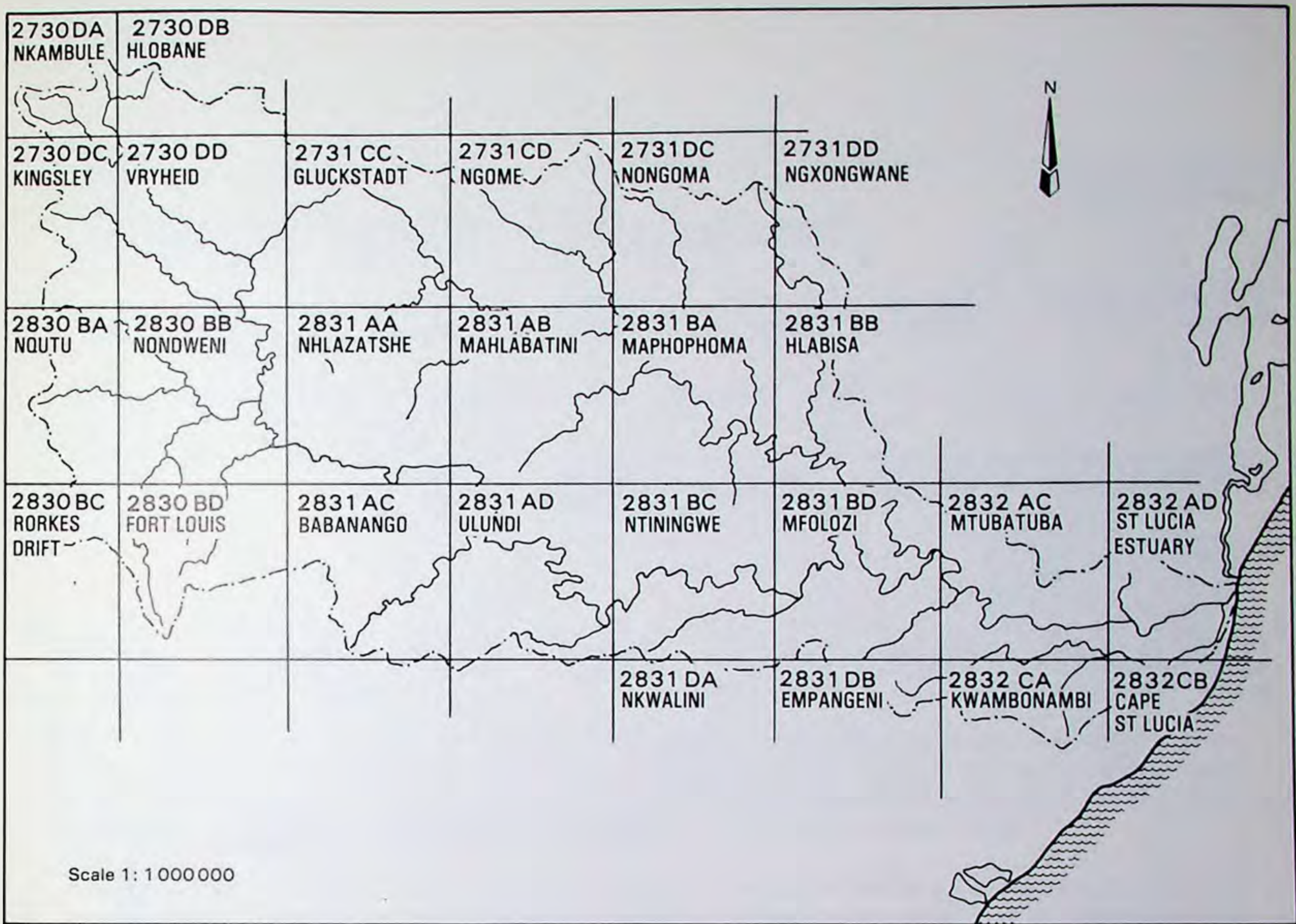


Fig. 2: The 1:50 000 map coverage of the Mfolozi catchment.

b. Evaluating the proportion of wetland cover in the Mfolozi catchment

- how extensive are wetlands in the catchment?
- how extensive were they originally?
- what are the problems associated with wetland losses?

c. Evaluating the present status of wetlands in the Mfolozi catchment

- how are wetlands presently being used?
- how many wetlands are presently undisturbed?
- what are the causes of the wetland losses?

d. The recording of information on wetlands in the Mfolozi catchment.

- what are the physical and biotic characteristics of the major wetlands?

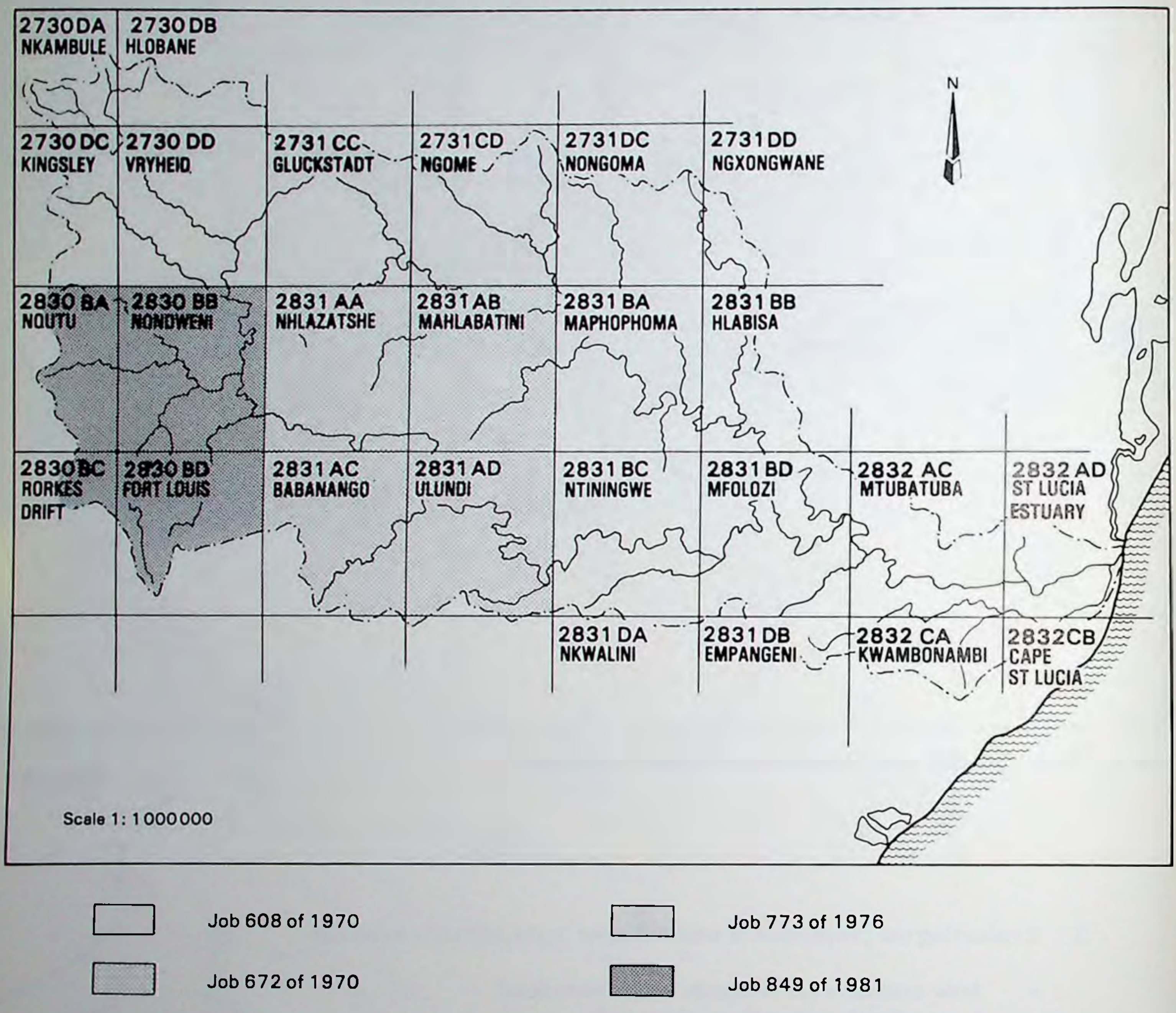


Fig. 3: The aerial photography selected from Appendix 3 for mapping the wetlands of the Mfolozi catchment.

Chapter 2

The Mfolozi Catchment

2.1 Physical geography

The Mfolozi catchment is the second largest drainage basin in Natal. Estimates of its size range from 9 918 km^2 (Chew & Bowen, 1971) to 11 318 km^2 (Archibald, 1969). The figure adopted by Pitman *et al.*, (1981) is 10 075 km^2.

There are three major sub-catchments (see frontispiece) :

- the White Mfolozi - draining 5 285 km^2
- the Black Mfolozi - draining 3 635 km^2
- the Lower Mfolozi - draining 1 155 km^2

Both rivers rise in the North-West portion of the catchment, but in different physiographic regions (Fig. 4), and at different altitudes. The White Mfolozi rises on the Skurweberg Plateau at an altitude of 1 620 m above sea level (a.s.l.), 20 km north west of Vryheid. The source of the Black Mfolozi is on the slopes of Mt. Mnyati at an altitude of 1 524 m a.s.l., 20 km north of Gluckstadt.

Initially, the fall of both rivers is extremely steep (Fig. 5), but thereafter they traverse hilly terrain, and in the process drain large portions of both KwaZulu and Natal before uniting on the eastern border of the Mfolozi Game Reserve (Fig. 6). Between its source and the sea, the river crosses 13 major geological formations (Fig. 7). The overall gradient of the river is 1 : 240 (Perry, 1986), and parameters such as the steepness and shape of the catchment have been determined by Looser (1985) because of the significance of these features when considering flood peak generation (see footnote).*

The Mfolozi River enters the Indian Ocean 395 km from its source (Porter, 1977), but shortly before entering the sea the river traverses the "Mfolozi Flats", which is a large depositional area (or fluvial plain) intensively used for agriculture. The Mfolozi Flats comprise the largest fluvial coastal plain in South Africa (van Heerden, 1985), and act as a sink for river-borne sediment, which in the case of the Mfolozi River, amounts on average to 2,5 million tons per year (Rooseboom, 1975). However, during floods, as in the case of "Domoina" for example, when 15 million tons of sediment were deposited on the flats in 1984, sediment accretion in areas of this nature is acutely felt.

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* *Footnote:*
The reason is that these influence the time taken by water to travel from the furthest part of the catchment to specified points in the drainage basin. This is referred to as the time of concentration.

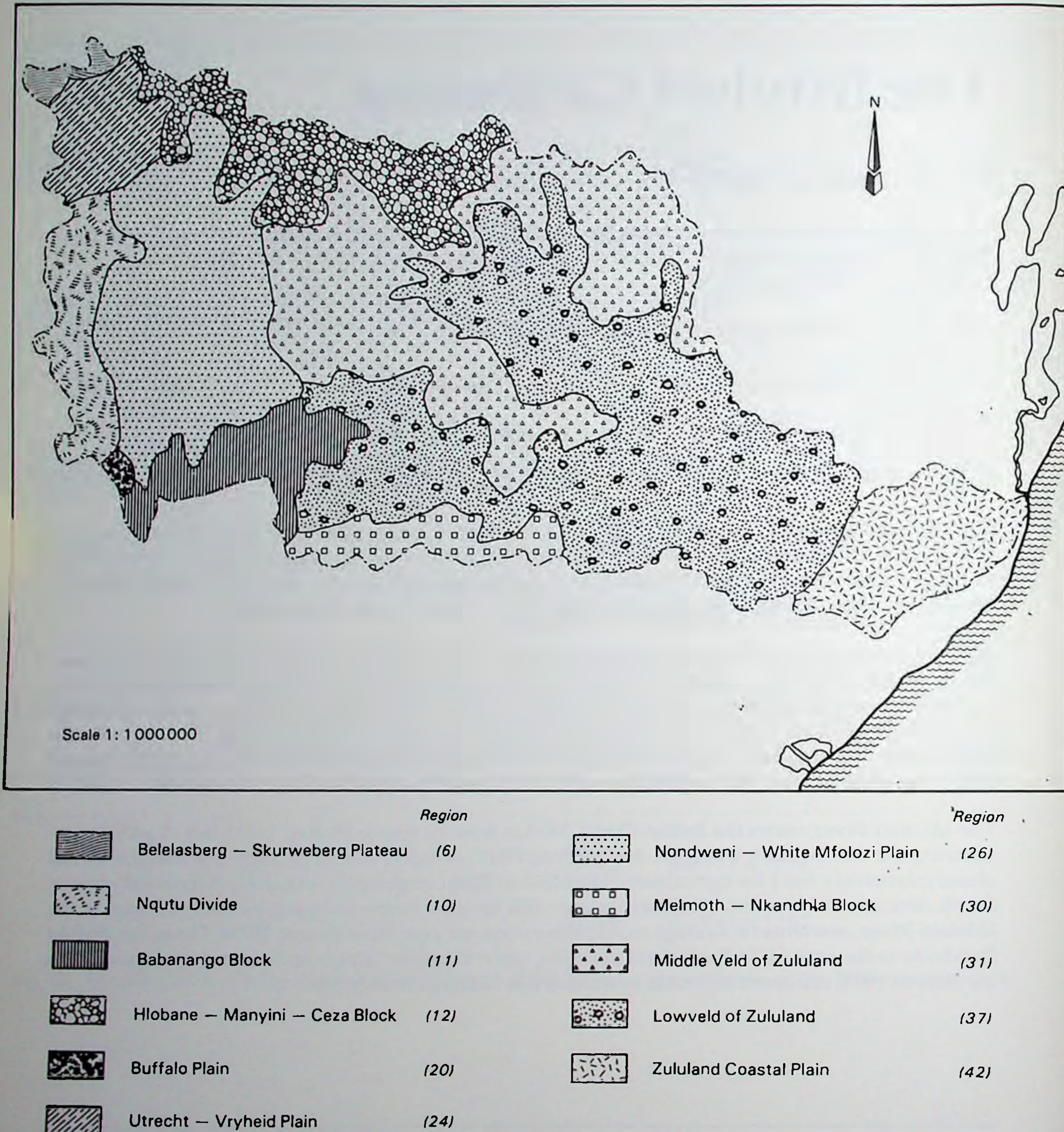


Fig. 4: The physiography of the Mfolozi catchment using the different regions defined by Turner (1967).

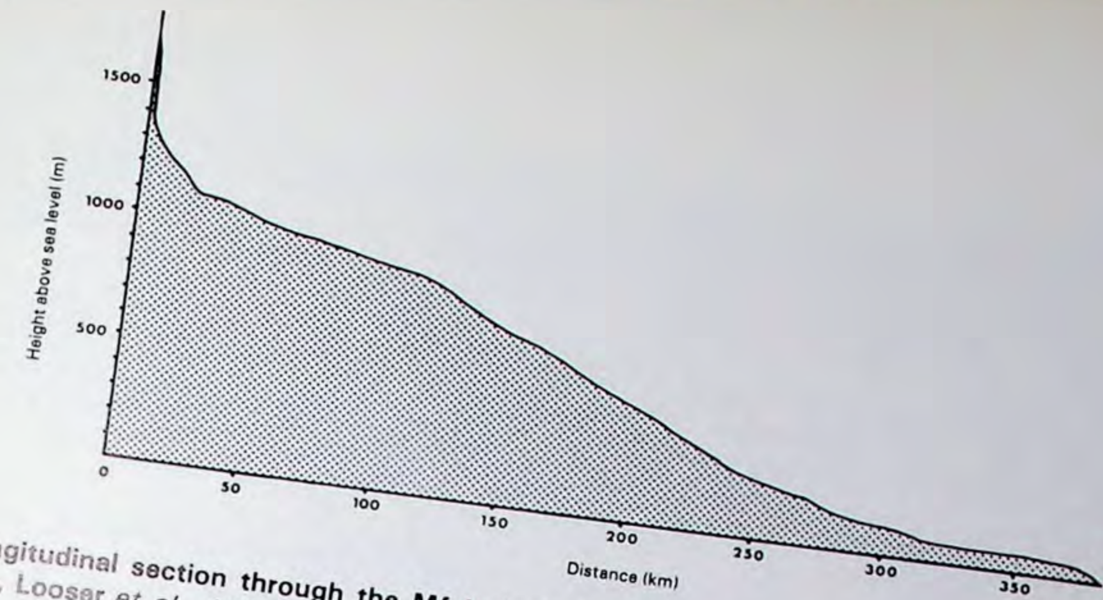


Fig. 5: A longitudinal section through the Mfolozi catchment, showing the approximate profile of the river (after, Looser *et al.*, 1985).

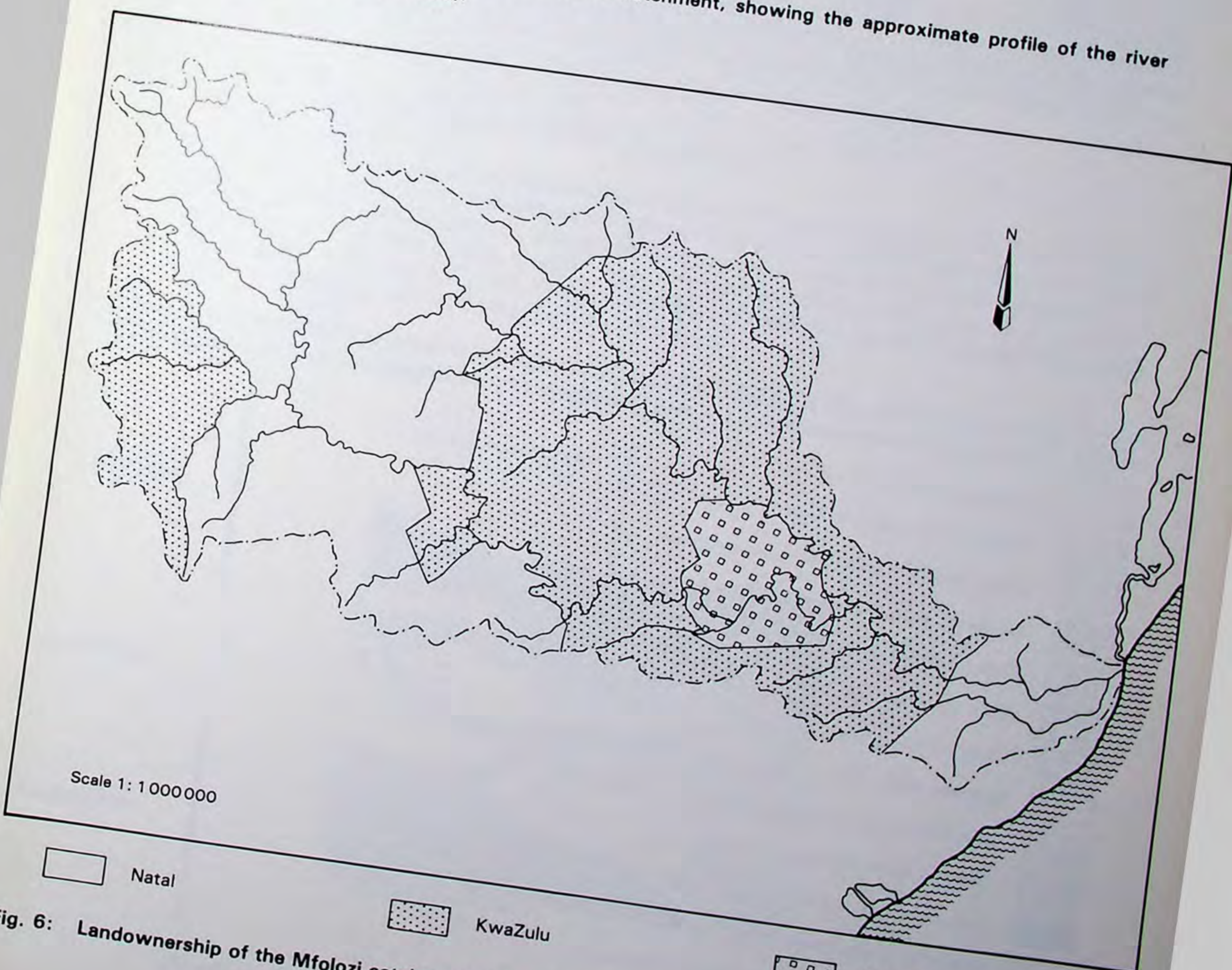
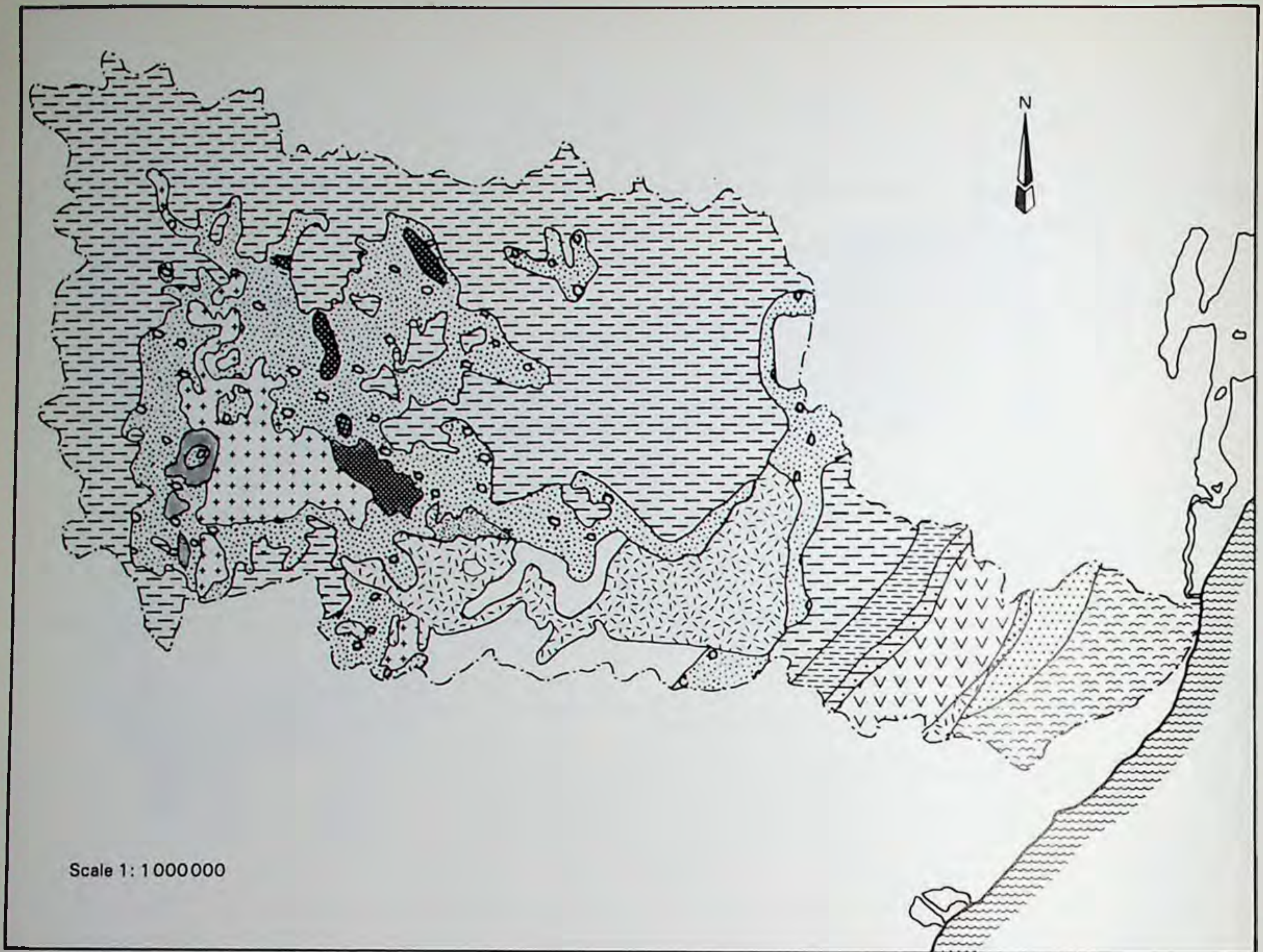


Fig. 6: Landownership of the Mfolozi catchment (after, Looser *et al.*, 1985)



Unconsolidated superficial deposits	TERTIARY TO QUATERNARY	CAINOZOIC
Sandstone, shale, limestone, marl	CRETACEOUS SYSTEM	MESOZOIC
Conglomerate, sandstone, shale, limestone	CRETACEOUS SYSTEM	MESOZOIC
Basalt, limburgite, pyroclasts, minor sandstones	KAROO SYSTEM	MESOZOIC
Sandstone, shale, mudstone, marl, coal	KAROO SYSTEM	MESOZOIC
Shale, mudstone, sandstone, limestone, coal	KAROO SYSTEM	MESOZOIC
Shale, sandstone, grit, coal	KAROO SYSTEM	PALAEOZOIC
Tillite, sandstone, shale	KAROO SYSTEM	PALAEOZOIC
Quartzite, shale, tillite	CAPE SYSTEM	PALAEOZOIC
Migmatite, gneiss, ultrametamorphic rocks		PRECAMBRIAN
Quartzite, shale, lava, conglomerate	PONGOLA SYSTEM	PRECAMBRIAN
Lava, pyroclasts, quartzite, schist	PONGOLA SYSTEM	PRECAMBRIAN
Migmatite, gneiss, ultrametamorphic rocks	KHEIS AND SWAZILAND SYSTEMS	PRECAMBRIAN
Metamorphosed sediments, volcanics and intrusives	KHEIS AND SWAZILAND SYSTEMS	PRECAMBRIAN

Fig. 7: The geology of the Mfolozi catchment using data from the Department of Mines (1970).

2.2 Hydrology

The upper Mfolozi has a high run-off potential (Comrie-Greig and Cooper, 1985) because two-thirds of the catchment consists of shallow soils and impermeable clays (Fig. 8) and overgrazing has generally denuded the area of vegetation (Looser, 1985). En route to the sea the river flows through 10 different veld types and 8 different bioclimatic regions (Figs. 9 and 10).

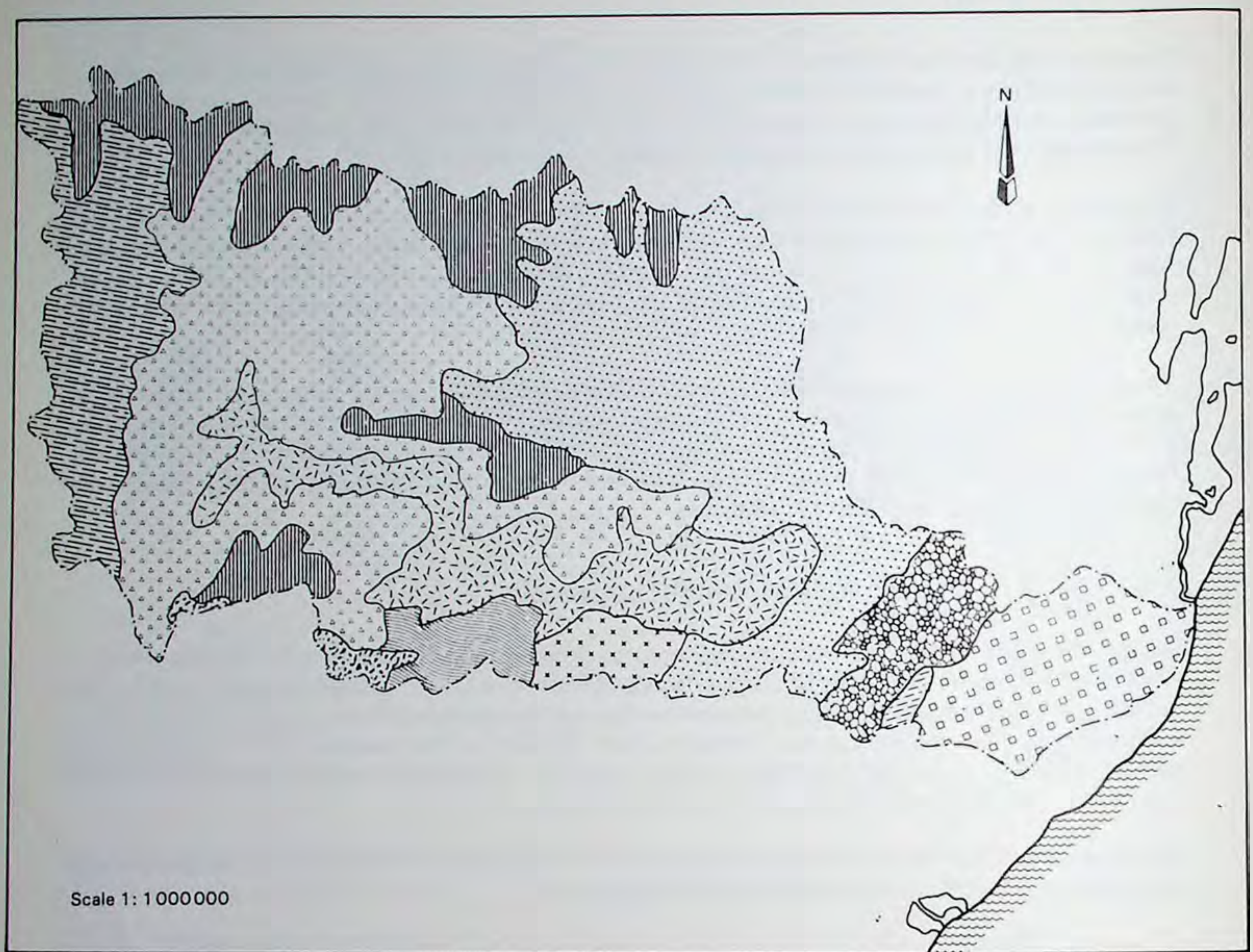
Discharge data have been collected at six gauging stations in the Mfolozi catchment (Pitman *et al.*, 1981), but some of these stations are no longer operative. The information available suggests that the mean annual run-off (MAR) is 887 million m^3, and that it is extraordinarily variable (Fig. 11). The average monthly coefficient of variation for the Mfolozi River is 218% (Perry, 1986), which makes it the highest in this regard of any river in Natal.

The mean annual precipitation for the catchment (Fig. 12) is 849 mm, and although 80% of this falls in the summer months, floods can occur at any time of the year. However, the time of concentration is of relatively long duration, which implies long storm durations are required for the generation of large floods (Looser, 1985). Rainfall is at its highest near the coast, and decreases inland unless the elevation of the area is above c. 1 200 m a.s.l.

2.3 The quaternary sub-catchment approach

Due to the considerable variation experienced in climatic and physiographic conditions within a catchment as large as that of the Mfolozi, a description of the wetland relationships within such terrain is best attempted by sub-dividing the catchment along the watersheds that separate the major river tributaries. The catchment had already been divided in this manner into 43 quaternary sub-catchments by Pitman *et al.*, 1981, (Table 1 and Fig. 13) and this made it possible to localise conditions within the whole catchment far more effectively.

This report has been purposefully structured therefore, to contain a description of the wetlands in each quaternary sub-catchment of the Mfolozi catchment.



Yellow and red apedal, freely drained, dystrophic soils

Yellow and red apedal, humic, freely drained, dystrophic soils

Red structured/apedal, freely drained clays and duplex soils

Yellow and grey hydromorphic, mainly mesotrophic sands/loams with some red clays and duplex soils

Black clays

Black clays, red structured clays and duplex soils

Red clays and duplex soils

Weakly developed soils (lithocutanic B), some duplex and plinthic

Weakly developed soils (lithocutanic B), plinthic and some red/black clays and duplex soils

Weakly developed soils, mainly sandy (lithocutanic B)

Grey and red sands (coastal)

Fig. 8: The generalized distribution of soils in the Mfolozi catchment using data provided by Fitzpatrick (1978).

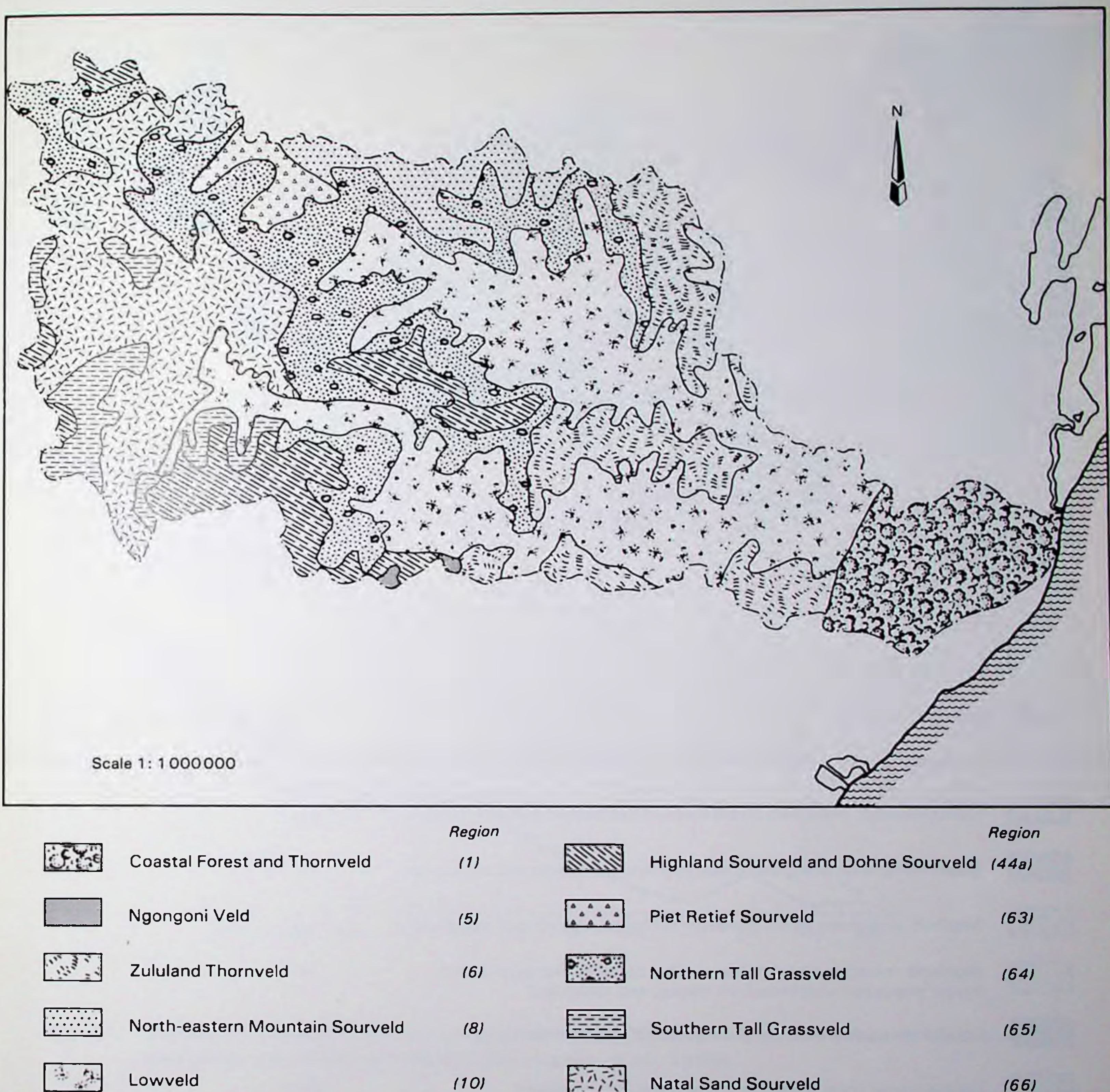
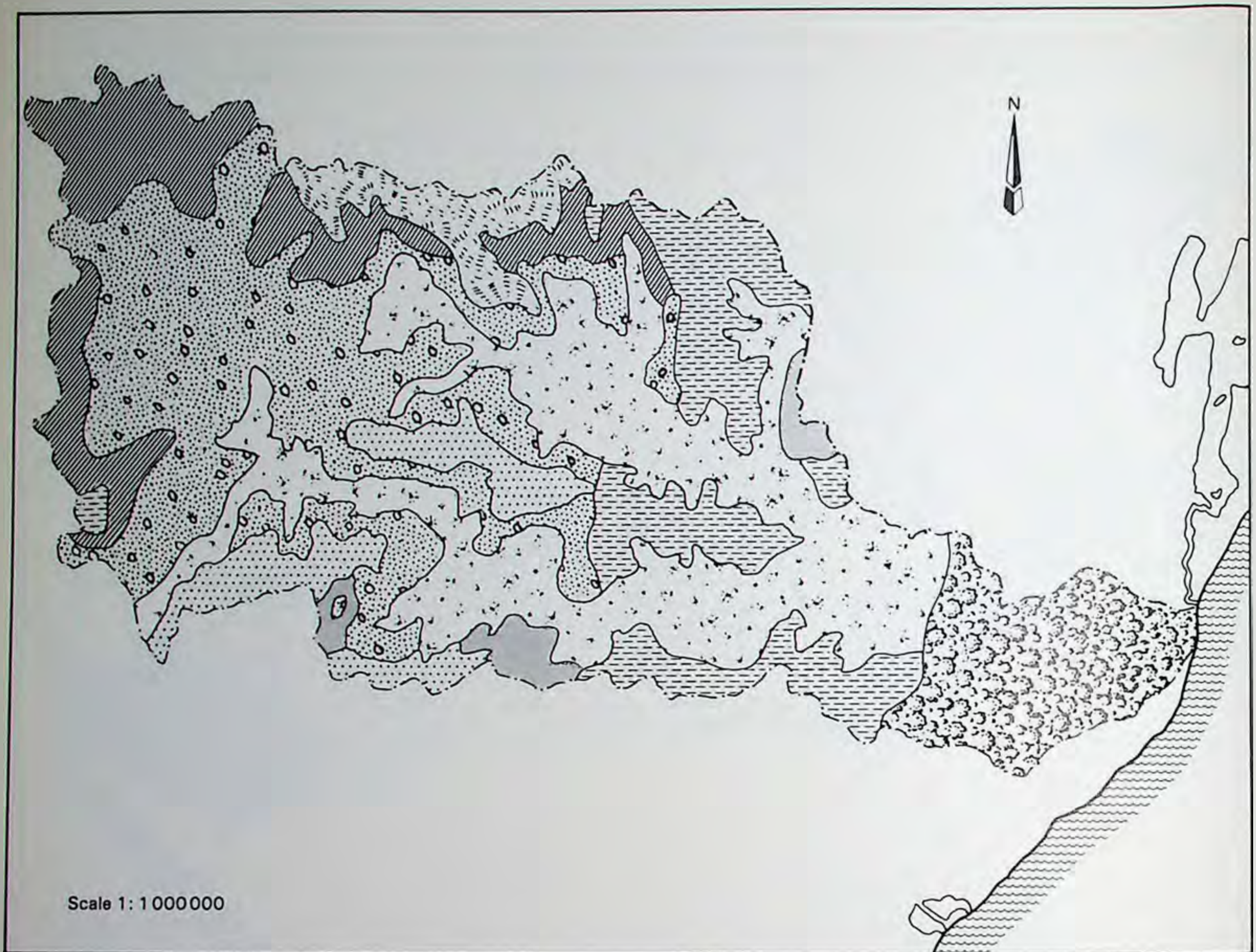


Fig. 9: The vegetation of the Mfolozi catchment according to the veld types defined by Acocks (1953).



		Region
	Coast lowland: evergreen forest medium/tall thicket and woodland	(1)
	Coast hinterland: evergreen forest medium/tall thicket and woodland	(2)
	Mistbelt: evergreen forest, medium/tall forest, thicket and woodland	(3)
	Highland: montane podocarpus – other species, evergreen forest, mixed evergreen short/medium thicket and woodland	(4)
	Upland mixed short thicket and woodland: moister faciation	(6a)
	Upland mixed short thicket and woodland: drier faciation	(8a)
	Lowland to upland mixed short/medium thicket and woodland	(9)
	Riverine and lowland mixed short/medium thicket and woodland	(10)

Fig. 10: The bioclimatic regions of the Mfolozi catchment according to Phillips (1973).

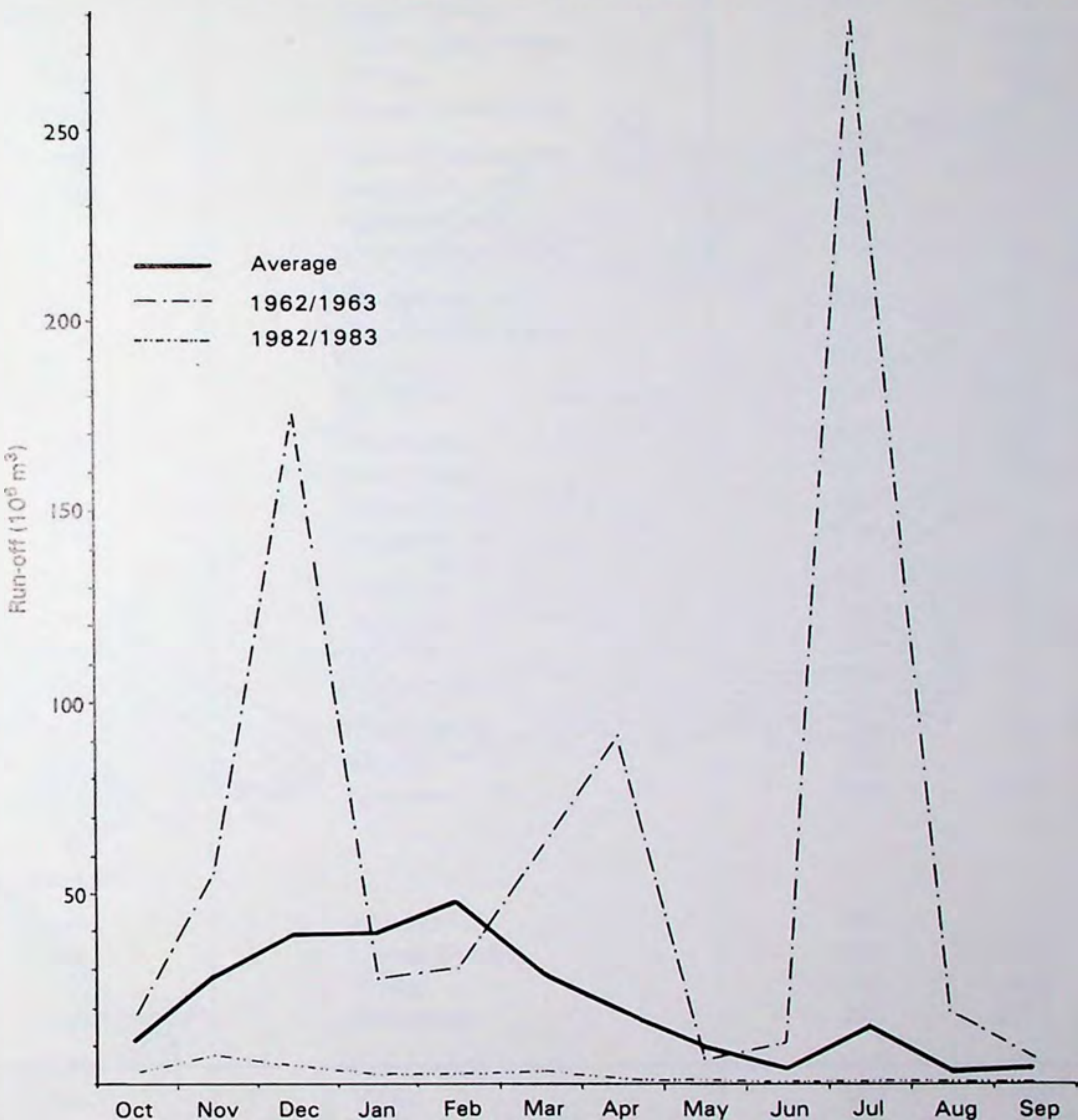


Fig. 11: Variation in monthly run-off at gauging weir W2M05, which is on the White Mfolozi river, in quaternary sub-catchment W233 (after, Looser *et al.,* 1985).

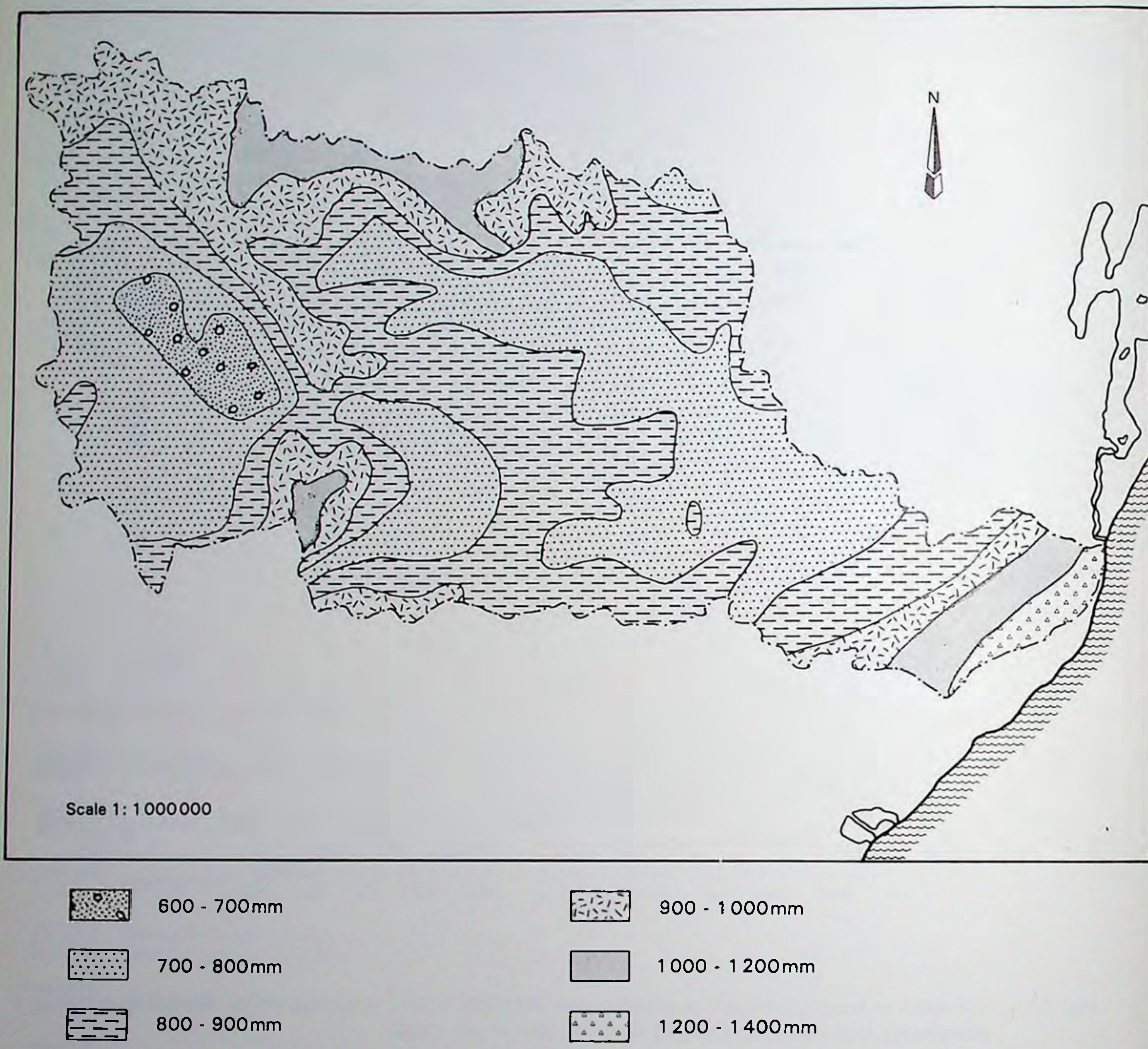


Fig. 12: The mean annual precipitation in the Mfolozi catchment using the data provided by Schulze (1982)

Table 1: An overview of the size, the mean annual precipitation (MAP) and mean annual run-off (MAR) for each of the quaternary subcatchments defined by Pitman *et al.*, (1981) in the Mfolozi catchment.

Quaternary Sub-catchment No.	Name (principal river)	Size (km^2)	MAP (mm)	MAR $x10^6m^3$
White Mfolozi				
W211	Upper White	275	922	30
212	Lower Klipfontein	120	885	12
213	iShoba	235	980	33
214	Upper Sandspruit	270	839	21
215	Lower Sandspruit	130	758	7
216	Lenjane	255	961	34
217	Goederwacht	190	768	12
221	Upper Mvunyana	220	752	12
222	Nondweni	400	752	22
223	Lower Mvunyana	320	738	17
224	Ntinini	300	745	16
225	Nsubeni	355	840	31
226	Mhlahlane	340	809	25
231	Mzinhlanga	165	904	18
232	Mpembeni	230	898	26
233	Mkumbane	170	796	13
234	Mbilane	185	821	15
235	Ophathe	110	806	8
236	Khwibi	245	814	18
237	Nlungwane	275	779	18
238	Munywana	185	801	14
239	Mpafa	140	758	8
262	Mfuyeni	170	760	5
Black Mfolozi				
W241	Hlonyana	340	849	30
242	Upper Black	415	922	53
243	Thaka	210	825	18
244	Skwebezi	205	1094	45
245	Bululwane	285	960	45
246	Vuna	260	849	23
247	Vungu	270	787	18
248	Mbhekamuzi	285	812	20
251	Upper Mona	255	826	26
252	Lower Mona	265	836	30
253	Sizinda	125	763	10
254	Wela	135	799	13
255	Mngeni	305	774	24
256	Mpelenyana	190	782	17
261	Mcacaza	90	750	3
Lower Mfolozi				
W263	Mvamanzi	185	789	6
264	Msunduzi	225	887	11
265	Nkata	240	835	9
266 & 267	Mfolozi	505	1 147	69

White Mfolozi — 23 quaternary sub-catchments

Black Mfolozi — 15 quaternary sub-catchments

Lower Mfolozi — 5 quaternary sub-catchments

43 quaternary sub-catchments

Fig. 13: Sub-division of the Mfolozi catchment into the 43 quaternary sub-catchments defined by Pitman *et al.*, 1981.

Chapter 3

Quaternary Sub-catchment No: W211

Name: Upper White Mfolozi (principal river)
Fig. No: 14

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  275 km^2
- Range in altitude.
  1 665 to 1 100 m above sea level
- Physiographic regions (Turner, 1967).
  region 6 (Skurweberg Plateau)
  region 24 (Utrecht-Vryheid Plain)
- Geology (Geological Survey Dept., pers. comm., Fig 15).
  major bedrock type: Sandstone (Vryheid formation)
  less dominant types: Karoo dolerite
- Soils (Fitzpatrick, 1978).
  Yellow and red apedal, freely drained dystrophic soils (on the plateau); yellow and grey hydromorphic, dystrophic clays (on the plainland).
- Veld types (Acocks, 1953).
  veld type 64 (Northern Tall Grassveld)
  veld type 66 (Natal Sand Sourveld)
- Bioclimatic region (Phillips, 1973).
  region 6a (moist upland region)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 920 mm
  Range (Schulze, 1982): 800 to 1 100 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  30 million cubic metres/year
- Land use (Nanni, 1982).
  White owned farmland, (cattle, maize, wattle) and urban development (Municipality of Vryheid).

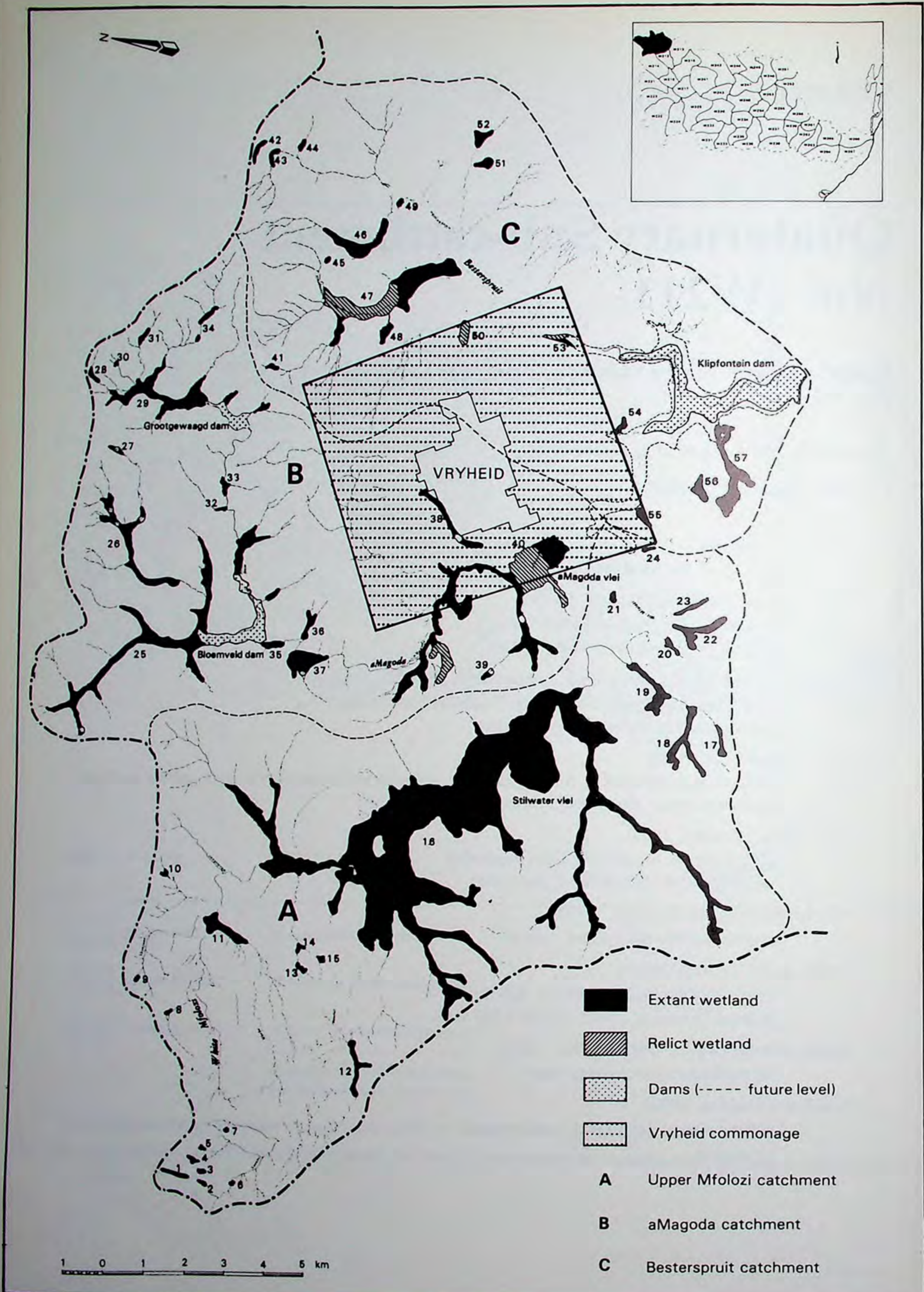
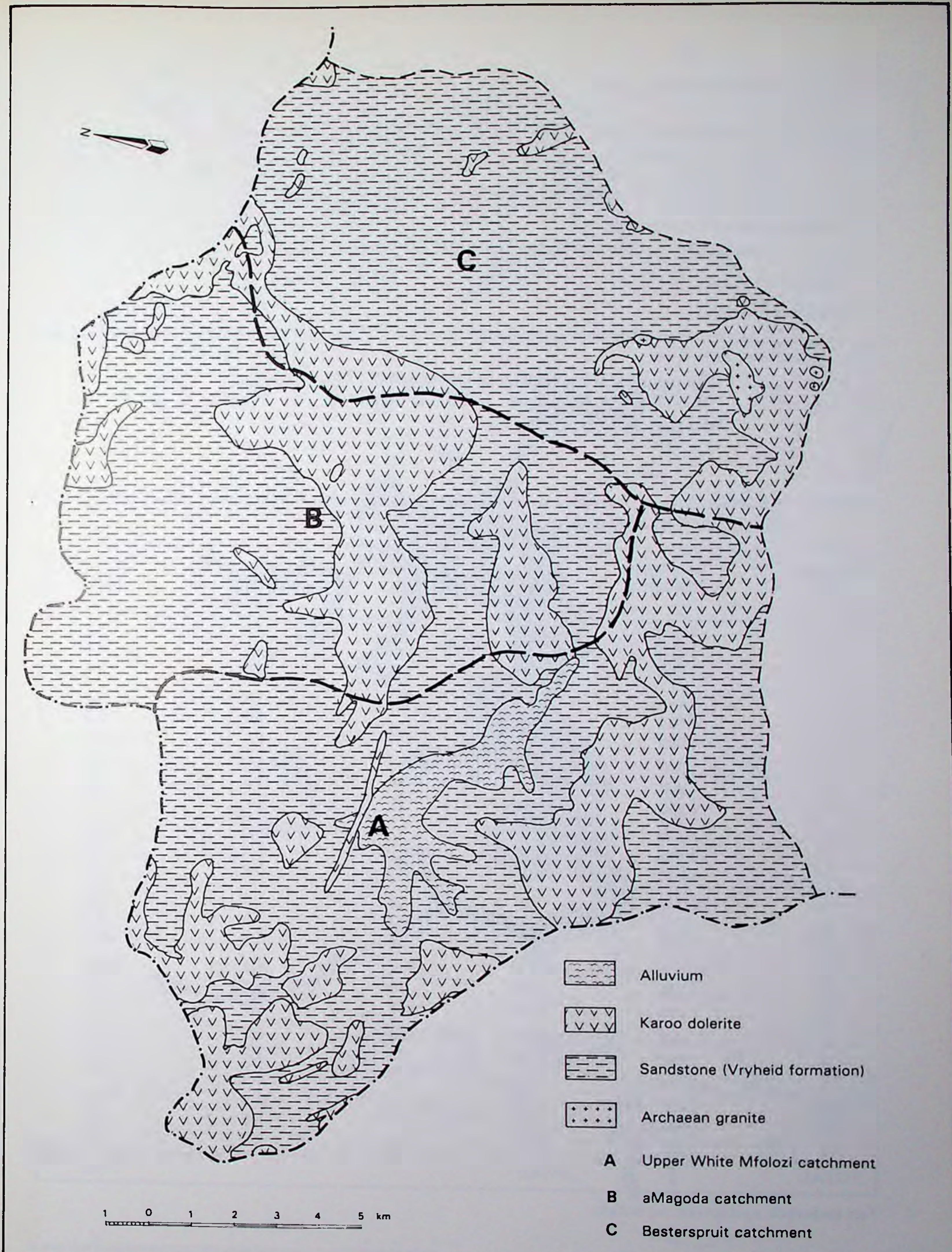


Fig. 14: The distribution of wetlands in quaternary sub-catchment W211. These data were derived from Job 773 of 1976 (see Fig. 3).



Source: Dept. of Geological Survey

Fig. 15: The geology of quaternary sub-catchment W211.

Wetland inventory (Tables 2, 4, 6)

- Wetland distribution (Pre Iron Age)
  No. of wetlands: 57
  Size range: 1 to 1 828 (ha)
  Area of sub-catchment under wetland: 3 052 ha (11,0%)
- Wetland status (at present)
  Area of sub-catchment under wetland: 2 864 ha (10,4%)
- Wetland losses: 188 ha (6%)
- Further details:
  The wetlands of quaternary sub-catchment W211 are best described by sub-dividing the area into three:
  - The catchment containing the source of the White Mfolozi
  - The aMagoda catchment
  - The Besterspruit catchment

Table 2: Variation in the form and catchment inter-relationships of wetlands in the catchment of the Upper White Mfolozi River (Fig. 16).

Wetland No.	Elevation (m a.s.l)	Size (ha)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	1 660	5,0	55	9,0	1,2
2	1 650	2,0	77	9,1	0,4
3*	1 665	2,5	7	33,0	0,4
4	1 660	2,5	25	10,0	0,5
5	1 655	1,0	20	5,0	0,3
6	1 590	1,0	125	6,4	0,2
7	1 660	1,0	12	8,0	0,2
8	1 390	1,5	75	2,0	0,2
9	1 350	1,0	15	6,6	0,2
10	1 360	1,5	12	12,0	0,3
11	1 240	22,0	5 800	0,4	2,9
12	1 240	15,0	10 250	0,3	3,2
13	1 280	2,5	45	5,5	0,6
14	1 255	2,0	142	4,6	0,5
15	1 280	2,0	32	6,1	0,5
16	1 230-1 150	1 828,0	11 700	16,1	84,0
17	1 180	5,0	90	5,5	1,6
18	1 180	25,0	3 025	0,8	5,5
19	1 140	22,0	7 000	0,7	4,0
20	1 130	1,0	45	2,2	1,0
21	1 140	2,5	55	4,5	0,2
22	1 130	22,0	192	11,4	3,5
23	1 140	4,0	127	3,1	1,9
24	1 110	2,5	92	2,7	0,4
TOTAL		1 974,0			114,0

* an endorheic system (i.e. no outlet).

Fig. 16: The distribution of wetlands in the catchment containing the source of the White Mfolozi (see Fig. 14).

3.1 The status of wetlands at the source of the White Mfolozi

The catchment containing the source of the White Mfolozi (Fig. 16) is 106 km^2 in extent. The river rises at an altitude of 1 620 m a.s.l., on the footslopes of the Skurweberg Plateau, and begins its journey to the sea by winding its way south eastwards, over the upper portion of the Utrecht-Vryheid Plain. It reaches the boundary of quaternary sub-catchment W211, 27 km from its source, at an altitude of 1 100 m a.s.l. Assuming the water yield is half of that given by Pitman *et al.*, 1981) for sub-catchment W211 (i.e. 30 million m^3) the mean annual run-off in this area is probably in the order of 15 million m^3 per annum.

Within this catchment there are 24 wetlands, ranging in size from 1 to 1 800 ha (Table 2). There are also many wetlands smaller than 1 ha (at the source of the Mbebe River for example) which, in accordance with the decision referred to in Chap. 1.2.1, were not mapped.

In total 1 974 ha of the area in question is covered by wetland, which is an exceptionally high proportion of wetland cover (18,6%) if compared to the situation elsewhere in the Mfolozi catchment. (Table 52, Chap. 45) and in Natal generally. It suggests that this particular region could be of vital significance in the Mfolozi catchment, from a hydrological point of view.

3.1.1 The Nsonto wetlands (Wetlands Nos. 1-7, Fig. 16)

Form

"The Nsonto wetlands" comprise a group of seven small grassy depressions which lie at the source of the Nsonto River (27° 42'S; 30° 27'E). They occur at elevations ranging from 1 590-1 665 m a.s.l. near the top of the Skurweberg Plateau, in bioclimatic region 4g (montane highland).

Access to the area is extremely difficult, so the following description has been based on an interpretation of aerial photographs, and a visit to a similar wetland which lay on the farm "Wachtenbietjeshoek" in the Pongola catchment.

The Nsonto wetlands range in size from 1 to 5 ha (Table 2) and lie surrounded by Karoo dolerite (Fig. 14). Intersecting barriers of rock which have arrested downward erosion of the Nsonto River, have impeded drainage in the area above, and given rise to these wetlands. The topsoil appeared to contain large accumulations of organic material. This, together with its black colour, and saturated condition, suggest that soils of the Champagne form (MacVicar *et al.*, 1977) occur. However, the soil depth and underlying sub-soil (which was presumably gleyed) could not be ascertained.

Macroclimate

With reference to the data provided by Schulze (1982) and Phillips (1973) the macroclimate of this region is indicated in the table below :

• mean annual precipitation	=	over 1 000 mm	(c. 20% in winter, and frequent mists)
• relative humidity	=	65-70 %	
• temperature			
mean annual	=	15 °C	
		Maximum (°C)	Minimum (°C)
mean daily	=	22	7
extreme daily	=	35	-11 (severe frost)
• mean annual potential evaporation	=	1 700 mm	

Hydrology

Streamflow in this area has never been measured, and so there are no data to substantiate the following observation. However, judging from the saturated condition of the wetland observed on the farm "Wachtenbietjeshoek", and the volume of the outflowing water downstream at the height of the dry season (pers. obs., 31 July 1986) it could be inferred that with the exception of wetland No. 3, which is endorheic, the Nsonto wetlands have a high potential to sustain the baseflow of streams in this portion of the catchment. The most important could be wetlands Nos. 1, 4 and 7 (Fig. 16) since the proportion of wetland cover in the catchments of these wetlands (Table 2) is over 8%.

Vegetation

The Nsonto wetlands are surrounded by short grassland of the "North-east Mountain variety" (Acocks, 1953). This forms a low, but dense cover of grass which is typical of cold, wind-swept areas. The following hygrophilous plants were found in the wetland visited on the farm "Wachtenbietjeshoek".

Submerged species

Potamogeton
Nitella (Characeae)

Herbs

Helichrysum sp.
Alchemilla natalensis
Limnosella sp.

Grasses

Eragrostis curvula
Agrostis huttoniae
Arundinella nepalensis

Sedges

Cyperus distans
Scirpus fluitans
Juncus sp. (two varieties)

Land ownership

All of the Nsonto wetlands occur on privately owned land (Dicks, pers. comm.*).

Land use

The land surrounding the Nsonto wetlands comprises natural veld which is subjected to a low intensity of grazing by cattle, and periodic burning.

Most of the wetlands are in an undisturbed condition. The only signs of alteration are within wetlands Nos. 2 and 8, where small dams have been constructed.

Conclusions

Although unsubstantiated because of the lack of any concrete evidence, from a conservation point of view it is probable that the importance of the Nsonto sponges lies in their hydrological influence on stream flow regulation and yield of high quality water. The effectiveness of small headwater wetlands in this respect has been demonstrated by Gucinski (1978) and Garbisch (1977 in Morant, 1981). They also support a distinctive flora, infrequently encountered elsewhere in the Mfolozi catchment. Their relatively undisturbed condition is noteworthy.

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* R J Dicks: Technician, Department of Agriculture and Water Supply, Vryheid.

Sources of information

Maps: 1:50 000 sheet 2730 DA Nkambule

Aerial photographs:

Year	Job	Scale	Strip No.	Photo No.
1944	73	1:18 000	35	6673
1953	327}			
1961	455}	1:36 000	No record	
1969	607}			
1976	773	1:30 000	11	8125-8127

3.1.2 Stilwater Vlei (Wetland No. 16, Fig. 16)

Form

Stilwater vlei comprises an enormous wetland which is centred upon co-ordinates 27°47'S; 30° 44'E, and extends for 11,5 km^2 in a northwesterly direction, along either side of the White Mfolozi, and several of its tributary streams (Plate 1).

The perimeter of the vlei is 84 km and its area is 1 828 ha. The overall slope of the vlei is 0,7%, but there is considerable variation in slope. For example, the slope of the wetland is much steeper in the Msolongo, Ntobane and uMvuzane portions of the Stilwater system.

Plate 1: A view of Stilwater vlei (arrowed) which is the largest wetland in the upper catchment of the White Mfolozi River.

Stilwater vlei is surrounded by sandstone of the Vryheid formation (Fig. 14), but the system largely owes its existence to a sill of Karoo dolerite which intersects the White Mfolozi, at the outlet (or keypoint) of the vlei, near its confluence with the uMvuzane River. Another important geological feature, particularly for the Msolongo portion of Stilwater vlei, is a narrow dolerite dyke which cuts across the Mfolozi River shortly above its confluence with the Nsonto, thus creating a second keypoint within the Stilwater vlei system.

The White Mfolozi River lies on the eastern edge of the vlei, and as a result, low, flood-deposited levees have formed in the vicinity of the river channel. The soils in this zone are alluvial in nature, whereas elsewhere, soils of the Katspruit form have been shown to occur. These do not have marked organic matter accumulations in the topsoil, and because the gleyed clayey sub-soil is alkaline in nature, soils of the Killarney series are involved (Swart, pers. comm.*).

Macroclimate

With reference to the data provided by Schulze (1982) and Phillips (1973) the macroclimate of this region is indicated in the table below :

• mean annual precipitation	=	900 mm	(c. 20% in winter, mist common)
• relative humidity	=	65 %	
• temperature			
mean annual	=	16,5 °C	
		Maximum (°C)	Minimum (°C)
mean daily	=	25	-11
extreme daily	=	41	-10
• mean annual potential evaporation	=	1 650 mm.	

The nearest weather station (ref. 372/467) is at Vryheid, with records dating back to 1906.

Hydrology

Apart from the flood peak measurements made during the 1984 Domoina floods (Kovacs *et al.*, 1985), streamflow in the upper reaches of the White Mfolozi has never been gauged. Thus inflow data, groundwater data and information on the variability of run-off are not readily available.

However, the high water table which is reported to underlie Stilwater vlei (Swart, pers. comm.) is a persistent feature of the system. This, together with the presence of hydromorphic soils, indicates that a significant storage of water, and slowing down in the movement of water occurs in this portion of the catchment. In certain places the water table comes to the surface and creates zones which are permanently waterlogged.

Stilwater vlei receives run-off from a catchment of 117 km^2, within which the proportion of wetland cover (15,6%) is exceptionally high. This reinforces the likelihood that water storage may be a significant attribute of the vlei.

Although the Mfolozi River is contained within a relatively deep channel (stream order 4), which meanders through the vlei, the pattern of drainage in the Msolongo, uMvuzane and Ntobane extensions is considerably more diffuse. The overall impression gained is that the system functions

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* Mr L Swart: Head of Landbouskool, Vryheid.

effectively from the point of view of attenuation processes, such as sediment interception and flood peak reduction.

For example, after the rainfall associated with Cyclone Domoina when 475 mm of rain were recorded at Vryheid, this portion of the catchment had to contend with a flood volume of 102 million m^3, and peak discharges of 1 000 m^3 sec (Kovacs *et al.*, 1985). During this event, Stilwater vlei was covered by water 0,5 m deep (de Jager, pers. comm.*), but there was no evidence of damage in the wetland after the floodwaters subsided.

Fauna and flora

The vegetation covering Stilwater vlei is a grassland community of dryland species, but this is a result of the alteration that has taken place over the years because of various agricultural practices, mainly related to pasture production. Large portions of the vlei are used as irrigated pastures (of Midmar rye) and are grazed intensively by cattle. These pressures may have resulted in a proliferation of palatable grasses, and a reduction in the amount of natural sedge and hygrophilous grass species.

Along the course of the Mfolozi River, wattle trees have become established, and in certain areas willows and poplars occur. Elsewhere the vegetation alongside the drainage lines and tributaries comprises "broom grass" (*Miscanthus sorgum*) and the occasional bullrush (*Typha latifolia*), but in the main body of the vlei the following grasses and sedges were found.

Grasses	Sedges
Andropogon eucomis	*Pycreus flavescens*
Paspalum urvillei	*Juncus sp.* (two varieties)
Arundinella nepalensis	*Scirpus sp.*
Eragrostis curvula	*Fuirena* (*pubescens*?)
Setaria sphacelata	

The uniformity of the plant community, the lack of open water and the intensive agricultural activities suggests that wildlife are unlikely to make much use of Stilwater vlei. Despite this, 41 species of wetland associated birds have been recorded in the area (Table 3) notable amongst which are varieties commonly found in open areas characterized by short grass.

Land Tenure

Stilwater vlei is privately owned by 23 persons (Fig. 17). This could complicate its management because co-operation between landowners is a prerequisite for the successful implementation of any planned works, and "the fact that wetlands may extend across several farm boundaries creates a major problem for both planners and farmers...."(Scotney and Wilby, 1983).

Land use

The land surrounding the Stilwater vlei is principally used for timber (wattle and pine), agriculture (maize) and the grazing of cattle.

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* Mr S de Jager: Zone Officer, Natal Parks Board, Vryheid.

Table 3: Occurrence of wetland associated birds from Stilwater vlei (from data provided by S de Jager, pers. comm.).

Reed cormorant	Ethiopian snipe
Blackheaded heron	Grass owl
Yellowbilled egret	Marsh owl
Cattle egret	Giant kingfisher
Hamerkop	Malachite kingfisher
White stork	European swallow
Sacred ibis	Whitethroated swallow
Bald ibis	Grassbird
Yellowbilled duck	Fantailed cisticola
Redbilled teal	Levailants cisticola
Spurwinged goose	Cape wagtail
African marsh harrier	Richards pipit
Swainsons francolin	Orangethroated longclaw
Common quail	Red Bishop
Crowned crane	Golden Bishop
Redknobbed coot	Redcollared widow
Crowned plover	Quail finch
Blackwinged plover	Pintailed whydah
Blacksmith plover	Yellowrumped widow
Wattled plover	Longtailed widow
	Common waxbill
	(41 species)

Farming activities within the vlei, have brought about varying degrees of disruption as listed below and shown in Plate 2.

	Perceived severity of problem*
• grazing	2
• burning	1
• pasture production	2
• crop production	1
• afforestation (poplars)	1
• mowing	2
• water abstraction (irrigation)	1
• ditching (see 1:50 000 maps)	2
• road construction	1
• rail construction	1
• dam construction	1

* 1 = moderately serious
2 = serious
3 = very serious

With respect to established dams as a "problem", it should be noted that the dams in question have been populated by numerous waterfowl. This has bestowed a recreational value upon the Stilwater system, in the form of duck hunting, which it formerly did not have (de Jager, pers. comm.).

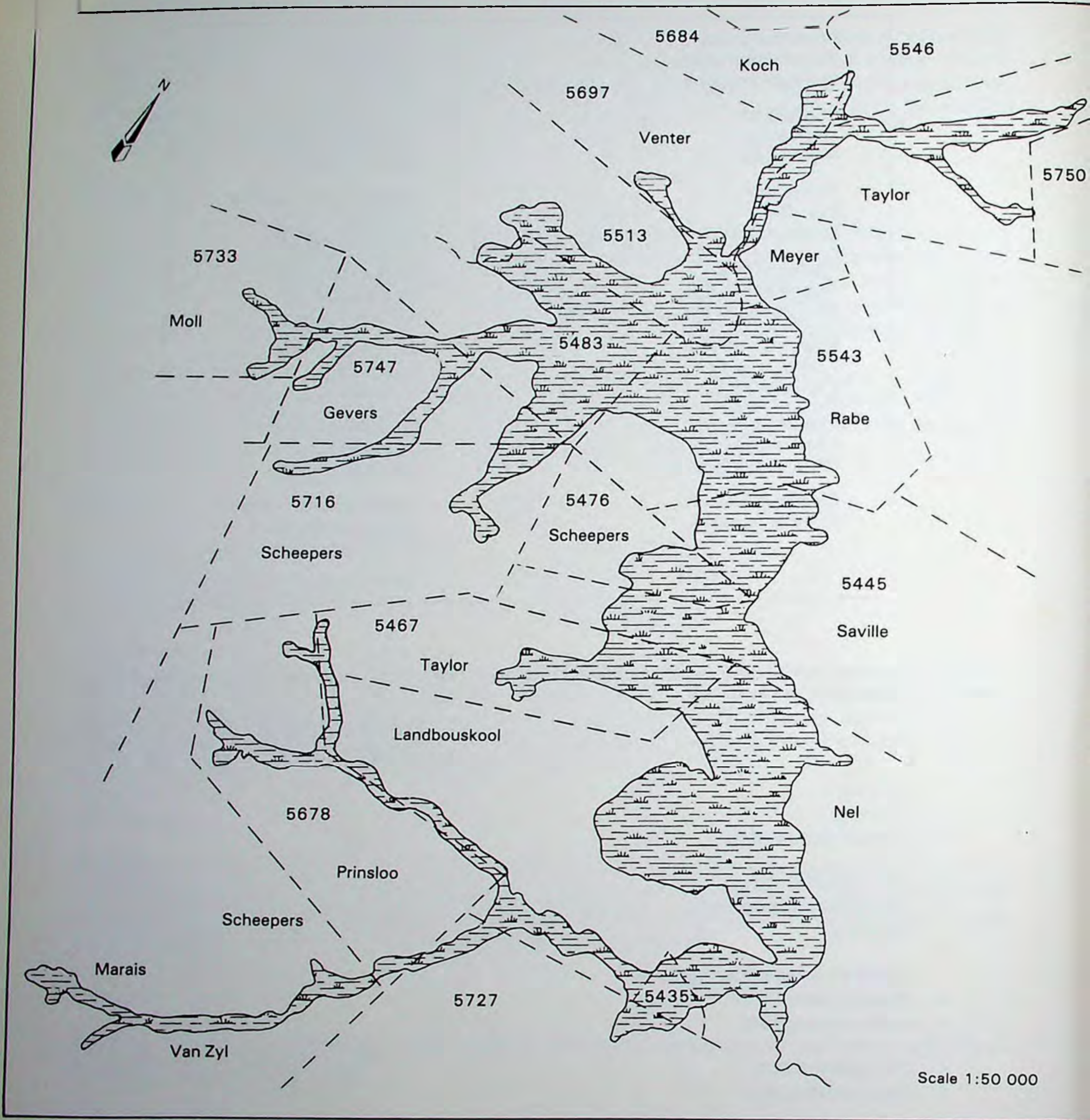

Fig. 17: Land ownership of Stilwater Vlei, showing the identification number of the farm (according to the local Extension Officer) and, where known, the owner's name.

Plate 2: The state of the uMvuzane portion of the Stilwater vlei after burning it in July. When burnt too early in the dry season (as in this case), the intensity of the fire can damage the roots of the vlei vegetation, and Cyperaceae are particularly susceptible since their large fibrous roots become excellent fuel when dry. However, in all likelihood this is done to protect the wattle plantations from fire. The fire resistant "broom grass" alongside the stream course (*Miscanthus sorgum*) is typical of the vleis in this area.

It should also be noted that in 1944 an extensive amount of cultivation within the vlei was evident (Job 73 of 1944 refers, App. 3) as well as signs of erosion and desiccation. By comparison, the situation today seems vastly improved, possibly because of the shift to pasture utilization.

Conclusions

Based on the above subjective conclusions, it is recommended that an integrated land use plan incorporating all of the farms shown in Fig. 17 is prepared by the Department of Agriculture and Water Supply, and that a concerted effort is made to ensure that the farmers in question work according to the plan in close consultation with the aforesaid Department.

Finally, very little is known about Stilwater vlei, and for a system of such potential, this situation should be remedied as soon as possible. In order to detect any signs of change at the earliest opportunity, land use within the vlei should be monitored regularly, by photographing it from the air, and research encouraged which is pertinent to its management. For example, the gauging of streamflow at the keypoint would be extremely valuable, as would a thorough survey of the soils of Stilwater vlei. This information would enable land uses to be tailored according to these soil forms and thus safeguard hydrological functions of the vlei that may be of wide regional significance.

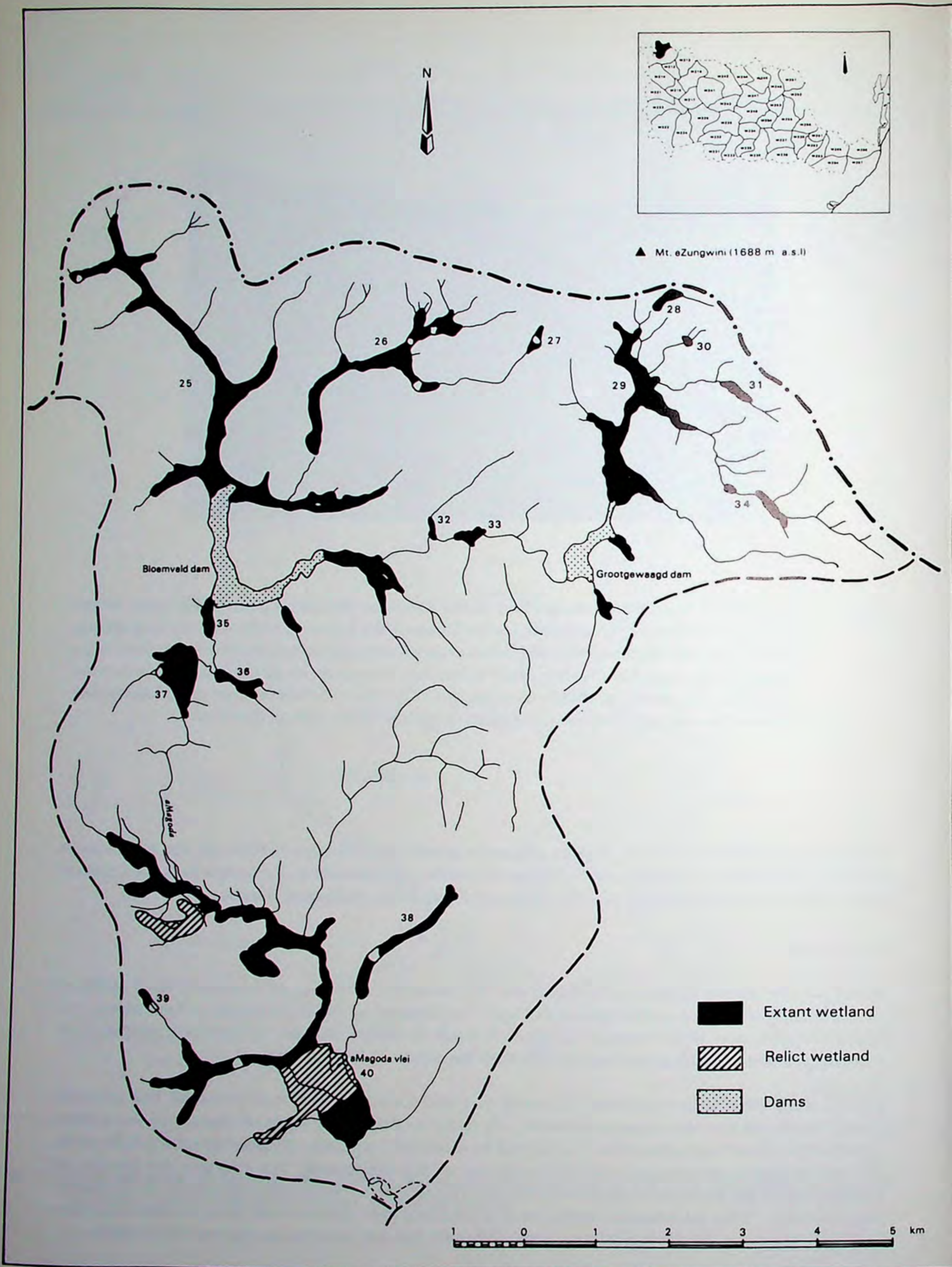

Fig. 18: The distribution of wetlands in the aMagoda catchment (see Fig. 14).

Sources of information

Maps: 1:50 000 sheet 2730 DC Kingsley
2730 DA Nkambule

Aerial photographs:

Year	Job	Scale	Strip No.	Photo Nos.
1944	73	1:18 000	35	6664-6669
			36	6704-6708
			37	6748-6753
			38	No record
1953	327}			
1961	455}	1:36 000	No record	
1969	607}			
1976	773	1:30 000	11	8129
			12	8819
			13	8224

3.2 The status of wetlands in the aMagoda catchment

That portion of the quaternary sub-catchment W211, hereafter referred to as the aMagoda catchment (Fig. 18), is 106 km^2 in size. It contains two important dams, Bloemveld and Grootgewaagd, both of which serve as municipal water supplies for the town of Vryheid in Northern Natal (population 86 000). The aMagoda catchment occupies 38% of quaternary sub-catchment W211, which suggests that the run off may be in the order of 11,5 million m^3 per year.

The aMagoda River rises at an altitude of 1 650 m a.s.l. on the edge of Mt. eZungwini (height 1 688 m a.s.l), before flowing westwards towards the White Mfolozi River. It joins the White Mfolozi outside Vryheid shortly after passing through a large wetland, known as the aMagoda vlei (see Chap 3.2.3).

Within the aMagoda catchment 16 wetlands which ranged in size from 1 to 330 ha were located. Prior to any wetland degradation occuring 734 ha (8,9%) of the catchment was covered by wetland (Table 4). Since then 125 ha (17%) have been lost for various reasons, thus reducing the present amount of wetland cover to 7,4%.

3.2.1 *Bloemveld vlei (Wetland No. 25, Fig. 18)*

Form

Bloemveld vlei (27° 42'S; 30° 45'E) comprises four partially separated wetlands surrounding the Bloemveld Dam, which prior to its construction in 1964, were parts of the same wetland system. Until recently, the "Reed Valley" portion of Bloemveld vlei (Fig. 19) was also a dam. The wall was breached in 1984 by the floods associated with cyclone Domoina (de Jager, pers. comm.), thus exposing the present vlei area in the process.

The slope of the land within Bloemveld vlei varies considerably according to location, but along most of its length, gradients are in order of 1,2%. The vlei receives the run-off from a catchment 5 700 ha in size, but a large proportion of this (27%) incorporates the Grootgewaagd catchment, which contains Grootgewaagd vlei (described in Chap. 3.2.2) and eight other smaller wetlands. In total, the ten wetlands involved occupy over 335 ha (5,8%) of the catchment, but of this 53% is accounted for by Bloemveld vlei alone.

Table 4: Variation in the form and catchment inter-relationships of the wetlands in the aMagoda catchment (Fig.18).

Wetland No.	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
25	178,0	178,0	-	5 700	5,9*	27,0
26	55,0	55,0	-	900	6,4*	9,0
27	2,5	2,5	-	60	4,1	0,8
28	3,2	3,2	-	30	10,8	0,9
29	81,5	81,5	-	1 577	6,0*	11,5
30	1,0	1,0	-	25	4,0	0,2
31	3,5	3,5	-	52	6,6	1,0
32	2,0	2,0	-	167	1,2	0,5
33	3,5	3,5	-	2 050	4,7	1,2
34	5,0	5,0	-	200	2,5	2,0
35	6,0	6,0	-	5 750	5,9*	1,1
36	7,5	7,5	-	127	5,8	1,8
37	35,0	35,0	-	6 350	5,9*	3,0
38	17,0	12,0	29	325	3,7	3,3
39	3,5	3,5	-	37	9,3	0,7
40	330,0	210,0	36	10 325	5,9*	29,0
TOTAL	734,0	609,0				93,0

* includes upstream wetlands.

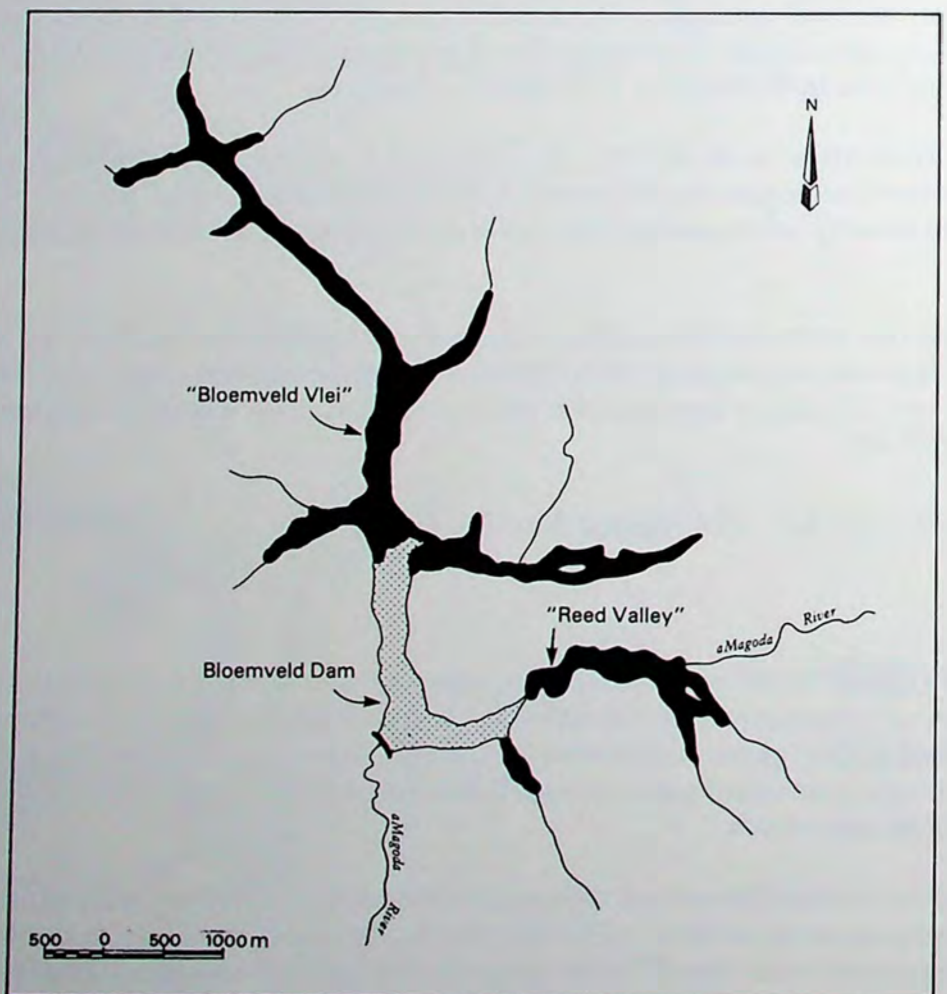

Fig. 19: The form of the Bloemveld Vlei system.

Bloemveld vlei has formed behind a sill of Karoo dolerite which intersects the aMagoda River, has arrested downward erosion of the channel and impeded drainage in the bottomlands of the valley above it. This 'keypoint' of the system was selected for siting of the dam wall.

In most areas, the soils of Bloemveld vlei are of the Katspruit form, which means that the accumulation of organic matter in the topsoil is not marked and the subsoil comprises a gleyed mottled clay. Soil of the Champagne form (i.e. richly organic topsoil) appears to occur in the "Reed Valley" portion of Bloemveld vlei.

Macroclimate

The macroclimate of this region is similar to that described for Stilwater vlei (see Chap. 3.1.2).

Hydrology

Despite the location of two municipal dams in the aMagoda catchment, no data are available on inflow or outflow from the dams (Olivier, pers. comm.). However, by the end of the recent drought in 1983 the Bloemveld Dam (with a capacity of 2 275 megalitres) was almost dry. It filled again, virtually overnight, after Cyclone Domoina.

Upstream of the dam, much of the wetland is used for crop production. The inflowing river (stream order 3) lies within a channel throughout the vlei, which suggests that overall, little opportunity for attenuation occurs. Added to this, the catchment is densely covered by timber plantations, which almost certainly diminish the water yield (Bosch and Hewlett, 1982).

The situation described above, is not the case in the "Reed Valley" portion of Bloemveld vlei which, although only 26 ha in size, is in far better condition, and outwardly appears to have a good attenuation rating. In other words, a potential for flood peak reduction, sediment reduction and water purification, are all probable attributes of the system in its present condition (Plate 3).

Plate 3: The "Reed Valley" portion of Bloemveld vlei.

All of these functions would be of vital significance to the municipal water supplies which lie below these wetlands, but an awareness of this, in the Vryheid Town Board appears to be lacking (pers. obs.).

Fauna and flora

The vegetation cover in the Bloemveld vlei varies greatly from one location to the next, depending on the degree of agricultural disturbance. However, in the undisturbed areas, such as the "Reed Valley" basin, large tracts of reeds (*Phragmites*), bullrushes (*Typha*), grasses (*Miscanthus*) and sedges (*Mariscus* and *Scirpus* sp.) occur. Other grasses noted include *Cymbopogon validus* and *Arundinella nepalensis*, and on the edges of the vlei herbs such as *Cliffortia linearifolia*.

The data in Table 5 accounts for the high value presently attributed to the area from an ornithological point of view.

Table 5: A list of birds* regularly associated with wetlands in the aMagoda catchment (from data provided by S de Jager, pers. comm.).

Column A = wetlands adjoining Bloemveld system
Column B = wetlands adjoining Grootgewaagd system
Column C = wetlands adjoining aMagoda system

	A	B	C
Greater crested grebe	•		
White breasted cormorant	•	•	
Reed cormorant	•	•	
Darter	•	•	
Grey heron	•	•	
Black headed heron	•	•	•
Goliath heron	•		
Great white egret	•	•	
Yellowbilled egret	•		
Cattle egret	•	•	•
Hamerkop	•	•	•
White stork			•
Sacred ibis	•	•	•
Bald ibis			•
African spoon bill	•	•	
Whitefaced duck	•	•	
Egyptian goose	•	•	•
Yellowbilled duck	•	•	•
African black duck	•	•	•
Redbilled teal	•	•	•
Cape shoveller	•		
Southern pochard	•		
Spurwinged goose	•		•
African marsh harrier	•		•
Swainsons francolin	•	•	•
Common quail		•	
Blue crane	•	•	
Crowned crane	•		
Black crake		•	
Moorhen	•		
Common waxbill		•	•
Orange breasted waxbill			•
Pintailed whydah	•	•	•

	A	B	C
Redknobbed coot	•	•	
Threebanded plover	•	•	
Crowned plover	•		•
Blackwinged plover	•	•	•
Blacksmith plover	•		•
Wattled plover	•	•	•
Common sandpiper	•		
Wood sandpiper	•		
Marsh sandpiper	•		
Greenshank	•		
Ethiopian snipe	•	•	
Spotted dikkop			•
Pied kingfisher	•		
Giant kingfisher		•	•
Malachite kingfisher	•		•
Rufousnaped lark	•	•	•
Redcapped lark		•	
European swallow	•	•	•
Whitethroated swallow	•	•	•
African marsh warbler		•	
African sedge warbler			•
Grassbird	•		•
Levailants cisticola	•	•	•
Cape wagtail	•	•	•
Richards pipit	•	•	
Orangethroated longclaw	•	•	•
Yellowthroated longclaw	•	•	•
Red bishop	•	•	•
Golden bishop	•		
Redshouldered widow	•	•	•
Redcollared widow	•	•	•
Longtailed widow	•		•
Quail finch	•		•

TOTAL A = 55 species
B = 39 species
C = 36 species

* excluding opportunistic species.

Land Tenure

Bloemveld vlei is owned by eight different farmers and the Vryheid Town Board (Fig. 20).

Land use

The land surrounding Bloemveld vlei is used for timber (wattle and pine), agriculture (maize) and the grazing of cattle.

Apart from the construction of the Bloemveld Dam, which inundated 60 ha of the original vlei (1944 aerial photography refers), various other forms of man-induced disruption are evident. These include:

	Perceived severity of problem*
• ditching (furrows)	2
• grazing	2
• crop production	3
• burning	2
• road construction	1
• farm dam construction	1

* 1 = moderately serious
2 = serious
3 = very serious

The Bloemveld Dam is a recreational asset, being used for motorboating, water-skiing and fishing.

Conclusions

The value of Bloemveld vlei is intimately linked to the value of the dam as a municipal water supply, because it should be clear that any natural system which positively influences factors such as water quantity and quality, is of economic and hydrologic importance. Steps should be taken, therefore, to halt further deterioration of the vlei upstream of the dam, and the "Reed Valley" portion should be managed as a municipal nature reserve.

Sources of information

Maps: 1:50 000 sheet 2730 DA Nkambule
2730 DB Hlobane

Aerial photographs:

Year	Job	Scale	Strip No.	Photo Nos.
1944	73	1:18 000	34	6625-6623
			35	6661-6664
1953	327}			
1961	455}	1:36 000	No record	
1969	607}			
1976	773	1:30 000	10	8792
			11	8130

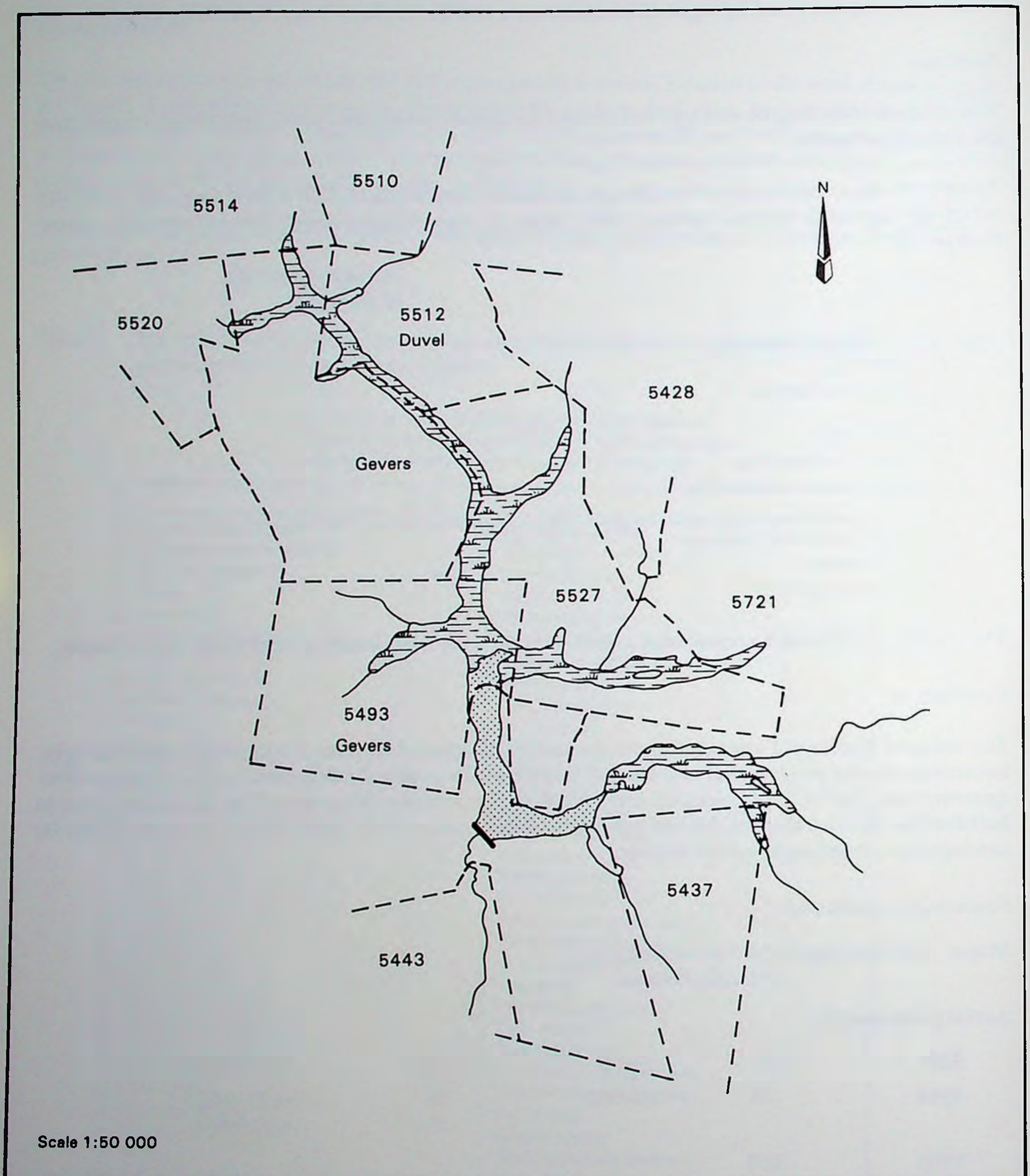

Fig. 20: **Land ownership of the Bloemveld vlei, showing the identification number of the farm (according to the local extension officer) and, where known, the owner's name.**

3.2.2 *Grootgewaagd vlei (Wetland No. 29, Fig. 18)*

Form

Grootgewaagd vlei (27° 42'S; 30° 49'E) comprises a 75 ha wetland, which extends along the floor of various feeder valleys upstream of the Grootgewaagd Dam (Plate 4). The catchment under consideration (1 577 ha) contains the headwaters and source of the aMagoda River, and, apart from Grootgewaagd vlei, includes four other smaller wetlands (Nos. 28, 30, 31 and 34) which occupy more high-lying terrain. Overall the amount of wetland cover in the area is 6%.

The Grootgewaagd Dam (built in 1948) is 25 ha in size. An impression of the former wetland basin prior to the dam, can be obtained from 1944 aerial photography. This reveals that the vlei was not as broad as expected in its lower reaches, and that only 15 ha of the original wetland were inundated.

The upper reaches of the vlei lie at an elevation of 1 400 m a.s.l, and from this point it grades fairly steeply (over slopes of 2,8%) towards the vlei outlet, which lies at 1 315 m a.s.l. The perimeter of Grootgewaagd vlei is 11,5 km.

As in the case of Bloemveld vlei (Chap. 3.2.1), Grootgewaagd vlei was formed by a sill of Karoo dolerite which arrested downward erosion of the aMagoda River, and impeded drainage of the soils in the bottomlands above it. This geological feature (or keypoint) of the vlei was selected, for engineering reasons, as the site for the dam wall.

The main vlei area comprises wet, organically rich soil materials characteristic of the Champagne form, but these alter in the steeper, and consequently more dry, areas of the vlei. Katspruit soils occupy these portions of the system.

Plate 4: Grootgewaagd Dam.

Macroclimate

As for Bloemveld vlei (Chap. 3.2.1).

Hydrology

No hydrological data exist specific to this portion of the catchment, and no routine measurements are made of water levels in the dam (capacity 1 375 megalitres). By the end of the drought in 1983, the dam was reported to be almost empty, but it refilled again after Domoina (van der Walt, pers. comm.*).

Despite this, the high water table and nature of the soils within the wetlands above Grootgewaagd Dam suggest that the quantity and quality of water supplied by this area is influenced by these systems.

Vegetation

The main body of the Grootgewaagd vlei is covered by reeds (*Phragmites australis*), but these plants are confined to the permanently waterlogged zones of the system. In the upper reaches of the vlei therefore, these give way to hygrophilous grassland and sedge communities, no specific collections of which have been made.

These reeds have been harvested in the past, on a regular basis, for thatching purposes. The same reedbeds are also recognised locally, as an important wildlife refuge and breeding area, and a list of the 39 species of birds that have been seen in this wetland appears in Table 5.

Land Tenure

Most of the Grootgewaagd vlei falls under the ownership of the Vryheid Town Board. However, in its upper reaches the vlei extends onto private property.

Land Use

The catchment surrounding Grootgewaagd vlei is principally used for timber production (gum, wattle and pine), but extensive tracts of natural veld used for the grazing of cattle occur. The establishment of timber plantations in the area has meant that the vlei is deliberately burnt once every two years, in order to protect the forests (v.d. Walt, pers. comm.) (Plate 5). This is insisted upon by the municipality's insurers, who would otherwise not entertain any claim for damages. However, people who have known the area for 30 years or more contend that the vlei has not altered as a result of these burning practices.

Land use activities within the vlei which have a potential to damage it in the long term include:

	Perceived severity of problem*
• burning	2
• grazing	1
• afforestation (poplars encroaching)	1

* 1 = moderately serious
2 = serious
3 = very serious

* Mr van der Walt: Head of Parks and Forests Dept., Vryheid Municipality.

Plate 5: The condition of Grootgewaagd vlei in July 1986 after burning it to protect the adjacent plantations.

The dam is used for fishing (primarily) and various passive forms of water sport.

Conclusions

Like Bloemveld vlei, the value of Grootgewaagd vlei is closely linked to that of the dam as a municipal water supply. This is due to the probable influence of the vlei upon processes upstream of the dam, such as the regulation of streamflow and water purification.

The vlei would make an ideal study area from the point of view of monitoring the consequences of burning it every two years. However, there is no reason why the municipality's timber plantations could not still be adequately protected by firebreaks without having to burn the vlei. Examples of such firebreaks can be found a few kilometres away in the Pongola watershed. When the utilitarian value of the vlei for reed harvesting, its hydrological value, and its value to wildlife is taken into account, such management alternatives merit attention.

Sources of information:

Maps: 1:50 000 sheet 2730 DB Hlobane

Aerial photographs:

Year	Job	Scale	Strip No.	Photo Nos.
1944	73	1:18 000	34 35	8413 6658
1953 1961 1969	327} 455} 607}	1:36 000	No record	
1976	773	1:30 000	11	8133

3.2.3 aMagoda vlei (Wetland No. 40, Fig. 18)

Form

aMagoda vlei (27° 47'S; 30° 46'E) lies on the outskirts of Vryheid and comprises what was formerly a 330 ha wetland situated just above the confluence of the aMagoda and White Mfolozi Rivers. In its present day condition approximately 120 ha (36%) of the system has been altered by erosion, cultivation, silviculture and various other land-use practices (see below).

The vlei receives the run-off from the entire aMagoda catchment (10 325 ha), but benefits from the attenuation afforded upstream by the Bloemveld vlei/dam (Chap. 3.2.1), the Grootgewaagd vlei/dam (Chap. 3.2.2), and various smaller wetlands (Nos. 35-38) which occur on tributary streams. Without these the downstream consequences of the vlei's degradation would have been far more severe.

The upper reaches of the vlei lie at an elevation of 1 190 m a.s.l, and the outlet is at 1 105 m a.s.l. Between these two points the wetland occupies the floor of a valley, with grades of 1,2% (on average). Its linear form means that the perimeter of the vlei (29 km) is a distinctive feature of the system. Just before its confluence with the White Mfolozi, however, the vlei changes its form from a valley, c. 20 m wide, to a plain, c. 200 m across at its widest point.

There is no evidence to suggest that any particular geological feature among the sandstone and Karoo dolerite formations which surround the vlei, coincides with the vlei outlet. Unless caused by fluvial deposits laid down by the White Mfolozi the geological structure which accounts for the impeded drainage of the aMagoda vlei is unclear at present.

Judging from the blocky structure of the soil being excavated at the site of the new Vryheid by-pass road (which is presently under construction, and cuts straight across the aMagoda vlei) soils of the Rensburg form occur (MacVicar *et al.*, 1977). The soil comprised dark, heavily structured clays at the surface, beneath which were distinctive, grey-coloured (gleyed) materials. These features suggest that the water table is high, but variable, in this portion of the landscape, and that because the soil materials cannot transmit the water downslope at rates faster than that at which it is entering the vlei, water retention occurs in this area.

Macroclimate

As for Stilwater vlei (Chap. 3.1.2).

Hydrology

At some stage in its history, the aMagoda River (stream order 3) has cut a fairly deep channel through the length of the vlei, and this suggests that the amount of interception during storm events, will have been reduced.

In certain areas however, subsidence of the floodplain has created low-lying depressions (or backswamps) in which conditions conducive to water storage and the interception of overland flow exist (Plate 6). There seems little doubt that if floodwaters were forced to spread laterally within these areas, a significant reduction in water velocity would occur, together with the deposition of sediment.

Another portion of the vlei which appears to have the potential to act as an absorbent area which will stabilize and cleanse river flow, is the west extending arm of the system (Fig. 18) which leads towards wetland No. 39, and a contributory wetland (No. 38) which flows into the aMagoda vlei from the north east.

Plate 6: A "backswamp" area on the floodplain of the aMagoda River.

Vegetation

Broadly speaking, the aMagoda vlei is covered by hygrophilous grasses of various species (*Setaria sphacelata, Arundinella nepalensis* and *Miscanthus sorgum*) amongst which, remarkably few other forms of plants co-exist. These include reeds (*Phragmites*) which occur along the streamcourse in the middle reaches of the vlei, a few Cyperaceae (e.g. *Fimbristylis dichotoma*), and *Helichrysum* sp.

The marginal vegetation comprises tall *Hyparrhenia* dominated grassveld, and weed/crop encroached agricultural lands, especially on the western flank. The amount of community interspersion is low. In the lower reaches of the vlei, poplars (*Populus deltoides*) and wattles (*Acacia mearnsii*) have become established to the detriment of most other forms of wetland-associated plants (Plate 7).

Land Tenure

Most of aMagoda vlei forms part of the "Vryheid commonage", and falls under the jurisdiction of the Vryheid Town Board. Elsewhere it is privately owned, and the western arm extends across the boundaries of several small holdings.

Land Use

The land surrounding aMagoda vlei is used in a variety of different ways, including agriculture (maize production), timber production (wattle), the grazing of cattle and urban development. The vlei receives the run-off from the town of Vryheid.

Plate 7: The lower reaches of aMagoda vlei showing some of the reasons for its non-functional condition (the encroachment of alien trees and disruptive activities such as ploughing).

Within the vlei disruptive activities include:

	Perceived severity of problem*
• crop production	2
• afforestation	2
• road construction	1
• rail construction	1
• erosion	2
• dam construction	1
• burning	2
• ploughing	2
• grazing	1

* 1 = moderately serious
2 = serious
3 = very serious

In July 1986, the Vryheid municipality were ploughing up part of the vlei, in an area destined to be developed as a picnic site (Plate 7). This suggests that a recreational value can be attributed to part of the system.

Sources of information:

Maps: 1:50 000 sheet 2730 DC Kingsley
2730 DD Vryheid

Aerial photographs:

Year	Job	Scale	Strip No.	Photo Nos.
1944	73	1:18 000	37	6746-6748
			38	no record
1953	327}			
1961	455}	1:36 000	no record	
1969	607}			
1976	773	1:30 000	12	8821
			13	8227

3.3 The status of wetlands in the Besterspruit catchment

3.3.1 *Introduction*

The Besterspruit catchment (Fig. 21) occupies 87 km^2 of quaternary sub-catchment W211. It is notable from the point of view that it contains the Klipfontein Dam (completed in June 1984, with a capacity of 18,9 million m^3, Perkins, pers. comm.*). A portion of the dam flooded the lower reaches of the Besterspruit River, but no wetlands were lost in the process, either on this river, or on the Mfolozi.

The source of Besterspruit is on the farm Nooitgedacht, which lies on the foothills of Mt. eZungwini (alt. 1 688 m a.s.l). The river rises at an altitude of 1 640 m a.s.l. The only headwater wetland at this altitude (wetland No. 41) is a small 1,5 ha system near the divide between Besterspruit and the aMagoda catchment (Chap. 3.2.4). Although the Besterspruit catchment occupies c. 35% of quaternary sub-catchment W211, the low stream frequency suggests that the run-off from this area is less than 10 million m^3 per year.

Unlike the situation in the Stilwater and aMagoda catchments, the Besterspruit catchment is dominated entirely by sandstone of the Vryheid formation (Fig. 15). Near the Klipfontein dam some Karoo dolerite and outcrops of Archaean granite occur, but this uniformity in geology seems to account for the relatively low proportion of wetland cover in the Besterspruit catchment (see below). The soils are predominantly yellow and red apedal, freely drained, dystrophic soils (Fitzpatrick, 1978) with a very high agricultural potential (Edwards & Scotney, 1978).

Within the Besterspruit catchment there are 17 wetlands, ranging in size from 1,5 to 182 ha (Table 6). Fairly slight wetland losses amounting to 63 ha (18,4%) have occurred over the years. Prior to this the wetland cover in Besterspruit catchment totalled 343 ha, which meant that the proportion of wetland cover was 3,9%. This has now been reduced to 3,2% (280 ha).

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* Mr J Perkins: Circle Engineer (Natal), Department of Water Affairs.

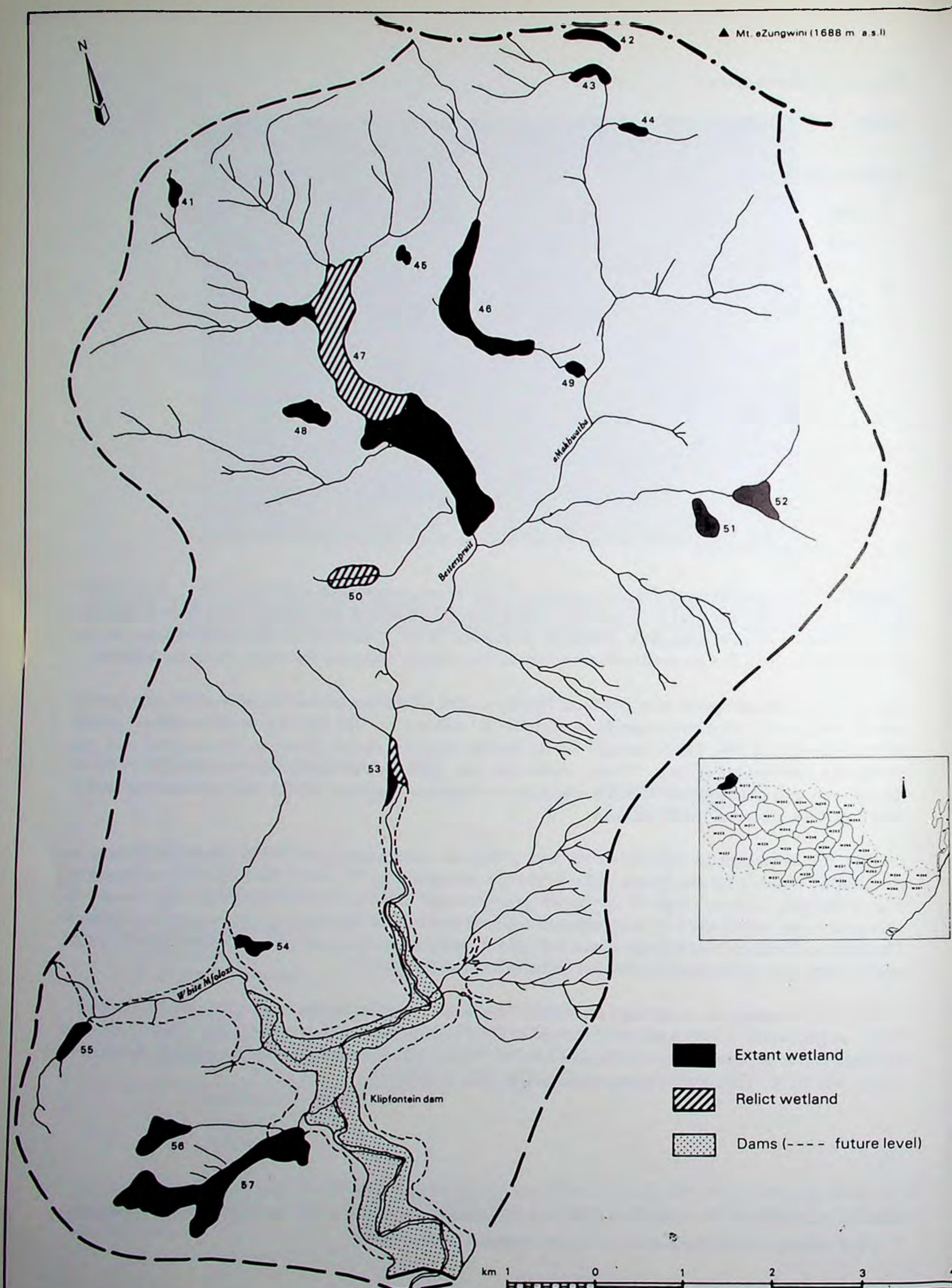


Fig. 21: The distribution of wetlands in the Besterspruit catchment (see Fig. 14).

Table 6: Variation in the form and catchment inter-relationships of the wetlands in the Besterspruit catchment (Fig. 21). Where wetland losses have amounted to 100%, no further data are provided.

Wetland No.	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
41	1,5	1,5	-	42	3,5	0,6
42	4,0	4,0	-	15	26,0	1,6
43	3,0	3,0	-	127	2,3	1,1
44	1,7	1,7	-	137	1,2	0,4
45	2,0	2,0	-	25	8,0	0,5
46	35,0	35,0	-	362	9,6	4,4
47	182,0	130,0	28	2 177	6,3*	4,7
48	5,0	5,0	-	132	3,8	1,1
49	2,0	2,0	-	480	7,7*	0,5
50	10,5	-	100	-	-	-
51	5,5	5,5	-	95	5,8	1,0
52	7,5	7,5	-	260	2,8	1,3
53	12,0	12,0	-	6 025	3,5*	1,9
54	3,0	3,0	-	95	3,1	0,8
55	4,0	4,0	-	95	4,2	1,1
56	9,0	9,0	-	105	8,5	1,5
57	55,0	55,0	-	352	15,6	6,3
TOTAL	343,0	280,0				29,0

* includes upstream wetlands.

For inventory purposes no single wetland is extensive enough to warrant detailed description. However, the amount of erosion and the number of small farm dams built within wetland sites is noteworthy. Within wetland No. 46 for example (aMakhwatha vlei), three farm dams have been established

The most important wetland in the Besterspruit catchment is wetland No. 47, which although heavily disturbed is still 130 ha in size, and on closer examination could well be shown to have the following attributes:

- good attentuation prospects (due to the generally diffuse drainage patterns)
- permanently waterlogged soils with potentially important water storage functions
- a high level of interspersion among plant communities, these mainly comprising hygrophilous grasses, reeds and bullrushes.

Regrettably, 40% of the vlei (52 ha of its upper reaches) has been lost through interferences that include infilling, cultivation, erosion and wattle encroachment.

Chapter 4

Quaternary Sub-catchment No: W212

Name: Lower Klipfontein
Fig. No: 22

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  120 km^2
- Range in altitude.
  1 250 to 950 m above sea level
- Physiographic regions (Turner, 1967).
  region 24 (Utrecht-Vryheid Plain)
  region 26 (Nondweni-White Mfolozi Plain)
- Geology (Geological Survey Dept., pers. comm.).
  major bedrock type: Sandstone (Vryheid formation) and dolerite
  less dominant types: Shale (Pietermaritzburg formation) and granite
- Soils (Fitzpatrick, 1978).
  Weakly developed soils (lithocutanic B) in the east; mesotrophic sands/loams with some red clays and duplex soils in north-west.
- Veld types (Acocks, 1953).
  veld type 64 (Northern Tall Grassveld)
  veld type 66 (Natal Sand Sourveld)
- Bioclimatic region (Phillips, 1973).
  region 8a (dry upland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 885 mm
  Range (Schulze, 1982): 800 to 1 000 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  12 million cubic metres/year
- Land use (Nanni, 1982).
  White owned farmland (cattle, maize).

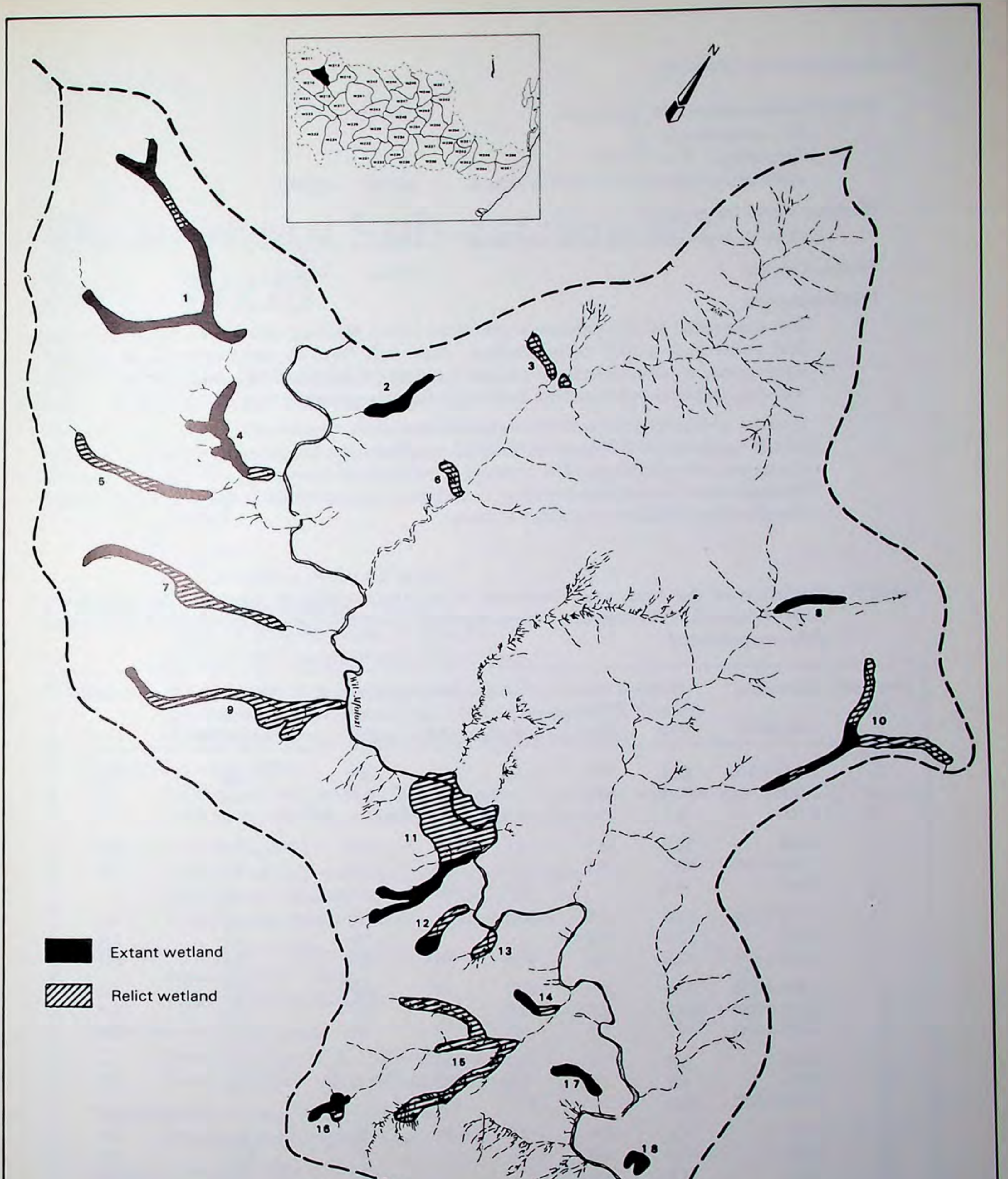


Fig. 22: The distribution of wetlands in quaternary sub-catchment W212. These data were derived from Job 773 of 1976 (see Fig. 3).

Wetland inventory (Table 7)

- Wetland distribution (Pre Iron Age).
  - No. of wetlands: 19
  - Size range : 2 to 114 (ha)
  - Area of sub-catchment under wetland: 422 ha (3,5%)
- Wetland status (at present).
  - Area of sub-catchment under wetland: 126 ha (1,2%)
- Wetland losses: 295 ha (70%)
- Further details:

Sub-catchment W212 contains 20 km of the White Mfolozi, into which flow numerous first order and second order streams. Although these do not have well developed catchments, erosion remains as a major degrading influence in this area, because stream velocity, (which is a function of stream gradient) is generally high in low-order streams.

Because of the extensive wetland losses mentioned above none of the remaining wetlands in sub-catchment W212 warrant detailed description for inventory purposes. However, it is noteworthy that most of the damage done has been caused by gully erosion, and that the farm dams in wetlands (totalling 10 in this area) appear to have enhanced the wetland situation by stabilizing the water courses.

Table 7: Variation in the form and catchment inter-relationships of wetlands in quaternary sub-catchment W212 (Fig. 22). Where wetland losses have amounted to 100%, no further data are provided.

Wetland No:	Elevation (m a.s.l)	Wetland size Former (ha)	Wetland size Existing (ha)	Proportion lost (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	1 180-1 100	40,0	37,5	2,5	6	870	4,3	9,0
2	1 080	10,5	10,5	-	-	107	9,8	2,2
3	1 100	6,5	-	6,5	100	-	-	-
4	1 070	20,5	16,5	4,0	19	1 495	3,9*	3,2
5	1 120-1 080	13,5	4,5	9,0	66	355	1,3	0,9
6	1 060	4,5	-	4,5	100	-	-	-
7	1 110-1 050	34,0	6,5	27,5	81	402	1,6	1,2
8	1 170	7,0	7,0	-	-	187	3,7	1,4
9	1 100-1 035	50,5	3,0	47,5	94	522	0,6	0,7
10	1 200-1 130	31,0	8,0	23,0	74	407	1,9	1,2
11	1 080-1 030	114,0	9,0	105,0	90	317	2,8	1,9
12	1 080-1 030	10,5	5,0	5,5	52	95	5,2	0,6
13	1 040	4,0	-	4,0	100	-	-	-
14	1 020	4,0	2,0	2,0	50	52	3,8	0,7
15	1 100-1 025	52,5	-	52,5	100	-	-	-
16	1 120	6,5	2,0	2,0	31	90	2,2	0,8
17	1 000	6,0	6,0	-	-	47	12,7	1,4
18	990	4,5	4,5	-	-	62	7,2	0,9
19	1 240	2,0	2,0	-	-	27	7,4	0,5
TOTAL		422,0	126,0	296,0				27,0

* includes upstream wetlands.

Chapter 5

Quaternary Sub-catchment No: W213

Name: iShoba (principal river)
Fig. No: 23

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  235 km^2
- Range in altitude.
  1 620 to 1 050 m above sea level
- Physiographic regions (Turner, 1967).
  region 12 (Hlobane-Manyini Ceza Block)
  region 26 (Nondweni-White Mfolozi Plain)
- Geology (Geological Survey Dept., pers. comm., Fig. 24).
  major bedrock type: Sandstone (Vryheid formation)
  less dominant types: Karoo dolerite and Dwyka tillite
- Soils (Fitzpatrick, 1978).
  Yellow and red apedal, freely drained, dystrophic soils (in east & west); weakly developed soils (lithocutanic B) in north and south.
- Veld types (Acocks, 1953).
  veld type 64 (Northern Tall Grassveld) in north
  veld type 63 (Piet Retief Sourveld) in east
  veld type 66 (Natal Sand Sourveld) in south
- Bioclimatic regions (Phillips, 1973).
  region 8a (dry upland)
  region 6a (moist upland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 980 mm
  Range (Schulze, 1982): 800 to 1 200 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  33 million cubic metres/year
- Land use (Nanni, 1982).
  White owned farmland (cattle, maize, wattle), coal mining.

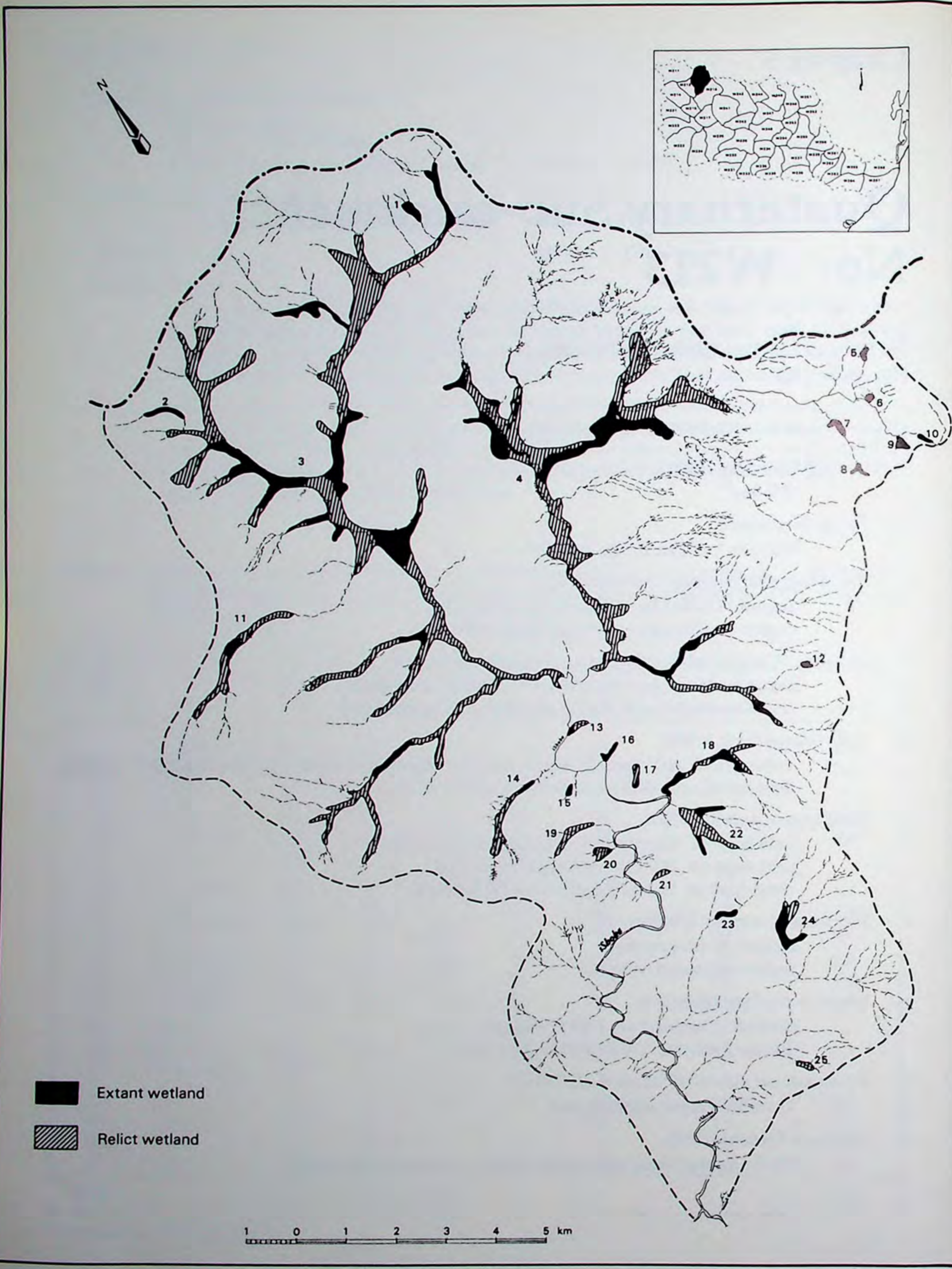
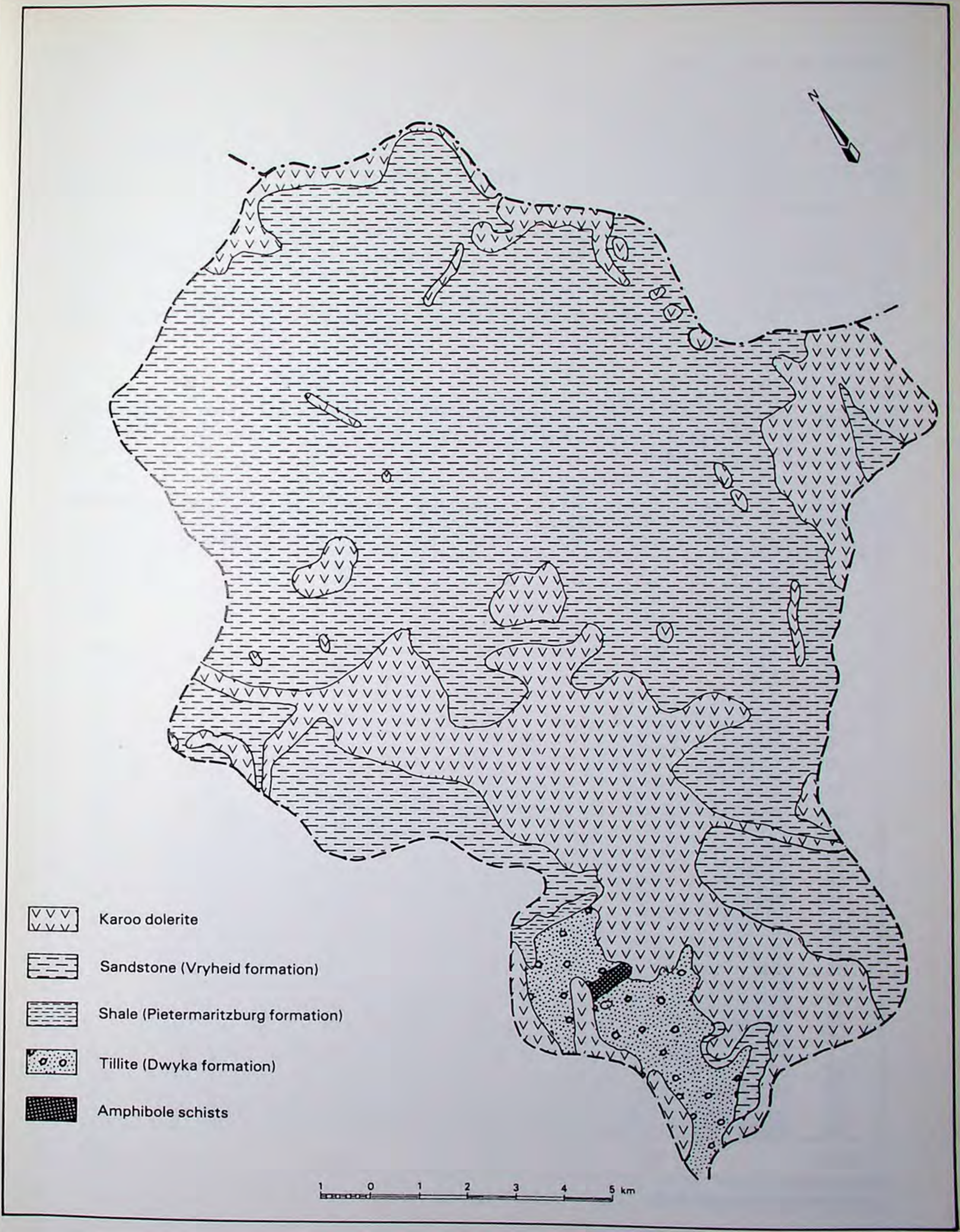


Fig. 23: The distribution of wetlands in quaternary sub-catchment W213. These data were derived from Job 773 of 1976 (see Fig. 3).



Source: Dept. of Geological Survey

Fig. 24: The geology of quaternary sub-catchment W213.

Wetland inventory (Table 8)

- Wetland distribution (Pre Iron Age).
  No. of wetlands: 25
  Size range : 1,5 to 905 (ha)
  Area of sub-catchment under wetland: 1 650 ha (7%)
- Wetland status (at present).
  Area of sub-catchment under wetland: 334 ha (1,4%)
- Wetland losses: 1 316 ha (80%)
- Further details:
  Two systems warrant further description. These are iShoba vlei (Chap. 5.1) and Sterkstroom vlei (Chap. 5.2).

Table 8: Variation in the form and catchment inter-relationships of wetlands in quaternary sub-catchment W213 (Fig. 23). Where wetland losses have amounted to 100%, no further data are provided.

Wetland No:	Elevation (m a.s.l)	Wetland size Former (ha)	Wetland size Existing (ha)	Proportion lost (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	1 230	7,0	7,0	-	-	52	13,3	1,0
2	1 215-1 180	6,0	6,0	-	-	130	4,6	1,9
3	1 240-1 105	905,0	156,0	749,0	82	8 525	2,0*	25,0
4	1 200-1 180	525,0	102,0	423,0	80	6 925	1,7*	13,0
5	1 600	1,5	1,5	-	-	27	5,4	0,5
6	1 490	3,0	3,0	-	-	245	3,4	1,4
7	1 475	3,5	3,5	-	-	157	3,4*	1,2
8	1 540	2,0	2,0	-	-	40	5,0	0,9
9	1 540	4,0	4,0	-	-	22	17,7	0,8
10	1 560	1,5	1,5	-	-	67	2,2	0,7
11	1 240-1 180	45,0	4,0	41,0	91	642	0,6	0,6
12	1 340	1,5	1,5	-	-	45	3,3	0,6
13	1 120	4,5	1,5	3,0	66	87	1,7	0,2
14	1 170-1 120	20,0	3,0	17,0	85	352	0,8	0,7
15	1 120	1,5	1,5	-	-	42	3,5	0,3
16	1 120	3,0	3,0	-	-	120	2,5	0,9
17	1 120	4,0	-	4,0	100	-	-	-
18	1 150-1 080	23,5	9,5	14,0	59	477	1,9	2,7
19	1 160-1 100	9,5	-	9,5	100	-	-	-
20	1 100	3,5	-	3,5	100	-	-	-
21	1 110	2,0	-	2,0	100	-	-	-
22	1 170-1 090	45,0	8,0	37,0	82	255	3,1	1,4
23	1 160	4,5	4,5	-	-	162	2,7	0,9
24	1 160	22,0	10,0	12,0	54	345	2,8	1,8
25	1 100	3,0	1,0	2,0	66	87	1,1	0,2
TOTAL		1 650,0	334,0	1 316,0				57,0

* includes upstream wetlands.

5.1 iShoba vlei (Wetland No. 3, Fig. 23)

Form

iShoba vlei (27° 46'S; 30° 55'E) formerly comprised a large vlei system 905 ha in extent, but today it has, been reduced in size by 82% to a series of widely separated portions of partially functional wetland totalling 156 ha.

The upper reaches of iShoba vlei lie at an elevation of 1 240 m a.s.l, but from this point the system extends for 14,8 km on either side of the iShoba River and several of its minor tributaries. Although highly variable, the average slope of the vlei is 1%. The outlet of the vlei is at an altitude of 1 105 m a.s.l, and its perimeter, even in its existing condition, is 25 km. This suggests that its potential to reduce the velocity of run-off from the adjacent hillslopes is high. Generally speaking, it is a narrow vlei, which at its widest point is 800 m across.

iShoba vlei has formed behind a sill of Karoo dolerite which has arrested downward erosion of the river near to its confluence with the "Sterkstroom" River. There is a second keypoint (also a dolerite dyke) higher up in the vlei which similarly impedes drainage of the soils in the bottomlands above it. From the generally eroded condition of iShoba vlei structural damage to these keypoints is suspected.

The main vlei area comprises soils of the Katspruit form, but these can be masked by alluvial deposits in the lower reaches of the system, and by highly organic Champagne soils in the permanently wet portions of the system, as on the farm "Dagbreek" (Fig. 25).

Macroclimate

As for quaternary sub-catchment W212 (Chap. 4).

Plate 8: A view of the anthracite washing plant at the head of iShoba vlei. Note the slime dams and cut-off drains that have been constructed in an effort to contain run-off from the dumps.

Plate 9: **White crystals of sulphate (after evaporation has occurred) in the bed of iShoba River, immediately below the vlei outlet (23 September 1986). This means coal mine drainage from upstream is by-passing the vlei because of its degraded condition.**

Hydrology

The eroded condition of iShoba vlei (c.f. 1940-1976 aerial photography, App. 3) suggests that comparatively little water storage and attenuation processes occur.

No hydrological data could be found which are specific to this portion of the Mfolozi catchment, other than measurements made of the water quality in this region in the 1960's (Archibald *et al.*, 1969). However, these observations are of particular significance, because in those days the iShoba was reported to be free of "coal mine drainage from the Vryheid area".

This is not the situation today (Plate 8), testimony to which is the sulphate contaminated water of the iShoba River (Plate 9) 15 km below these coal mining activities. This high sulphate content makes the water "hard" and corrosive, and renders it almost useless for domestic consumption, stock watering and irrigation purposes. Had the iShoba vlei been less degraded, this situation downstream may well have not materialised due to the self-purifying function of wetlands receiving contaminated inflows.

Vegetation

From a botanical point of view iShoba vlei is a varied system, because in certain parts it is covered in dense stands of reeds (*Phragmites*), bullrushes (*Typha*) and hygrophilous vegetation, notably the following:-

Grasses	Herbs
Setaria sphacelata	*Verbena bonariensis*
	Senecio madagascarensis
	Denekia capensis
	Helichrysum mundii

Sedges

Kyllinga melanosperma
Schoenoplectus corymbosus

However, as a result of erosion, crop cultivation, burning and overgrazing, desiccation of the vlei elsewhere has led to the invasion of dryland grasses and various woody species. These include indigenous species (*Acacia caffra* thornveld), and aliens such as gums and wattles.

Land tenure

The ownership of iShoba vlei is complex because it is owned by at least 20 persons (Fig. 25). This excludes an unestablished number of smallholdings in the centre of the system and portions of properties that may have been leased to third parties such as mining companies. Added to this, the properties concerned are constantly changing hands (Dicks, pers. comm.*), and so the prospect for the effective "management" of iShoba vlei could be slight.

Land use

The land surrounding iShoba vlei largely comprises natural veld used for the grazing of cattle and for the production of maize. Coal mining and wattle plantations are influential land uses in the area elsewhere.

Land use activities within the vlei which have already damaged it to varying degrees, or have the potential to damage it further include:

	Perception of problem severity**
• grazing	2
• burning	2
• pasture production	1
• crop production (maize)	2
• dam construction (7 dams exist within the vlei)	1
• waste disposal from the mines	3
• erosion (major factor in the past)	1
• road construction	1
• railway construction (in headwater areas)	1
• infilling (mainly associated with road construction)	1
• ridge and furrow development	2

** 1 = moderately serious
2 = serious
3 = very serious

* R J Dicks: Technician, Department Agriculture and Water Supply, Vryheid.

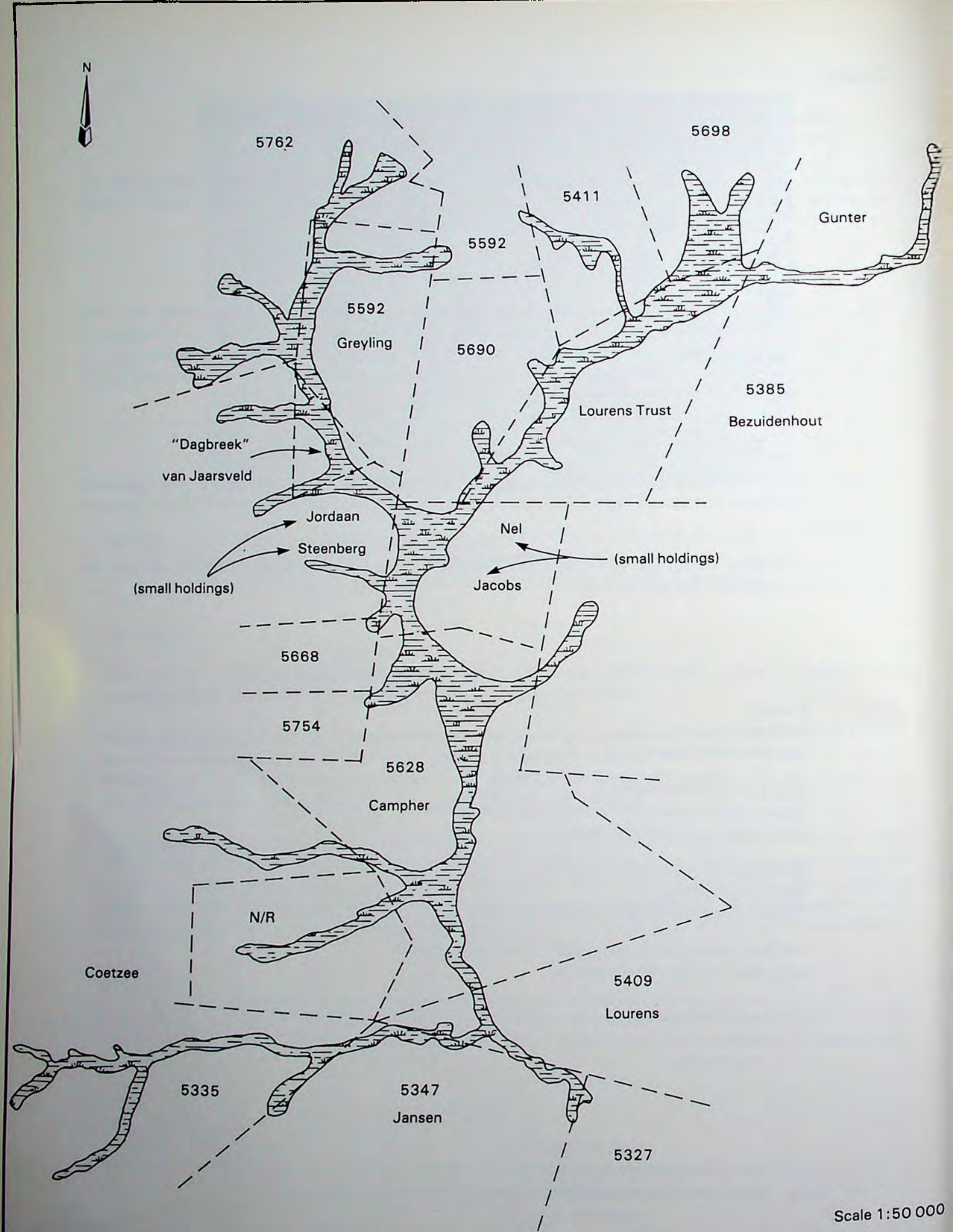


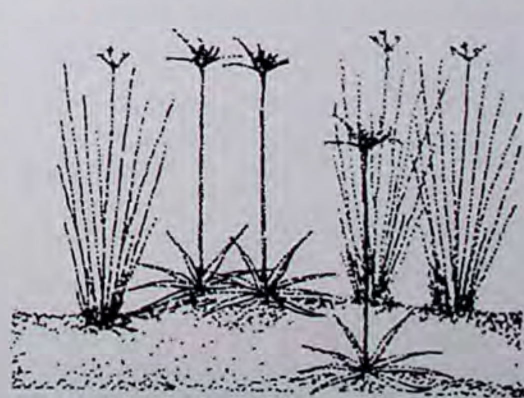
Fig. 25: Landownership of iShoba Vlei, showing the identification number of the farm (according to the local Extension Officer) and, where known, the owner's name

Conclusions

Although 82% of iShoba vlei is in a degraded condition, 156 ha remain, and this represents 46% of the remaining wetland in sub-catchment W213. Of this the "Dagbreek" portion is the most valuable, being the least degraded area, and clearly effective from the point of view of flood attenuation and sediment interception (Plate 10).

An important point is that on the floor of the so-called 'relict' portions of the eroded vlei, typical wetland associated grasses and sedges still occur. This would not be the case if physical conditions conducive to the retention of water did not exist. These portions of the vlei may therefore still be performing a useful hydrological role in the landscape, but this can only be established through further research. Field observations suggest that the existing dongas in the area are not active, and seem in fact to have stabilized within the last 40 years.

Plate 10: Aerial view of the Dagbreek portion of iShoba vlei. Notice the stabilizing effect of the vlei upon river flow (arrowed) when compared to the situation upstream.



Sources of information:

Maps : 1:50 000 sheet 2730 DB Hlobane
2730 DD Vryheid

Aerial photographs:

Year	Job	Scale	Strip No.	Photo Nos.
1944	73	1:18 000	36	6720-6727
			37	6732-6737
			38	No record
1953	327}			
1961	455}	1:36 000	No record	
1969	607}			
1976	773	1:30 000	11	8136-8138
			12	8827-8828
			13	8232-8233

Literature:

See References under
Archibald *et al.*, 1969.

5.2 Sterkstroom vlei (Wetland No. 4, Fig. 24)

Form

Sterkstroom vlei (27° 47′S; 30° 57′E) is the second most important wetland in the iShoba watershed. At the onset of the Iron Age (c. 400 A.D.) it used to be 525 ha in extent, but today has been reduced by 80% to 102 ha of partially- functional, isolated patches of wetland. This was brought about principally through the lowering of the water table which is associated with gully erosion.

The upper reaches of Sterkstroom vlei lie at an elevation of 1 200 m a.s.l, and the outlet is at 1 110 m a.s.l. It extends for 9,7 km along the floor of the Sterkstroom valley, at an average slope of 0,9%. At its widest point the vlei is 600 m across, although in gradually sloping terrain of this nature, the precise boundary of the vlei is difficult to fix.

Sterkstroom vlei formed as a result of the impediment to drainage caused by a sill of Karoo dolerite near the confluence of the Sterkstroom and iShoba Rivers. This sill, or keypoint, determined the outlet position, and accounted for waterlogging of the soils above it. These constitute stratified alluvial deposits adjacent to the river channel, and soils of the Katspruit form (a gleyed, clayey sub-soil overlain by an orthic topsoil) elsewhere in the vlei.

Macroclimate

As for iShoba vlei (Chap. 5.1).

Hydrology

Sterkstroom vlei receives the run-off from a catchment of 6 925 ha in which the amount of wetland cover has been reduced from 7,6% to 1,7%. The name "Sterkstroom" (taken to mean "Strong stream") is presumably indicative of a former characteristic of the system which is not in evidence today. The probable cause of this change is vlei degradation.

Erosion of the vlei appears to have reduced its former capacity to store and slow down the movement of water in this portion of the catchment, although in certain places the water table still seems to be relatively high. Generally however, a low attenuation rating has been attributed to the system.

In view of this, it is important to notice that certain farm dams within the vlei have had a stabilizing effect on conditions downstream, particularly where these have been built within the confines of a donga. The wetness associated in the backswamp areas downstream of these sites is noteworthy (Plate 11).

Plate 11: Dam construction within the confines of a former donga in the lower reaches of Sterkstroom vlei (farm 5313 - Fig. 26) clearly improves the attenuating function of the wetland in this region.

Vegetation

The dominant plant cover in Sterkstroom vlei comprises a grassland community of various dryland species but this is a result of the considerable physical alteration of the system that has occurred. Regular burning of the vlei to promote its value for the grazing of cattle has altered the species composition, and reduced community interspersion. Patches of hygrophilous vegetation do occur alongside the drainage lines. These include broom grass (*Miscanthus*) and various species of sedges (*Cyperaceae*). A few willow trees have also established themselves near the river, but wattle have encroached where the vlei has dried out.

Land tenure

Sterkstroom vlei is privately owned by 13 persons (Fig. 26), which complicates its future "management" because of the unlikely prospect of co-operation between each landowner.

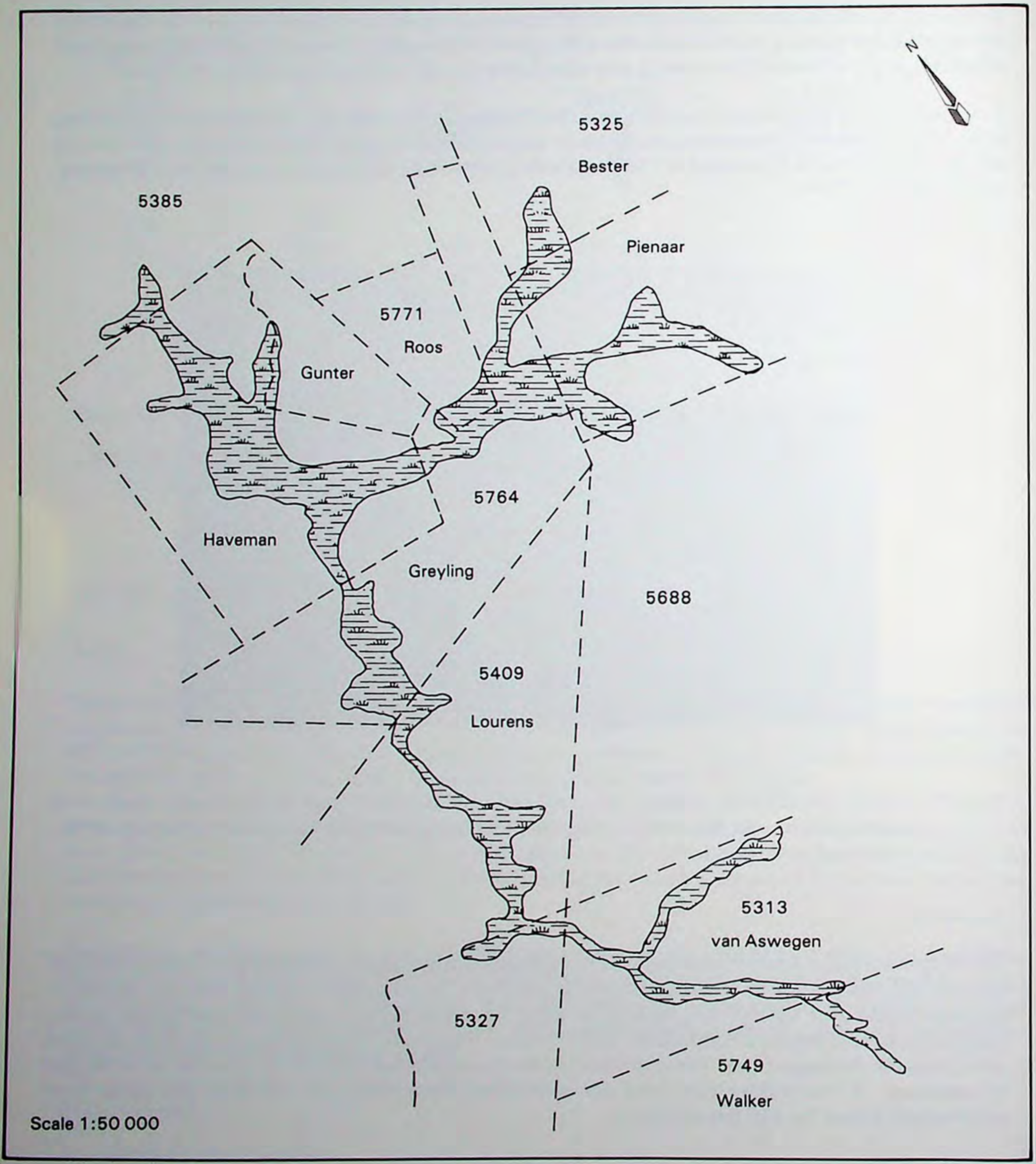


Fig. 26: Landownership of Sterkstroom Vlei, showing the identification number of the farm (according to the local Extension Officer) and, where known, the owner's name

Land use

The land surrounding Sterkstroom vlei is principally used for agriculture (maize production) and the grazing of cattle. A large proportion of the area is natural veld. In the head water zone some coal mining activities (the "Leeunek Section" of Amcoal's Coronation Mine) occur above farms 5325 and 5749, and wattle plantations have become established at the source of the Sterkstroom River on the slopes of Mt. Mnyati.

Of the various factors that have accounted for degradation of the vlei, erosion in historical times has been the most consequential. Other disruptive, more recent man-induced activities within the vlei include:

	Perception of problem severity*
• grazing	2
• burning	2
• pasture production	1
• maize production	2
• road construction	1
• dam construction	1
• waste disposal	1
• siltation	2
• stock watering	1

* 1 = moderately serious
2 = serious
3 = very serious

Conclusions

Although 80% of Sterkstroom vlei is in a degraded condition, 102 ha remain, and this represents 30% of the remaining wetland in the iShoba catchment (sub-catchment W213).

When seen in this light, it is probable that Sterkstroom vlei still represents a valuable natural resource because of the various beneficial functions that wetlands are known to perform, and because the rehabilitation of Sterkstroom vlei (or portions of it) may still be possible (Plate 11). This will depend upon co-operation between land-owners and to a large degree, upon assistance from the State. In order to initiate this process, the preparation of an integrated land use plan is recommended.

Sources of information

Maps : 1:50 000 sheet 2730 DD Vryheid

Aerial Photographs

Year	Job	Scale	Strip No.	Photo Nos.
1944	73	1:18 000	37	6729-6731
			38	No record
1953	327}			
1961	455}	1:36 000	No record	
1969	607}			
1976	773	1:30 000	12	8829
			13	8234
			14	8583

Chapter 6

Quaternary Sub-catchment No: W214

Name: Upper Sandspruit (principal river)
Fig. No: 27

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  270 km^2
- Range in altitude.
  1 400 to 940 m above sea level
- Physiographic regions (Turner, 1967).
  region 24 (Utrecht-Vryheid Plain)
  region 26 (Nondweni-White Mfolozi Plain)
  region 10 (Nqutu Divide)
- Geology (Geological Survey Dept., pers. comm., Fig 28).
  major bedrock types: Sandstone (Vryheid formation) and shale
  less dominant types: Dwyka tillite, Archaean granite
- Soils (Fitzpatrick, 1978).
  Yellow and grey hydromorphic, mainly mesotrophic sands/loams with some red clays and duplex soils. According to Acocks (1953), large areas are waterlogged in summer.
- Veld types (Acocks, 1953).
  veld type 66 (Natal Sand Sourveld)
  veld type 64 (Northern Tall Grassveld)
- Bioclimatic region (Phillips, 1973).
  region 8a (dry upland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 839 mm
  Range (Schulze, 1982): 700 to 900 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  21 million cubic metres/year
  Major tributaries include the Vovela and the Wolweloop Rivers.
- Land use (Nanni, 1982).
  White owned farmland (cattle and maize).

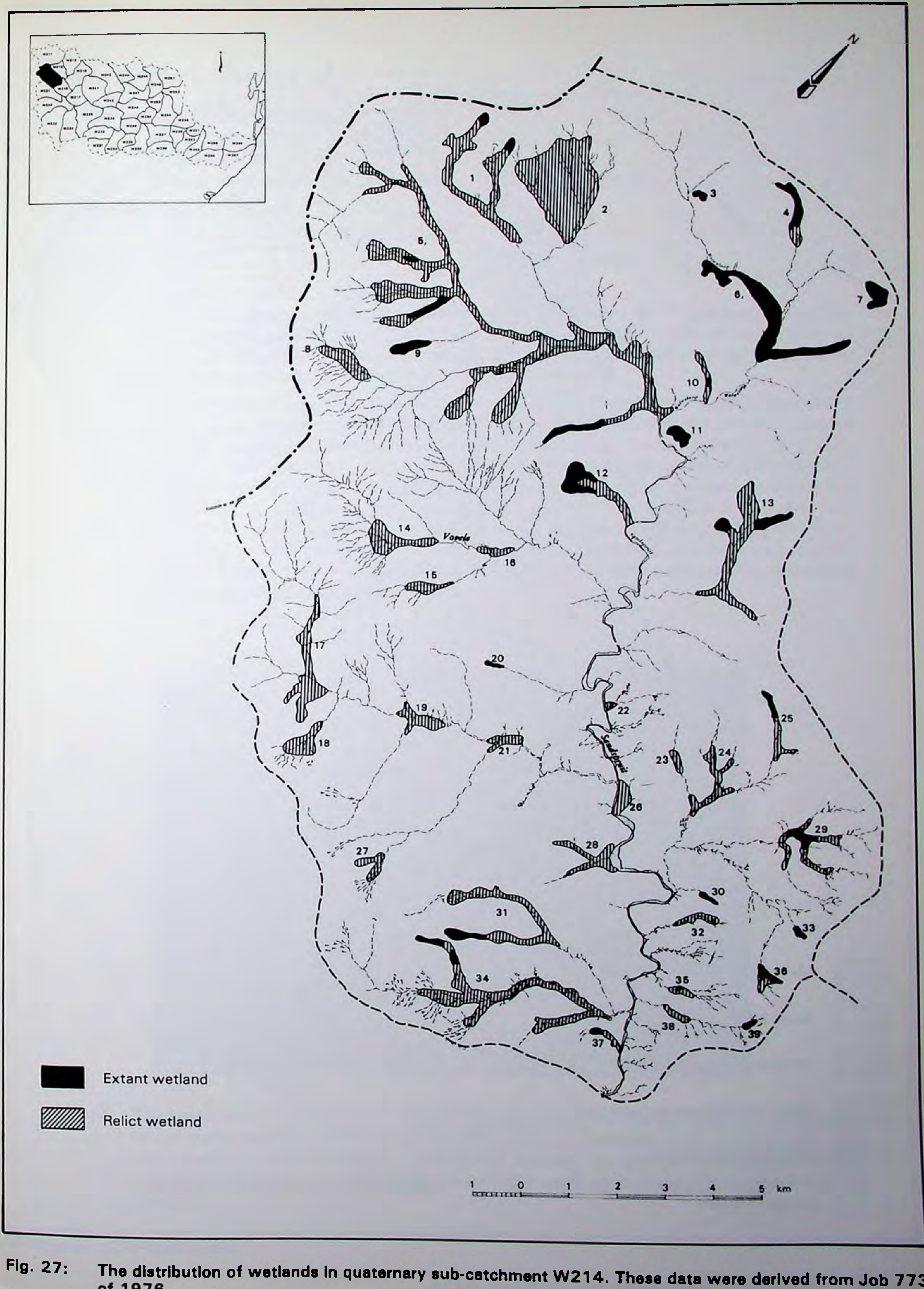
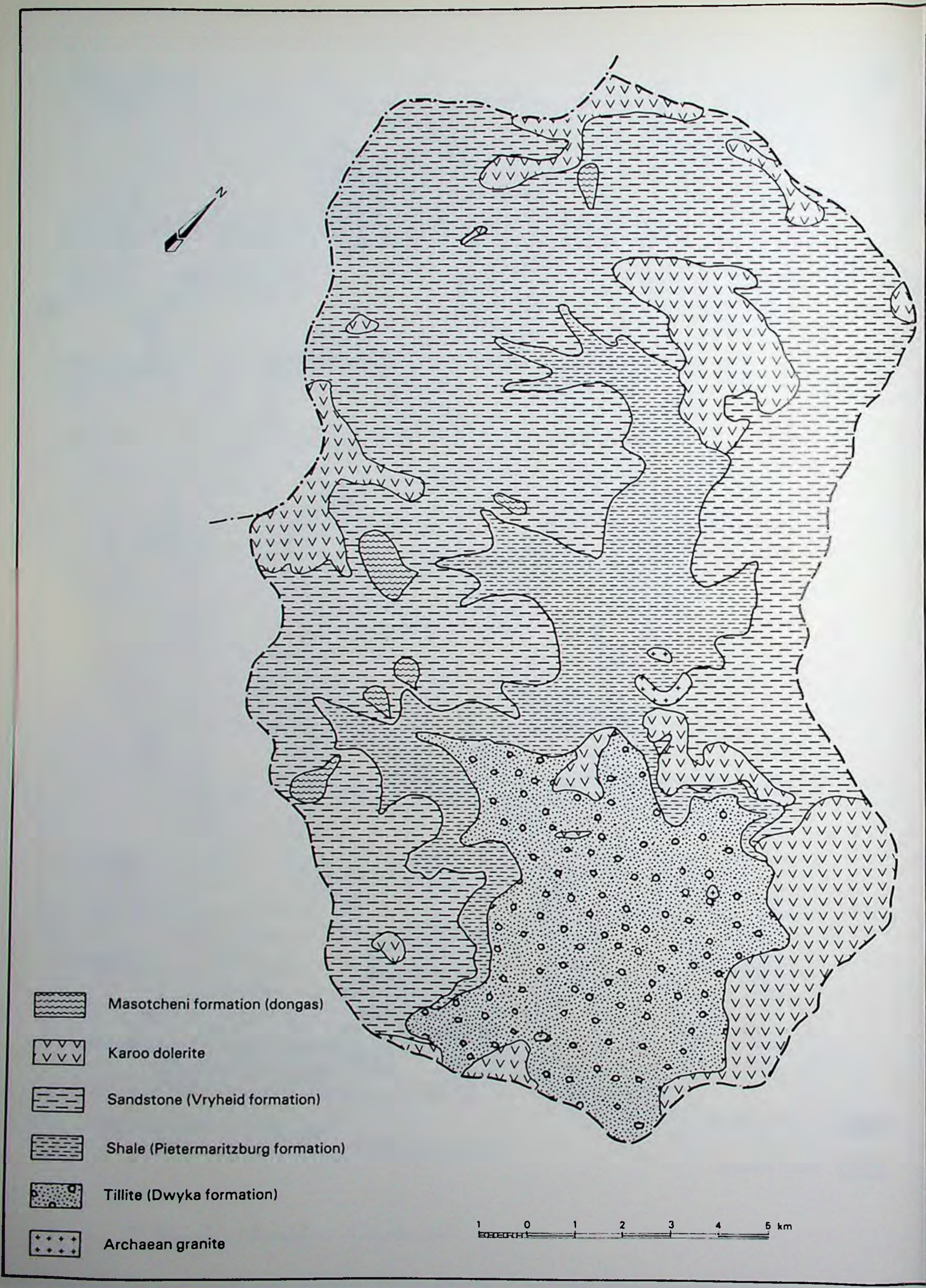


Fig. 27: The distribution of wetlands in quaternary sub-catchment W214. These data were derived from Job 773 of 1976.



Source: Dept. of Geological Survey

Fig. 28: The geology of quaternary sub-catchment W214.

Wetland inventory (Table 9)

- Wetland distribution (Pre Iron Age).
  - No. of wetlands: 39
  - Size range : 2 to 447 (ha)
  - Area of sub-catchment under wetland: 1 850 ha (6,8%)
- Wetland status (at present).
  - Area of sub-catchment under wetland: 275 ha (1%)
- Wetland losses: 1 575 ha (85%)
- Further details:

The features mapped by the Department of Geological Survey as "Masotcheni formation" in this region warrant attention because these coincide with former wetlands in these areas. Wetlands Nos. 2, 10 and 16 for example (Fig. 27) fall within such sites, and prove that these are extremely ancient erosion features (Plate 12).

For inventory purposes, no individual wetland system within sub-catchment W214 warrants detailed description due to the extensive losses incurred. However, the largest existing wetland in this region is Wolweloop vlei (wetland No. 6) which is 75 ha in size, and owes its existence to an erosion resistant sill of Karoo dolerite in this vicinity (Fig. 27). Wolweloop vlei receives the run-off from a catchment 2 025 ha in extent, in which the proportion of wetland cover (i.e. wetlands 3, 4, 6 & 7 included) is 5,1%. The vlei comprises two arms, one extending in a westerly and the other in an easterly direction. In the latter, two dams have been constructed within the wetland, and these seem to have stabilized the watercourse downstream. Wolweloop vlei extends across the boundaries of three privately owned farms.

Plate 12: **The remains of wetland No. 17 (Fig. 27) in sub-catchment No. W214 as an indication of the present condition of many former wetlands in this region, and of the erosion that took place c. 1 000 years ago. These sites formerly comprised sodium-rich, highly erodible Katspruit soils. Notice the thornveld encroachment which has occurred in the interim.**

Table 9: The present status of wetlands in quaternary sub-catchment W214 (Fig. 27). Where losses have amounted to 100%, no further data are provided.

Wetland No:	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	124	7	94	517	1,3	1,0
2	240	-	100	-	-	-
3	3	3	-	100	3,0	0,6
4	21	12	40	182	6,6	3,0
5	447	33	92	5 427	0,6	2,7
6	75	75	-	2 025	5,1*	10,3
7	13	13	-	62	20,9	1,2
8	39	-	100	-	-	-
9	17	17	-	107	15,9	1,8
10	10	1	90	272	0,4	0,2
11	15	15	-	45	33,3	1,8
12	58	27	52	275	9,8	2,0
13	108	19	82	650	2,9	2,0
14	52	-	100	-	-	-
15	18	-	100	-	-	-
16	11	-	100	-	-	-
17	75	-	100	-	-	-
18	28	-	100	-	-	-
19	29	-	100	-	-	-
20	2	2	-	37	5,4	0,7
21	16	-	100	-	-	-
22	3	-	100	-	-	-
23	6	-	100	-	-	-
24	37	-	100	-	-	-
25	17	5	68	267	1,8	0,9
26	14	-	100	-	-	-
27	16	-	100	-	-	-
28	30	-	100	-	-	-
29	37	8	77	537	1,5	1,0
30	2	2	-	20	10,0	-
31	75	10	86	562	1,8	1,6
32	11	-	100	-	-	-
33	3	3	-	30	10,0	0,6
34	150	7	95	1 077	0,6	1,4
35	8	-	100	-	-	-
36	10	6	35	67	9,7	1,2
37	8	3	37	87	3,4	0,6
38	9	-	100	-	-	-
39	2	2	-	27	7,4	0,7
TOTAL	1 850	275				35,3

* includes upstream wetlands.

Chapter 7

Quaternary Sub-catchment No: W215

Name: Lower Sandspruit (principal river)
Fig. No: 29

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  130 km^2
- Range in altitude.
  1 080 to 935 m above sea level
- Physiographic region (Turner, 1967).
  region 26 (Nondweni-White Mfolozi Plain)
- Geology (Geological Survey Dept., pers. comm., Fig 30).
  major bedrock type: Dwyka tillite (glacial deposit)
  less dominant types: Karoo dolerite in north-west
- Soils (Fitzpatrick, 1978).
  Weakly developed (lithocutanic B), plinthic and some red/black clays and duplex soils.
- Veld types (Acocks, 1953).
  veld type 66 (Natal Sand Sourveld)
  veld type 65 (Southern Tall Grassveld)
- Bioclimatic region (Phillips, 1973).
  region 8a (dry upland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 758 mm
  Range (Schulze, 1982): 600 to 900 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  7 million cubic metres/year
- Land use (Nanni, 1982).
  White owned farmland, principally used for cattle and maize production.

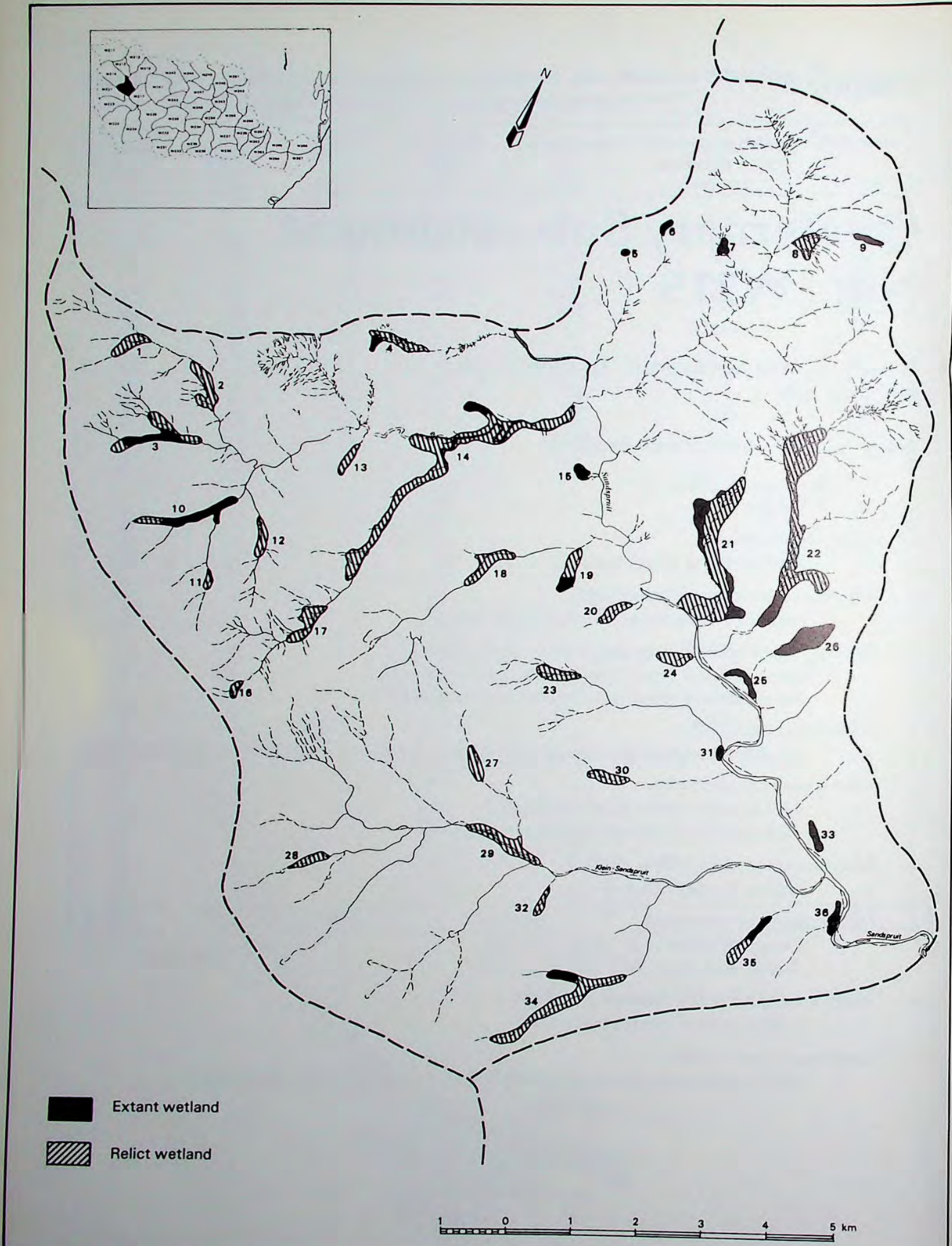
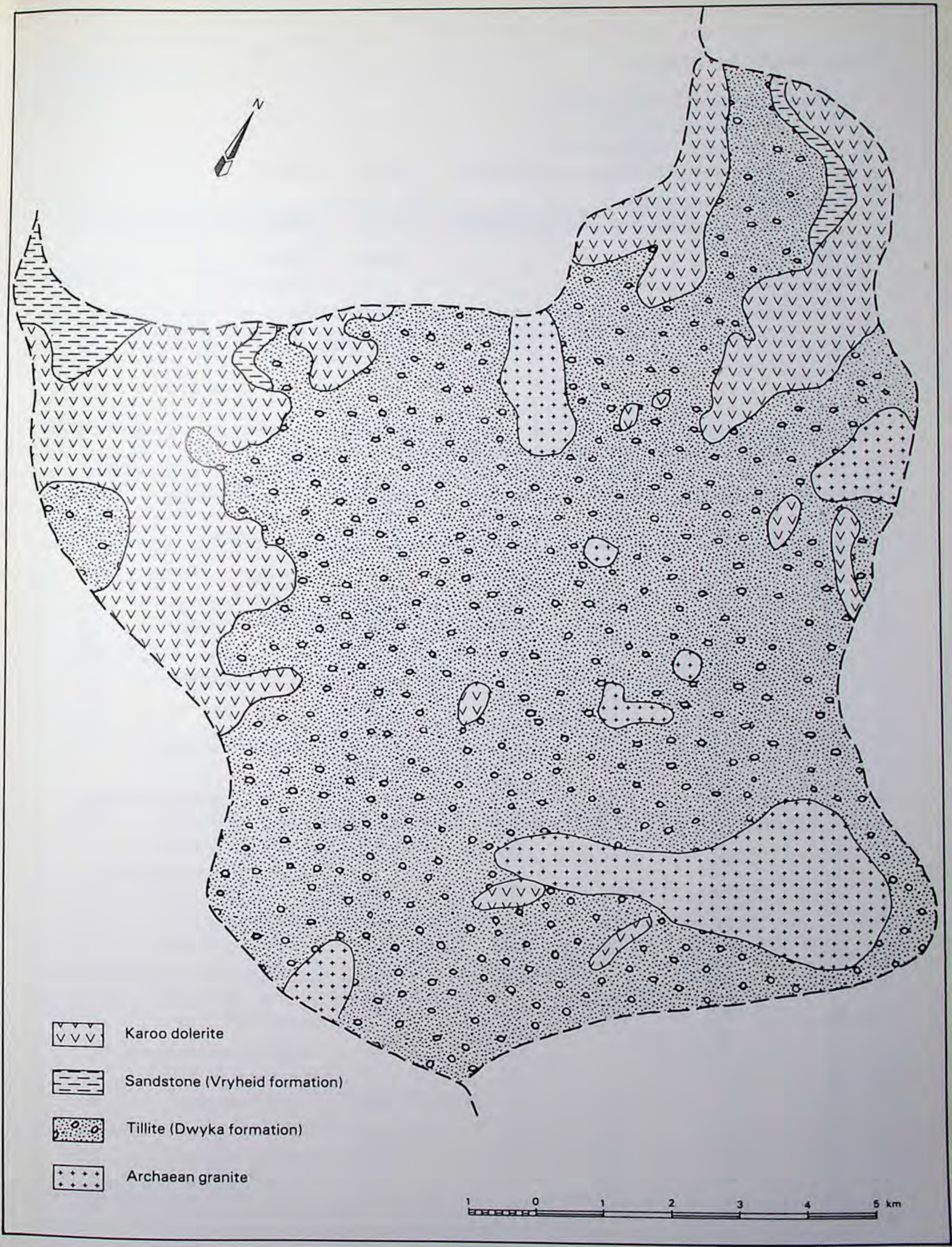


Fig. 29: The distribution of wetlands in quaternary sub-catchment W215. These data were derived from Job 773 of 1976.



Source: Dept. of Geological Survey

Fig. 30: The geology of quaternary sub-catchment W215.

Wetland inventory (Table 10)

- Wetland distribution (Pre Iron Age).
  No. of wetlands: 36
  Size range : 1,5 to 105 (ha)
  Area of sub-catchment under wetland: 594 ha (4,6%)
- Wetland status (at present).
  Area of sub-catchment under wetland: 102 ha (0,8%)
- Wetland losses: 492 ha (83%)
- Further details:
  Due to the high incidence of small, badly eroded wetlands in sub-catchment W215, no further description of individual sites are warranted for inventory purposes.

Table 10: The present status of wetlands in quaternary sub-catchment W215 (Fig. 29). Where losses have amounted to 100%, no further data are provided.

Wetland No:	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	10,0	-	100	-	-	-
2	13,0	-	100	-	-	-
3	22,5	8,5	62	282	3,0	1,2
4	13,0	2,0	85	215	0,9	0,3
5	1,5	1,5	-	35	4,3	0,3
6	2,5	2,5	-	25	10,0	0,6
7	3,5	3,5	-	80	4,4	0,5
8	9,0	-	100	-	-	-
9	2,5	2,5	-	32	7,8	0,9
10	17,0	13,0	23	177	7,3	2,8
11	3,0	-	100	-	-	-
12	6,0	-	100	-	-	-
13	6,0	-	100	-	-	-
14	105,0	3,0	97	3 175	0,1	0,5
15	4,5	3,0	33	42	7,1	0,4
16	2,5	-	100	-	-	-
17	12,0	-	100	-	-	-
18	11,0	-	100	-	-	-
19	11,0	3,0	73	72	4,2	0,4
20	7,0	-	100	-	-	-
21	102,0	15,0	85	365	4,1	2,0
22	103,0	8,0	92	837	1,0	1,1
23	9,0	-	100	-	-	-
24	9,0	-	100	-	-	-
25	5,0	5,0	-	205	2,4	1,3
26	17,0	17,0	-	112	15,1	1,8
27	7,5	-	100	-	-	-
28	5,0	-	100	-	-	-
29	14,0	-	100	-	-	-
30	9,0	-	100	-	-	-
31	2,0	2,0	-	45	4,4	0,4
32	4,5	-	100	-	-	-
33	3,0	3,0	-	45	6,6	0,9
34	29,5	3,5	88	320	1,1	0,8
35	9,0	3,0	66	152	1,9	0,7
36	3,5	3,5	-	87	4,0	0,8
TOTAL	594,0	102,0				17,7

Chapter 8

Quaternary Sub-catchment No: W216

Name: Lenjane (principal river)
Fig. No: 31

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  255 km^2
- Range in altitude.
  1 635 to 950 m above sea level
- Physiographic regions (Turner, 1967).
  region 12 (Hlobane-Manyini-Ceza Block)
  region 26 (Nondweni-White Mfolozi Plain)
- Geology (Geological Survey Dept., pers. comm., Fig 32).
  major bedrock types: In upper reaches: Sandstone (Vryheid formation), Shale (Pietermaritzburg formation)
  In lower reaches: Dwyka tillite
  less dominant types: Karoo dolerite (on the caps of the surrounding mountains) and Archaean granite.
- Soils (Fitzpatrick, 1978).
  Yellow and red apedal, freely drained dystrophic soils (in the north); weakly developed soils (lithocutanic B) in the south.
- Veld types (Acocks, 1953).
  veld type 63 (Piet Retief Sourveld) ↓ from north
  veld type 64 (Northern Tall Grassveld) to
  veld type 66 (Natal Sand Sourveld) south
- Bioclimatic regions (Phillips, 1973).
  region 6a (moist upland)
  region 8a (dry upland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 961 mm
  Range (Schulze, 1982): 800 to 1 200 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  34 million cubic metres/year
- Land use (Nanni, 1982).
  White owned farmland, comprising wattle plantations, maize fields and natural veld used for the grazing of cattle and sheep.

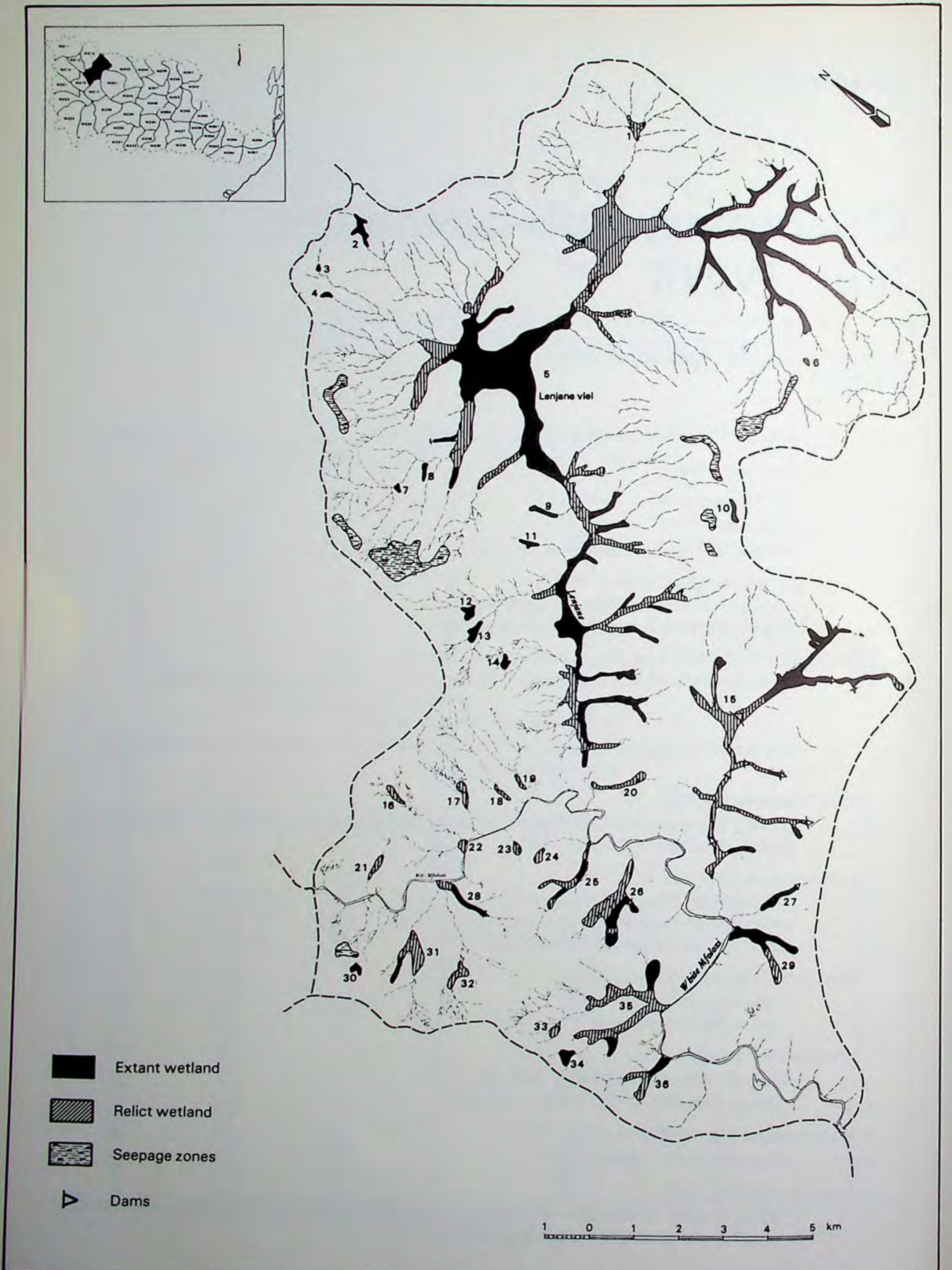
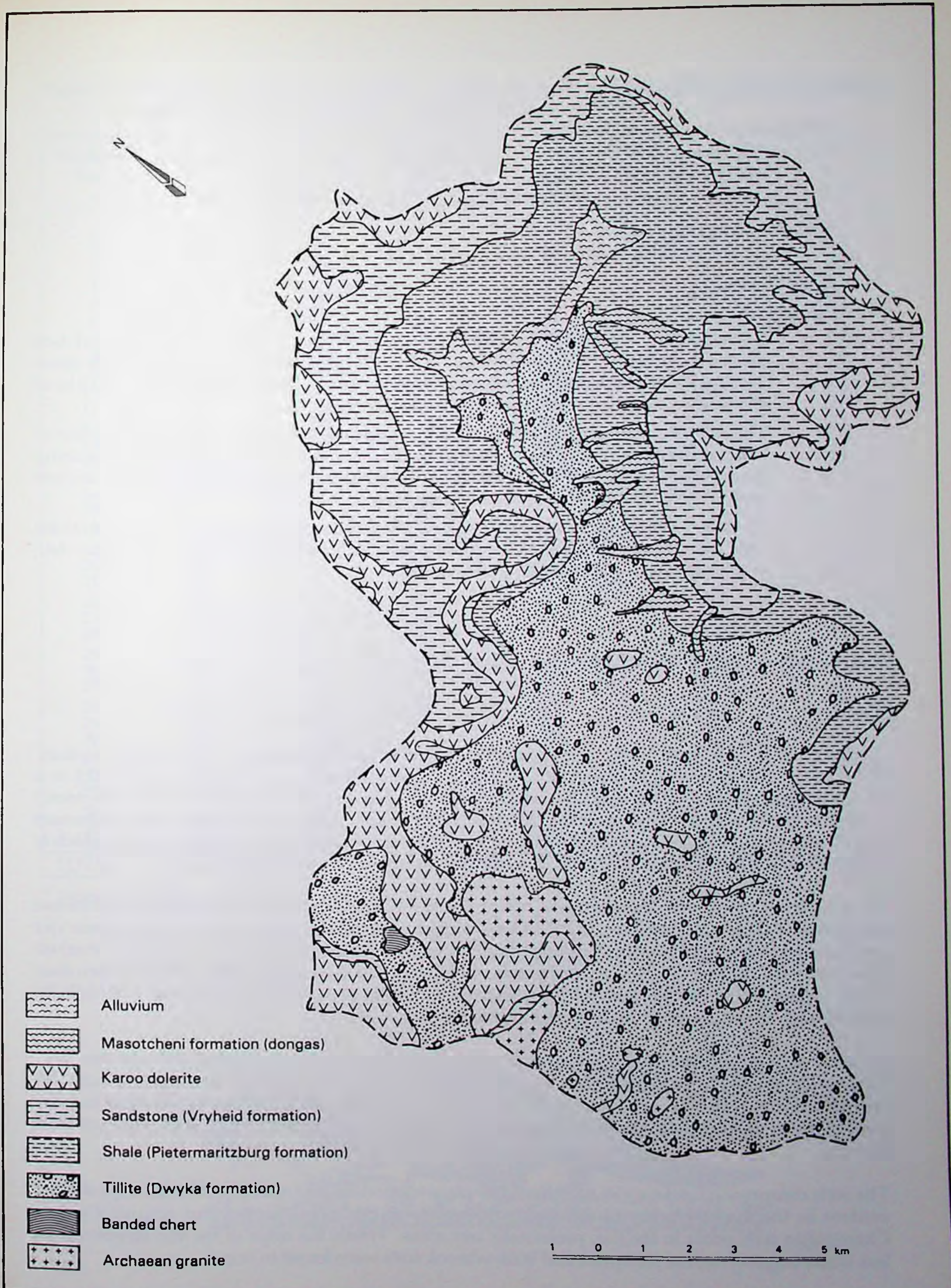


Fig. 31: The distribution of wetlands in quaternary sub-catchment W216. These data were derived from Job 773 of 1976.



Source: Dept. of Geological Survey

Fig. 32: The geology of quaternary sub-catchment W216.

Wetland inventory (Table 11)

- Wetland distribution (Pre Iron Age).
  No. of wetlands: 36
  Size range : 1,5 to 1 228 (ha)
  Area of sub-catchment under wetland: 1 822 ha (7,1%)
- Wetland status (at present).
  Area of sub-catchment under wetland: 938 ha (3,6%)
- Wetland losses: 884 ha (48%)
- Further details:

  Although not identifiable as individual wetland sites, it should also be noted that immediately below the sheets of Karoo dolerite mentioned above several seepage zones occur, each of which contain numerous small wetlands. These zones occupy c. 215 ha of the catchment, and range in size from 3 - 100 ha each.

  The sub-catchment is also characterised by a large tract of alluvium on the flood plain of the Lenjane River (Fig. 32) leading towards which are several dongas containing semi-consolidated sandy materials (of the Masotcheni formation). These were ancient wetland sites that have since been eroded away.

  By virtue of its large size (accounting for 76% of the wetland in this sub-catchment) the only wetland system which warrants attention for inventory purposes, is Lenjane vlei. A description of this system is given below.

8.1 Lenjane vlei (wetland No. 5, Fig. 31)

Form

Lenjane vlei (27° 52′ S; 31° 01′E) is an important wetland in the upper reaches of the White Mfolozi. Prior to any alteration the vlei occupied 1 228 ha, but today, it has been reduced in size by 42% to a series of partially connected wetlands, totalling 715 ha. The main body of the vlei (or "core area") occurs in the middle reaches, where the altitude is c. 995 m a.s.l. From here the vlei extends upstream in an easterly direction to an elevation of 1 097 m a.s.l, and downstream towards its outlet, which is at 960 m a.s.l, and approximately 1 km from the mainstream of the White Mfolozi.

Over its length of 19 km, the average slope of the vlei is 0,7%, and even in its present somewhat degraded condition, its perimeter is still 75 km in length. This information suggests that Lenjane vlei probably has a high potential to attenuate run-off, because determinants such as these have a marked effect on reducing the velocity of floodwaters. In most places it is narrow being seldom more than 300 m across, but in its middle reaches it widens considerably to over 1 500 m. Several waterfalls lie immediately above Lenjane vlei in its uppermost reaches.

Lenjane vlei is surrounded by Ecca shale in its upper reaches and by Dwyka tillite in its lower reaches. Structurally the keypoint of the system is not distinct, in that the vlei outlet does not appear to coincide with an erosion-resistant rock type such as Karoo dolerite. In this instance the keypoint seems to be Dwyka tillite, together with fluvial deposits possibly laid down by the White Mfolozi at the outlet of the vlei.

The soils comprising Lenjane vlei vary from one place to another. For example, alluvial deposits are evident in the lower reaches of the vlei in proximity to the river channel, but organically rich Champagne soils occur in the flat, perennially wet areas. Where the slope of the vlei steepens and less water-logging occurs, Katspruit and Willowbrook soils were found to occur.

Table 11: The present status of wetlands in quaternary sub-catchment W216 (Fig. 31). Where losses have amounted to 100%, no further data are provided.

Wetland No:	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	8,0	-	100	-	-	-
2	7,5	7,5	-	112	6,7	2,0
3	1,5	1,5	-	40	3,7	0,5
4	1,5	1,5	-	22	6,8	0,6
5	1 228,5	715,5	42	14 735	5,1*	75,0
6	1,2	1,2	-	15	8,3	0,4
7	1,7	1,7	-	15	11,6	0,5
8	3,0	3,0	-	35	8,5	1,0
9	6,0	6,0	-	120	5,0	1,2
10	3,5	3,5	-	60	5,8	1,3
11	3,5	2,0	43	77	2,6	0,5
12	5,0	5,0	-	122	4,1	1,1
13	6,5	6,5	-	57	11,4	1,0
14	3,7	3,7	-	30	12,5	0,8
15	214,5	82,5	62	2 700	3,0	16,5
16	6,0	-	100	-	-	-
17	6,5	-	100	-	-	-
18	3,5	-	100	-	-	-
19	3,0	-	100	-	-	-
20	14,0	-	100	-	-	-
21	5,5	-	100	-	-	-
22	3,0	-	100	-	-	-
23	4,0	-	100	-	-	-
24	4,5	-	100	-	-	-
25	21,5	7,0	67	420	1,6	2,0
26	58,0	19,0	67	330	5,7	2,5
27	7,0	7,0	-	187	3,7	1,6
28	10,5	7,0	33	195	3,6	2,1
29	33,0	22,0	33	277	7,9	3,6
30	3,0	3,0	-	50	6,0	0,7
31	28,0	4,0	86	287	1,4	0,9
32	9,0	-	100	-	-	-
33	5,5	-	100	-	-	-
34	6,0	6,0	-	50	12,0	0,9
35	74,0	15,0	80	850	2,5*	1,8
36	20,5	6,5	68	237	2,7	1,0
TOTAL	1 822,0	938,0				119,5

* includes upstream wetlands.

Macroclimate

Considering the fact that two bioclimatic regions are encountered in quaternary sub-catchment W216, the macroclimate of this region (after Phillips (1973); Pitman *et al.*, (1981) and Schulze (1982)) is indicated in the table below.

		Upper reaches (Bioclimatic region 6a)	Lower reaches (Bioclimatice region 8a)
• mean annual precipitation (mm)	=	1 000-1 200	900-1 000
• relative humidity (%)	=	70	60-65
• temperature			
mean annual (^oC)	=	18	18
maximum (^oC)			
mean daily	=	25	27
extreme daily	=	41	41
minimum (^oC)			
mean daily	=	11	11
extreme daily	=	-10	-7
• mean annual potential evapotranspiration (mm)	=	1 500	1 550

There are two weather stations in close proximity to Lenjane vlei, these being Langkrans (station 373/80 situated near the headwaters of the river, and with records extending back to 1921) and Gluckstadt (station 373/58 near the outlet of the vlei, with records dating back to 1922).

Hydrology

Streamflow in the Lenjane River (stream order 4) has never been gauged, thus information on the variability of run-off is not available.

However, the vlei lies at the receiving end of a 147 km catchment, expected to yield c. 30 million m^3 of water each year. Although the amount of wetland cover (5,1%) is not particularly high, various features of the vlei such as;

- its gradual slope (0,7%),
- its width in the middle reaches of over 1 km,
- diffuse drainage patterns in several portions of the vlei, and
- the widespread occurrence of dense stands of vegetation,

all suggest that Lenjane vlei functions satisfactorily from the point of view of attenuating run-off, and hence is likely to bring about sediment accretion and flood peak reduction.

However, in disturbed portions of the vlei, especially where gully erosion has occurred, it is likely that functions such as these are no longer operative.

Fauna and flora

Depending on the amount of soil moisture and disturbance, the vegetation cover of Lenjane vlei varies greatly from one locality to the next. This has resulted in a high level of interspersion between plant communities, and as a consequence of the greater habitat diversity, a significant amount of wetland associated birdlife occurs (de Jager, pers. comm.*).

The dominant forms of plant cover are reeds (*Phragmites australis*), bullrushes (*Typha latifolia*) and various species of hygrophilous grasses. Tree ferns occur in the upper reaches of the vlei. The permanently waterlogged "core area" of the vlei comprises dense reedswamps (Plate 13) which are used each year by egrets and herons for breeding. The patches of open water in the vlei also attract a wide variety of waterfowl, and as a result the vlei has a good reputation (locally) for duck hunting.

On the 23rd September 1986, fresh crab-filled scats of the clawless otter (*Aonyx capensis*) were evident amongst the reedswamps referred to above. This, together with the reported breeding of Crowned and Blue crane (de Jager, pers. comm.) is another indication of a generally favourable wetland environment.

Land Tenure

Lenjane vlei is privately owned by 25 persons (Fig. 33), and this situation is one of the most difficult problems confronting managers of the vlei, if ever it is to be effectively managed as a single ecosystem. It is alleviated only by the fact that at present several of the farms involved are owned by the same person (e.g. farms 5408, 5757 and 5354 are all owned by Mr L.A.S. van Aswegen).

Plate 13: An impression of the reedswamps in the main body of Lenjane vlei. With cattle being paddocked in this area, notice the trampling that has occurred in the foreground.

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* Mr S de Jager: Zone Officer, Natal Parks Board, Vryheid.

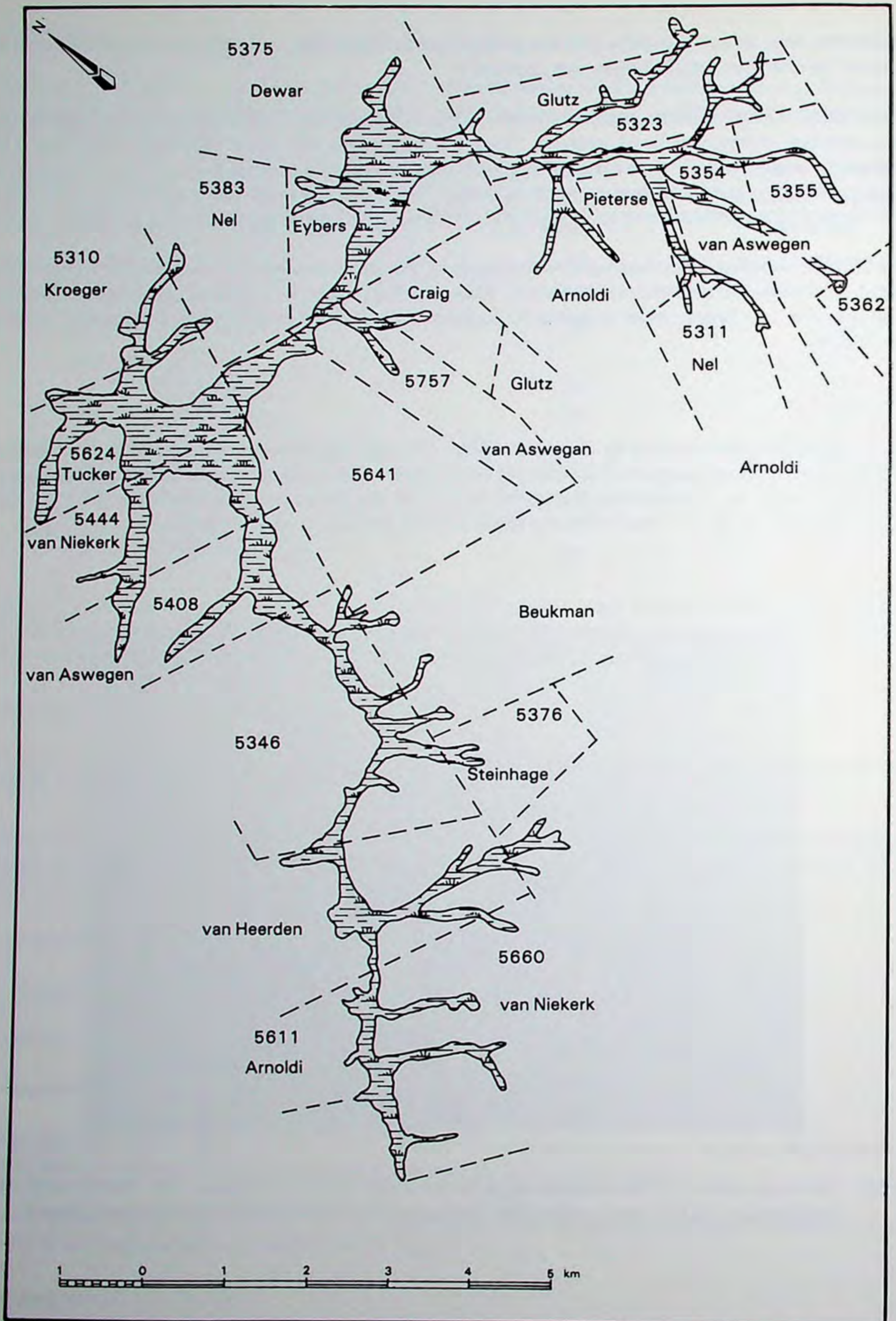


Fig. 33: The land ownership of Lenjane vlei, showing the identification number of the farm (according to the local extension officer) and, where known, the owner's name.

Land Use

The land surrounding Lenjane vlei is principally used for crop production, and in the upper reaches of the catchment, for forestry (wattle plantations). A large proportion of the catchment area is natural veld used for the grazing of cattle.

Apart from severe erosion in the past, which has caused more damage to the vlei than any other single factor, numerous forms of disruption (Plates 14 and 15) are evident within the vlei. These include:

	Perceived severity of problem*
• grazing of cattle and sheep	1
• burning	2
• pastures	1
• crops (especially in lower reaches)	2
• encroachment of alien trees (willows, poplars, wattle)	1
• trampling by cattle	1
• cutting of reeds	1
• irrigation (centre pivot)	1
• sand extraction	1
• ditching and channelling	2
• water abstraction	1
• road construction	1
• stockwatering	1

* 1 = moderately serious
2 = serious
3 = very serious

Conclusions

Although Lenjane vlei has been extensively altered, its unquestionable agricultural importance, most probable hydrological importance and value to wildlife all suggest that the system warrants more careful treatment and protection than it currently receives.

As some of the uses to which the vlei is presently subjected are likely to prove incompatible, it is recommended that an integrated land use plan is prepared by the Department of Agriculture and Water Supply, incorporating all of the farms shown in Fig. 32. An effort will also have to be made to ensure that the farmers concerned work according to the plan, and in close consultation with the Department. An initial way may be to test the acceptability of forming a conservancy comprising the farmers adjoining Lenjane vlei, with assistance in achieving this being provided by the Natal Parks Board.

In addition, the environmental condition of Lenjane vlei needs to be closely monitored in future, and steps taken to rehabilitate those portions of the system which are presently verging on extinction. These measures include the blocking of drains, reducing the interval of burning, reducing the intensity of grazing and stabilizing watercourses in the lower reaches of the vlei. If necessary the latter process could include dam construction.

Plate 14: Evidence of the ditches that have been dug through Lenjane vlei in order to divert the inflowing water, and hence allow a greater degree of utilization of the vlei by cattle.

Plate 15: An impression of the grazing intensity of cattle in a portion of Lenjane vlei (farm 5346 - Fig. 33) This can insidiously lead to erosion, compaction of the soil and reduced water storage.

Sources of information

Maps : 1:50 000 sheet 2731 CC Gluckstadt
2730 DD Vryheid

Aerial photographs

Year	Job	Scale	Strip No.	Photo Nos.
Whole vlei				
1961	455	1:36 000		
1969	607	1:36 000		
1973	773	1:50 000		
1976	773	1:30 000	14	8579-8581
			15	8629-8633
Upper vlei				
1943	16	1:25 000	No record	
Lower vlei				
1944	73	1:18 000		

Chapter 9

Quaternary Sub-catchment No: W217

Name: Goederwacht
Fig. No: 34

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  190 km^2
- Range in altitude.
  1 142 to 920 m above sea level
- Physiographic region (Turner, 1967)
  region 26 (Nondweni-White Mfolozi Plain)
- Geology (Geological Survey Dept., pers. comm., Fig. 35).
  major bedrock type: Dwyka tillite
  less dominant type: Granite
- Soils (Fitzpatrick, 1978).
  Weakly developed soils (lithocutanic B), except in the south (lowveld area) where red clays and duplex soils prevail.
- Veld types (Acocks, 1953).
  veld type 66 (Natal Sand Sourveld)
  veld type 10 (Lowveld)
- Bioclimatic regions (Phillips, 1973).
  region 8a (dry upland)
  region 10 (riverine-interior lowland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 768 mm
  Range (Schulze, 1982): 600 to 1 000 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  12 million cubic metres/year
  There are no well developed tributaries in this region, and the stream frequency is relatively low.
- Land use (Nanni, 1982).
  White owned farmland, principally used for the production of cattle and maize.

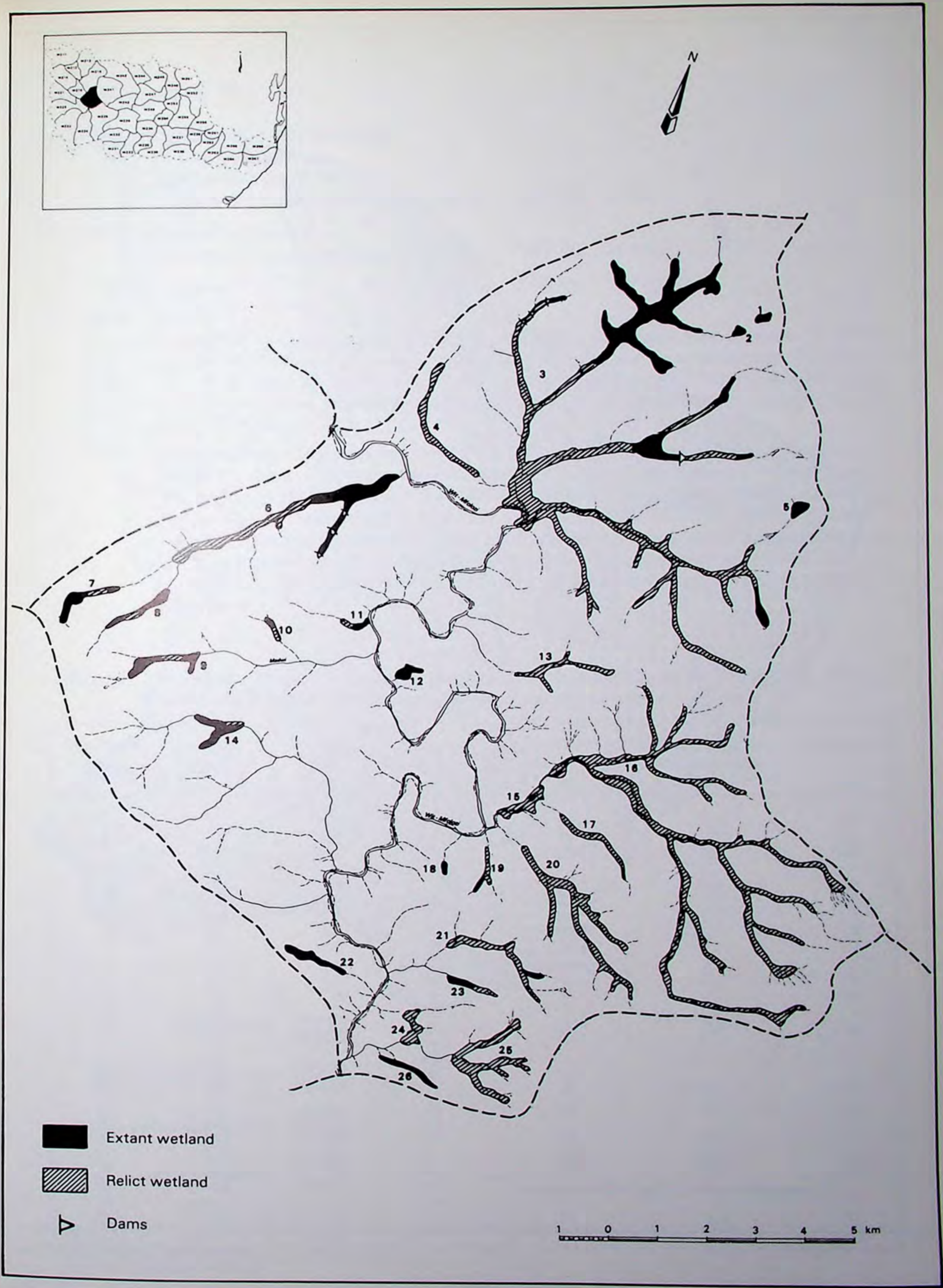
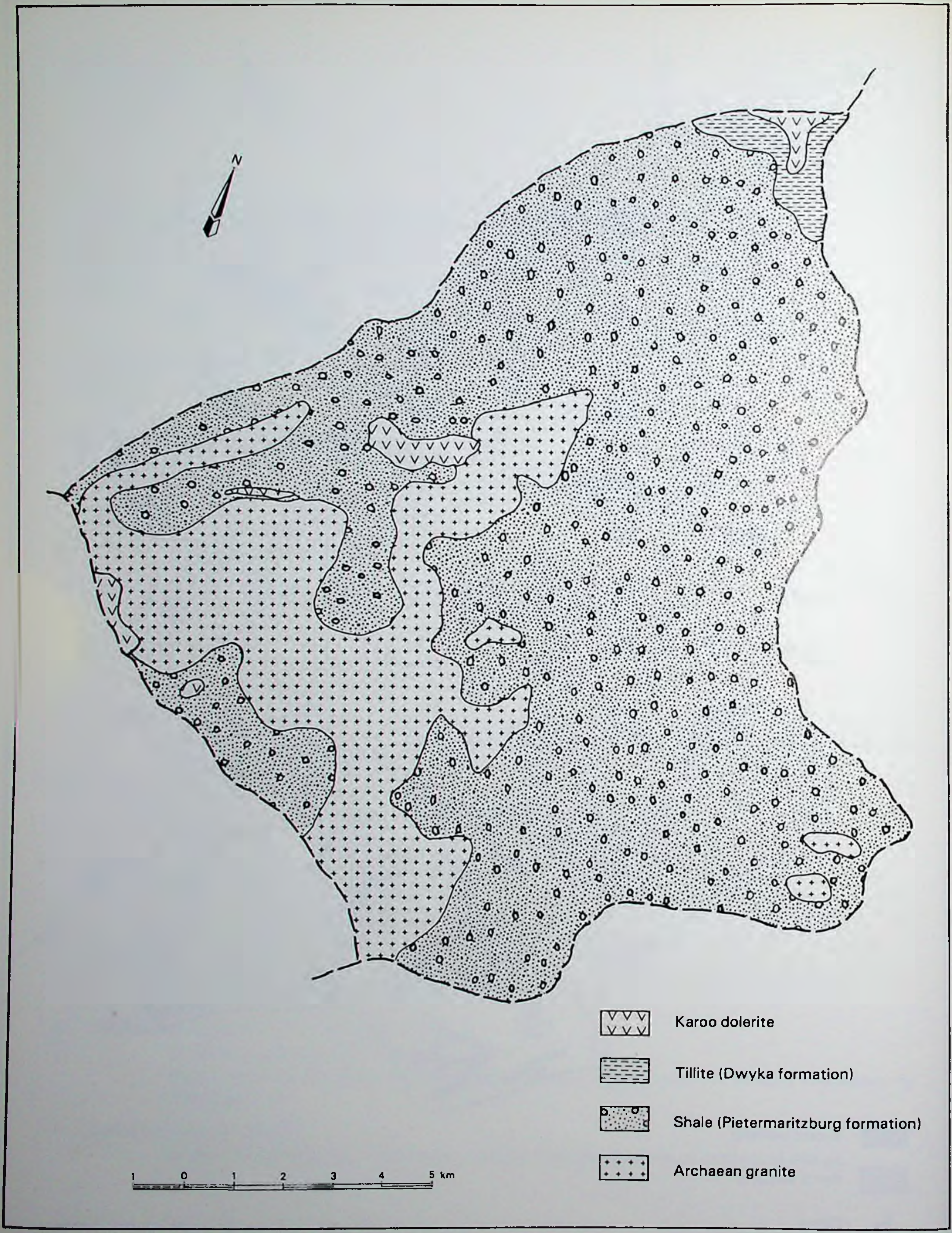


Fig. 34: The distribution of wetlands in quaternary sub-catchment W217. These data were derived from Job 672 of 1970 and Job 849 of 1981.



Source: Dept. of Geological Survey

Fig. 35: The geology of quaternary sub-catchment W217.

Wetland inventory (Table 12)

- Wetland distribution (Pre Iron Age).
  - No. of wetlands: 26
  - Size range : 2 to 678 (ha)
  - Area of sub-catchment under wetland: 1 469 ha (7,7%)
- Wetland status (at present).
  - Area of sub-catchment under wetland: 287 ha (1,5%)
- Wetland losses: 1 182 ha (80%)
- Further details:

Due to the extensive losses of wetland incurred in this region (see above) none of the remaining wetlands warrant further description for inventory purposes. However, "Goederwacht vlei" (wetland No. 3, Fig. 34) which was formerly 678 ha in size definitely warrants further investigation with a view to determining its suitability for rehabilitation.

Aerial photography suggests that 78% of the system has been ruined by gully erosion. However, some of the wettest remnants of this vlei occur downstream of the railway line that intersects the wetland (c.f. 1:50 000 sheet 2831 AA Nhlazatshe). This could be due to the railway embankments which have reduced the velocity of run-off from upstream, and thus stabilised the watercourse for a certain distance downstream. It is possible that soil conservation structures designed in accordance with the requirements specified by Crosby *et al.*, (1980) could achieve similar results if placed in eroded portions of the vlei elsewhere.

Table 12: The present status of wetlands in quaternary sub-catchment W217 (Fig. 34). Where losses have amounted to 100%, no further data are provided.

Wetland No:	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	3,5	3,5	-	20	17,5	0,7
2	2,5	2,5	-	97	6,2*	0,6
3	678,0	145,0	78	5 900	2,7*	20,2
4	33,0	-	100	-	-	-
5	7,0	7,0	-	50	14,0	0,9
6	67,0	36,0	46	1 587	3,6*	5,9
7	16,0	12,0	25	205	5,8	1,7
8	13,5	9,5	30	182	5,2	1,9
9	17,0	14,0	18	342	4,1	2,3
10	4,5	1,5	66	87	1,7	0,3
11	5,5	3,5	36	145	2,4	0,6
12	7,0	7,0	-	87	8,0	1,0
13	24,0	-	100	-	-	-
14	15,5	13,0	16	520	2,5	2,3
15	15,0	-	100	-	-	-
16	357,0	-	100	-	-	-
17	16,0	-	100	-	-	-
18	2,0	2,0	-	50	4,0	0,5
19	9,0	2,0	78	112	1,8	0,6
20	65,0	-	100	-	-	-
21	25,5	1,5	94	362	0,4	0,5
22	15,0	15,0	-	100	15,0	2,5
23	9,5	5,5	42	82	6,7	1,0
24	14,0	-	100	-	-	-
25	40,0	-	100	-	-	-
26	7,0	7,0	-	82	8,5	3,0
TOTAL	1 469,0	287,0				46,5

* includes upstream wetlands.

Chapter 10

Quaternary Sub-catchment No: W221

Name: Upper Mvunyana (principal river)
Fig. No: 36

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  220 km^2
- Range in altitude.
  1 530 to 950 m above sea level
- Physiographic regions (Turner, 1967).
  region 10 (Nqutu Divide)
  region 26 (Nondweni-White Mfolozi Plain)
- Geology (Geological Survey Dept., pers. comm.).
  major bedrock types: Ecca sandstone and Dwyka tillite
  less dominant type: Karoo dolerite
- Soils (Fitzpatrick, 1978).
  Mesotrophic sands and loams in highlying areas, weakly developed soils (lithocutanic B) in lowerlying areas.

  See also soil maps prepared by van der Eyk *et al.*, (1969).
- Veld types (Acocks, 1953).
  veld type 65 (Southern Tall Grassveld)
  veld type 66 (Natal Sour Sandveld)
- Bioclimatic regions (Phillips, 1973).
  region 6a (moist upland)
  region 8a (dry upland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 752 mm
  Range (Schulze, 1982): 600 to 800 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  12 million cubic metres/year
- Land use (Nanni, 1982).
  Virtually the whole of sub-catchment W221 lies in KwaZulu, and falls under the jurisdiction of Chief Sotho and Chief Mdlalose (NTRPC, pers. comm.). The township of eMondlo (population in 1982 : 23 000, excluding an estimated 22 000 squatters in its immediate vicinity, (KwaZulu Govt., pers. comm.)) occurs in the NW portion of the

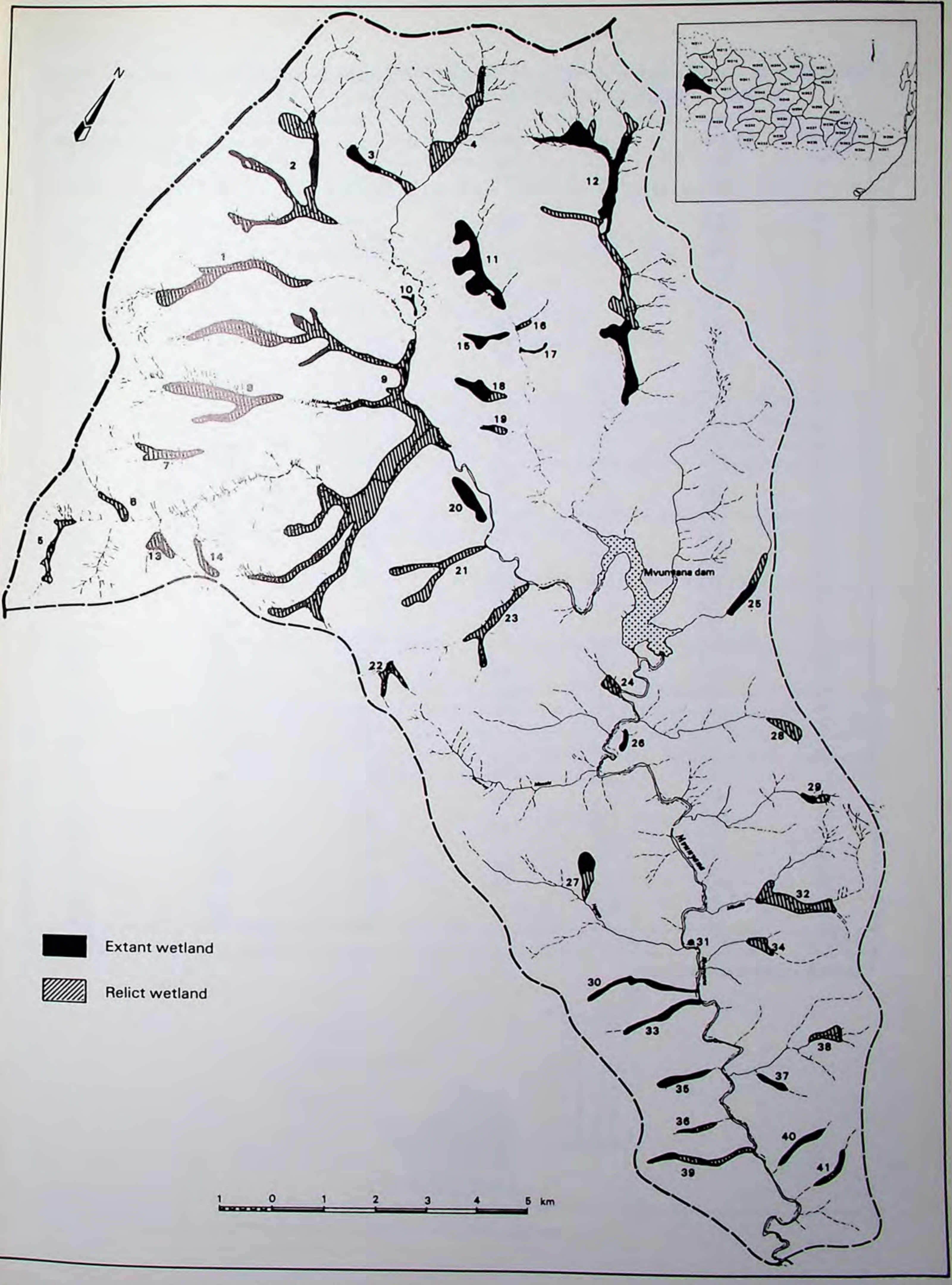


Fig. 36: The distribution of wetlands in quaternary sub-catchment W221. These data were derived from Job 849 of 1981 (see Fig. 3).

Table 13: The present status of wetlands in quaternary sub-catchment W221 (Fig. 36). Where losses have amounted to 100%, no further data are provided.

Wetland No:	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	52,0	-	100	-	-	-
2	72,0	18,0	75	1 025	1,7	3,5
3	18,0	10,0	44	275	3,6	1,2
4	39,0	-	100	-	-	-
5	12,0	-	100	-	-	-
6	7,0	-	100	-	-	-
7	10,0	-	100	-	-	-
8	46,0	5,0	89	325	1,5	0,5
9	375,0	11,0	97	6 425	0,7*	2,0
10	2,5	2,5	-	52	4,8	1,1
11	53,0	53,0	-	520	10,2	5,2
12	123,0	72,0	41	1 700	4,2	10,5
13	11,0	-	100	-	-	-
14	8,0	-	100	-	-	-
15	11,0	11,0	-	112	9,8	2,0
16	2,0	1,0	50	82	1,2	0,3
17	2,0	2,0	-	48	4,1	0,9
18	14,5	12,0	17	87	13,7	1,2
19	4,5	2,0	55	45	2,2	0,5
20	19,0	19,0	-	125	15,2	2,1
21	27,0	-	100	-	-	-
22	9,0	-	100	-	-	-
23	25,0	-	100	-	-	-
24	6,5	-	100	-	-	-
25	12,0	6,0	50	162	3,7	1,4
26	3,5	3,5	-	30	11,6	0,7
27	12,5	8,0	36	80	10,0	0,8
28	9,0	-	100	-	-	-
29	4,0	1,5	62	70	2,1	0,7
30	17,0	17,0	-	145	11,7	4,0
31	1,5	1,5	-	15	10,0	0,2
32	23,0	-	100	-	-	-
33	15,0	15,0	-	170	8,8	3,0
34	6,0	-	100	-	-	-
35	11,0	11,0	-	107	10,3	2,0
36	3,5	1,5	57	72	2,1	0,6
37	5,0	5,0	-	100	5,0	1,2
38	6,0	-	100	-	-	-
39	15,5	5,5	64	195	2,8	1,4
40	5,0	5,0	-	112	4,5	1,9
41	4,0	2,5	37	98	2,6	1,1
TOTAL	1 102,0	301,0				50,0

* includes upstream wetlands.

catchment, as well as the 245 ha Mvunyana (or Mondlo) dam. This was built in the early 1970's (Perkins, pers. comm.*) and has a capacity of 5,2 million m^3.

Wetland inventory (Table 13)

- Wetland distribution (Pre Iron Age).
  No. of wetlands: 41
  Size range : 1,5 to 375 (ha)
  Area of sub-catchment under wetland: 1 102 ha (5%)
- Wetland status (at present).
  Area of sub-catchment under wetland: 301 ha (1,4%)
- Wetland losses: 801 ha (73%)
- Further details:

  Generally speaking, soil erosion is rife throughout the area. The fact that many of the dongas located in this region are mapped as "semi-consolidated sandy materials of the Masotcheni formation" (Department of Geological Survey, pers. comm.), suggests that several hundred years ago these were ancient wetlands which have since been lost through erosion.

  For inventory purposes, none of the remaining wetland sites are large enough to warrant further description. However, it should be noted that:

  - at present active erosion in the area implies that further wetland losses could be incurred.
  - the intensity of grazing seems to be a major factor in accounting for this situation.
  - in certain areas (for example near the township of eMondlo) tracts of existing wetland (Plate 16a & b) are used extensively as drinking water supplies and for other domestic purposes such as washing and laundering. Destocking may be required to protect such wetlands from being ruined altogether in the long term, if only to extend their usefulness to society.

* J Perkins: Circle Engineer (Natal), Department of Water Affairs.

Plate 16a: The condition of wetland No. 12 (Fig. 36) which is surrounded by the township of eMondlo. Notice Mt. Nkanda in the background, and signs of grazing and burning. (Date of photo: 31 July 1986).

Plate 16b: The condition of wetland No. 12 (Fig. 36) (looking downstream) showing the erosion which has occurred, and the surrounding township of eMondlo.

Chapter 11

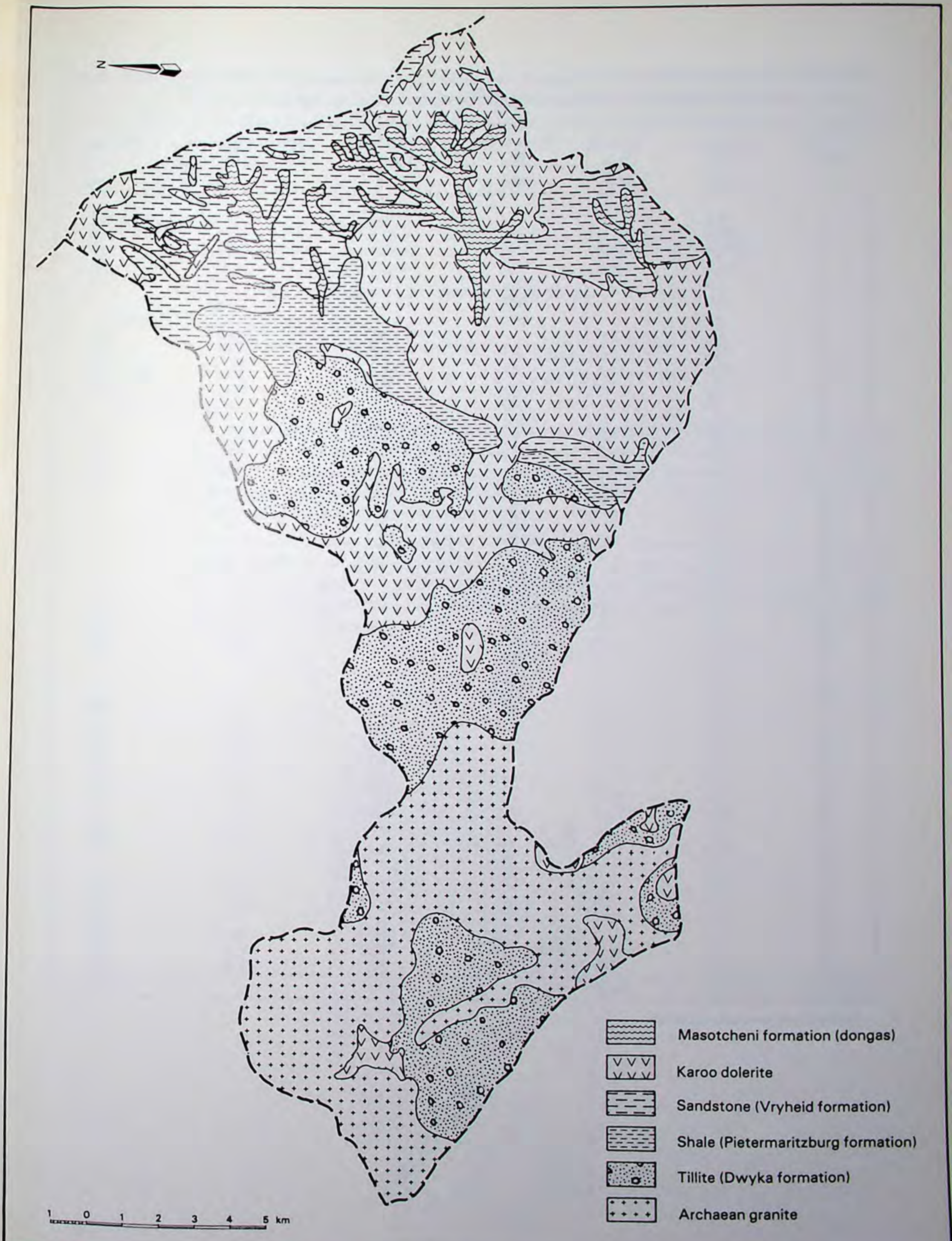
Quaternary Sub-catchment No: W223

Name: Lower Mvunyana (principal river)
Fig. No: 37

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  320 km^2
- Range in altitude.
  1 526 to 840 m above sea level
- Physiographic regions (Turner, 1967).
  region 10 (Nqutu Divide)
  region 26 (Nondweni-White Mfolozi Plain)
- Geology (Geological Survey Dept., pers. comm., Fig 38).
  major bedrock types: Karoo dolerite, Dwyka tillite
  less dominant type: Sandstone, granite
- Soils (Fitzpatrick, 1978).
  Yellow and grey hydromorphic, mainly mesotrophic sands and loams in the uplands; weakly developed soils (lithocutanic B), red clays and duplex soils in lowlands.
  See also soil maps prepared by van der Eyk *et al.*, (1969).
- Veld types (Acocks, 1953).
  veld type 66 (Natal Sand Sourveld)
  veld type 65 (Southern Tall Grassveld)
  veld type 44a (Highland Sourveld)
- Bioclimatic regions (Phillips, 1973).
  region 6a (moist upland)
  region 8a (dry upland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 738 mm
  Range (Schulze, 1982): 600 to 900 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  17 million cubic metres/year
  Sub-catchment W223 contains three important tributaries of the Mvunyana River (the Jojosi, Magongolozi and the Vumankala).

Fig. 37: The distribution of wetlands in quaternary sub-catchment W223. These data were derived from Job 849 of 1981.



Source: Dept. of Geological Survey

Fig. 38: The geology of quaternary sub-catchment W223.

Table 14: The present status of wetlands in quaternary sub-catchment W223 (Fig. 37). Where wetland losses have amounted to 100%, no further data are provided.

Wetland No:	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	2,5	2,5	-	100	2,5	0,8
2	937,0	39,0	96	6 325	0,6	8,8
3	780,0	15,0	98	5 975	0,3*	1,0
4	212,0	8,0	96	2 020	0,4	1,5
5	8,0	-	100	-	-	-
6	3,0	-	100	-	-	-
7	6,0	-	100	-	-	-
8	2,0	2,0	-	25	8,0	0,7
9	8,5	3,5	59	52	6,7	0,7
10	79,0	44,0	44	562	7,8	5,0
11	6,5	2,5	61	50	5,0	0,6
12	6,0	-	100	-	-	-
13	18,0	-	100	-	-	-
14	8,5	5,0	41	80	6,2	0,9
15	11,0	3,0	73	85	3,5	0,7
16	4,0	1,5	62	77	1,9	0,5
17	31,5	1,5	95	357	0,4	0,6
18	18,0	-	100	-	-	-
19	11,0	-	100	-	-	-
20	1,5	-	100	-	-	-
21	2,5	-	100	-	-	-
22	4,0	-	100	-	-	-
23	4,0	-	100	-	-	-
24	4,0	4,0	-	45	8,8	1,2
25	5,5	1,5	73	30	5,0	0,5
26	18,0	3,0	83	290	1,0	0,7
27	44,0	-	100	-	-	-
28	12,5	-	100	-	-	-
29	4,0	-	100	-	-	-
30	4,5	3,0	33	62	4,8	0,6
31	9,5	4,5	53	200	2,2	1,8
32	5,0	4,0	20	77	5,2	1,1
33	2,0	2,0	-	42	4,7	0,4
34	6,0	3,0	50	102	2,9	0,8
35	18,0	14,0	22	1 787	4,1*	3,8
36	90,0	56,0	38	1 050	5,3	9,5
37	4,0	4,0	-	150	2,6	0,8
38	27,0	17,0	37	350	4,8	4,2
39	5,5	-	100	-	-	-
40	24,0	7,0	71	1 030	0,9*	1,4
41	5,5	2,0	64	245	0,8	0,5
42	6,0	6,0	-	80	7,5	1,7
43	2,5	1,0	60	1 500	0,7*	0,3
44	6,5	1,0	85	72	1,4	0,3
45	16,5	7,5	55	392	1,9	1,3
TOTAL	2 485,0	268,0				52,7

* includes upstream wetlands.

- Land use (Nanni, 1982).

  West of the Mvunyana River (Fig. 37) the area lies in KwaZulu, within the jurisdiction of Chief Sotho and Chief Mdlalose (NTRPC, pers. comm.). The area is overgrazed and overpopulated.

Wetland inventory (Table 14)

- Wetland distribution (Pre Iron Age).

  No. of wetlands: 45
  Size range : 1,5 to 937 (ha)
  Area of sub-catchment under wetland: 2 485 ha (7,7%)

- Wetland status (at present).

  Area of sub-catchment under wetland: 268 ha (0,8%)

- Wetland losses: 2 217 ha (88%)

- Further details:

  Very severe erosion is evident in this area (for confirmation see van der Eyk *et al.*, (1969) and the extensive areas mapped as semi-consolidated sandy alluvium (or "Masotcheni") by the Department of Geological Survey (Fig. 38)). The steepness of the surrounding land, the slope of these former wetlands, and the highly erodible Katspruit soils which comprised them are all contributory factors to this state of affairs.

  Wetland Nos. 2 (Magongolozi vlei), 3 (Jojosi vlei) and 4 (Vumankala vlei) (Fig. 37) could be potentially suitable as reclamation sites. Given the experience of Pienaar (1980) and his colleagues, and the prospect of state assistance (through the recently created "Unemployment Fund") reconnaisance surveys and the preparation of feasibility reports is therefore recommended.

Chapter 12

Quaternary Sub-catchment No: W222

Name: Nondweni (principal river)
Fig. No: 39

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  400 km^2
- Range in altitude.
  1 580 to 920 m above sea level
- Physiographic regions (Turner, 1967).
  region 26 (Nondweni-White Mfolozi Plain)
  region 10 (Nqutu Divide)
  region 20 (Buffalo Plain)
  region 11 (Babanango Block)
- Geology (Geological Survey Dept., pers. comm., Fig. 40).
  major bedrock types: Ecca sandstone and Dwyka tillite
  less dominant type: Volcanic intrusives
- Soils (Fitzpatrick, 1978).
  Mesotrophic sands and loams, or weakly developed soils (lithocutanic B) and plinthic forms.

  See also the soil maps prepared by van der Eyk *et al.*, (1969), some of which incorporate part of sub-catchment W222.
- Veld types (Acocks, 1953).
  veld type 65 (Southern Tall Grassveld)
  veld type 66 (Natal Sand Sourveld)
  veld type 44a (Highland Sourveld)
- Bioclimatic regions (Phillips, 1973).
  region 8a (dry upland)
  region 6a (moist upland)
  region 4 (highland to sub-montane)
  region 10 (riverine-interior lowland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 752 mm
  Range (Schulze, 1982): 700 to 900 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  22 million cubic metres/year

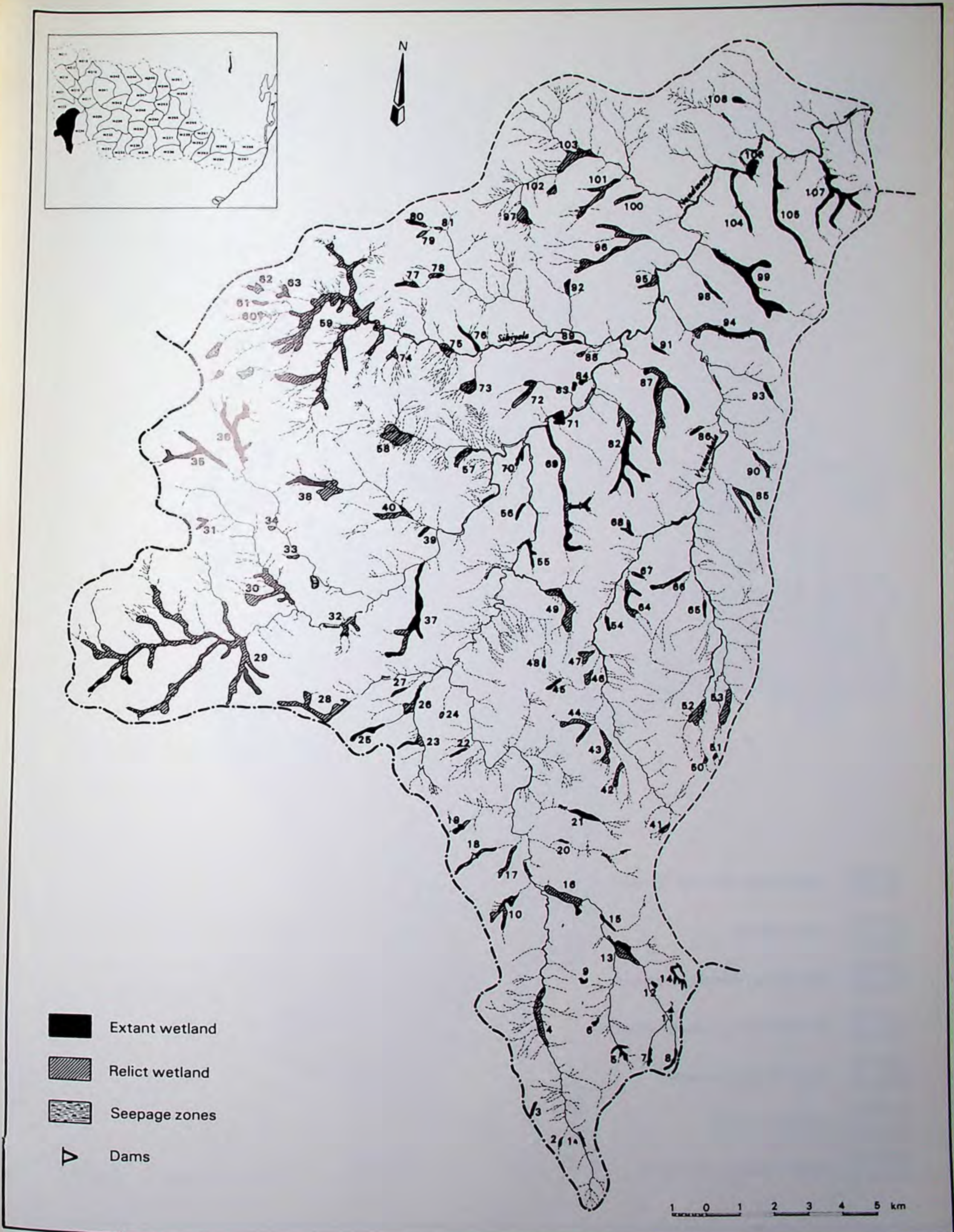
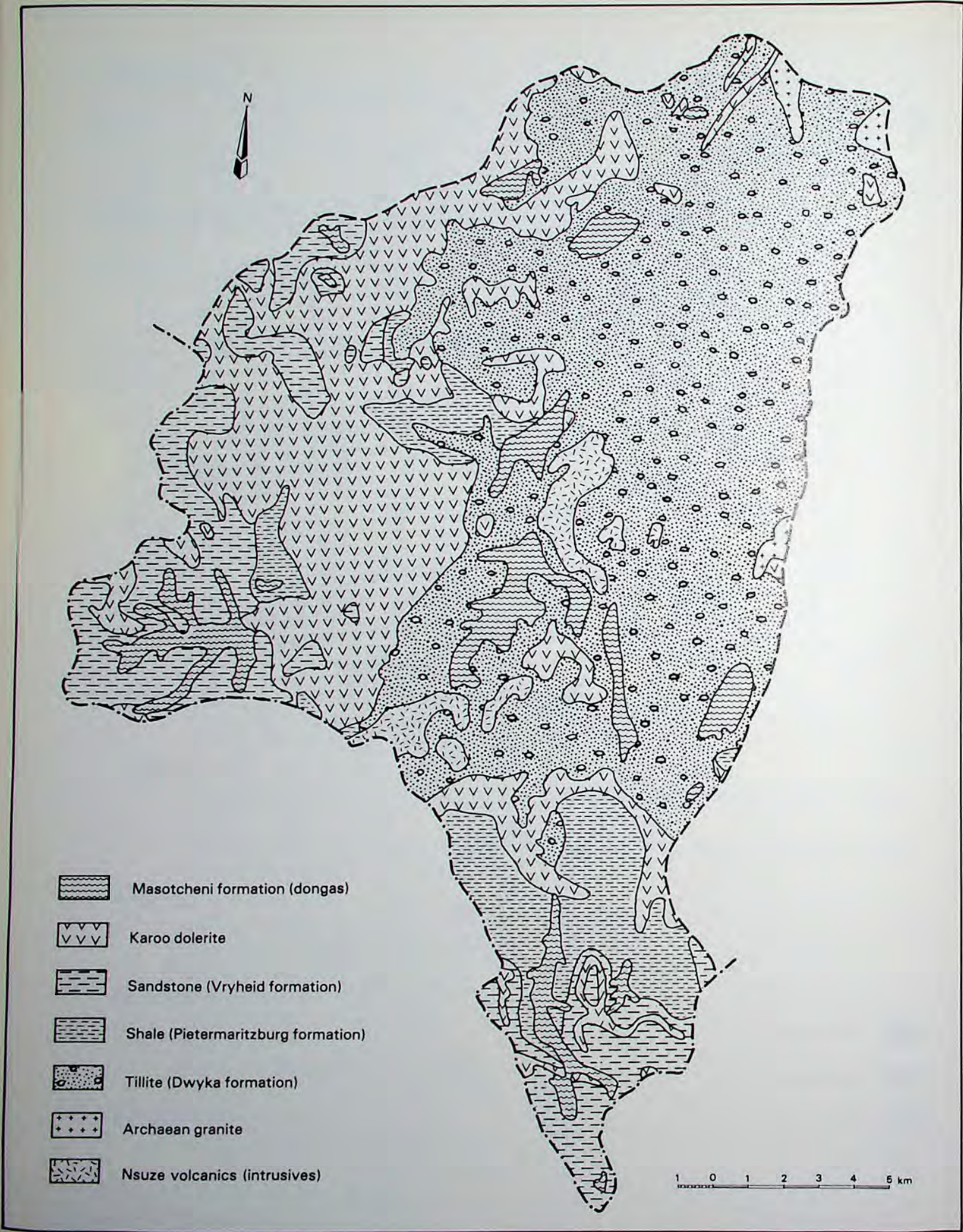


Fig. 39: **The distribution of wetlands in quaternary sub-catchment W222. These data were derived from Job 849 of 1981.**



Source: Dept. of Geological Survey

Fig. 40: The geology of quaternary sub-catchment W222.

- Land use (Nanni, 1982).

  Most of the area (west of the Nondweni River) lies in KwaZulu, falling within the jurisdiction of Chiefs Sotho, Hlatywayo, Ngabese, Ncubeni and Makibuko (NTRPC, pers. comm.). The remainder of the area is presently owned by the Department of Development Aid and shortly is destined to be handed over to KwaZulu (Lagerwall, pers. comm.).

Wetland inventory (Table 15)

- Wetland distribution (Pre Iron Age).

  No. of wetlands: 108
  Size range : 1 to 262 (ha)
  Area of sub-catchment under wetland: 1 625 ha (4,1%)

- Wetland status (at present).

  Area of sub-catchment under wetland: 475 ha (1,2%)

- Wetland losses: 1 150 ha (71%)

- Further details:

  Of the 108 wetlands which occurred in quaternary sub-catchment W222 (the largest in the White Mfolozi) only 32 (29%) have escaped alteration. The largest of these (wetland No. 107) is only 32 ha in size, thus for inventory purposes, no further data need be provided.

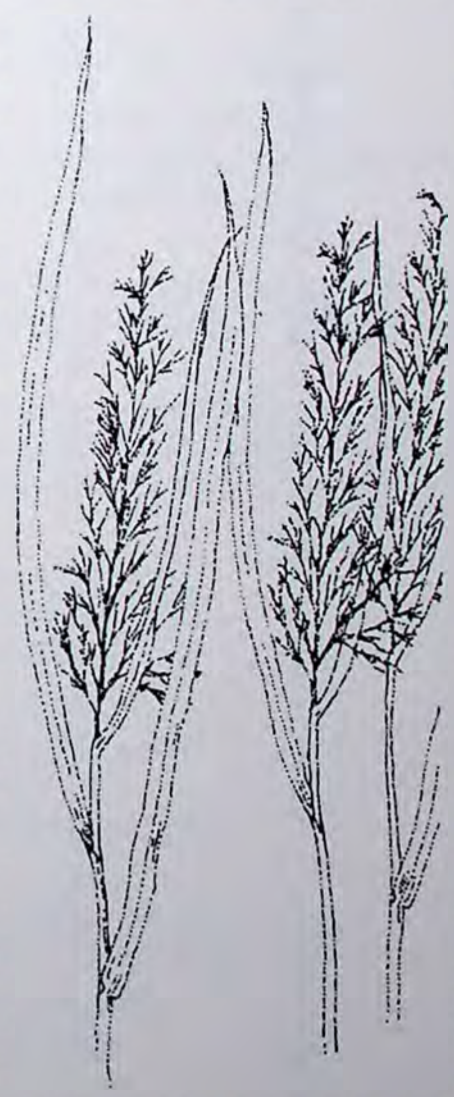


Table 15: The present status of wetlands in quaternary sub-catchment W222 (Fig. 39). Where wetland losses have amounted to 100%, no further data are provided.

Wetland No:	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	1,0	1,0	-	17	5,9	0,2
2	2,0	-	100	-	-	-
3	2,0	2,0	-	22	9,1	0,9
4	20,0	-	100	-	-	-
5	5,0	5,0	-	87	5,7	1,8
6	2,0	2,0	-	32	6,2	0,6
7	4,0	4,0	-	40	10,0	1,0
8	4,5	4,5	-	45	10,0	1,6
9	3,0	3,0	-	15	20,0	0,7
10	12,5	3,5	72	205	1,7	0,6
11	2,0	2,0	-	15	13,3	0,5
12	1,0	1,0	-	17	5,9	0,3
13	19,0	7,0	63	1 200	2,2	0,9
14	5,0	5,0	-	100	5,0	3,2
15	4,0	4,0	-	162	2,5	1,2
16	20,0	3,0	85	1 800	2,1	0,6
17	8,0	-	100	-	-	-
18	6,5	1,0	85	175	0,6	0,2
19	5,0	3,5	30	87	4,0	0,7
20	1,0	1,0	-	295	0,4	0,4
21	9,0	9,0	-	195	4,6	1,9
22	3,0	2,0	33	62	3,2	0,7
23	7,0	3,5	50	45	7,7	1,2
24	2,0	-	100	-	-	-
25	7,0	7,0	-	137	5,1	2,0
26	10,0	-	100	-	-	-
27	3,0	-	100	-	-	-
28	23,0	-	100	-	-	-
29	262,0	20,0	92	2 387	0,8	4,2
30	32,5	2,5	92	850	0,3	0,7
31	2,5	2,5	-	75	3,3	0,9
32	12,0	-	100	-	-	-
33	2,0	-	100	-	-	-
34	2,0	-	100	-	-	-
35	27,0	27,0	-	325	8,3	5,5
36	30,0	30,0	-	355	8,4	6,0
37	34,0	27,0	20	375	7,2	5,8
38	32,0	15,0	53	275	5,4	2,1
39	2,5	-	100	-	-	-
40	12,0	-	100	-	-	-
41	3,0	-	100	-	-	-
42	6,0	-	100	-	-	-
43	11,0	-	100	-	-	-
44	8,0	-	100	-	-	-
45	3,5	1,5	57	42	3,6	0,4
46	5,0	-	100	-	-	-
47	6,0	-	100	-	-	-
48	2,5	2,5	-	15	16,6	0,8
49	29,0	-	100	-	-	-
50	2,0	-	100	-	-	-
51	2,0	-	100	-	-	-
52	14,0	-	100	-	-	-
53	16,0	-	100	-	-	-
54	3,5	3,5	-	57	6,1	0,9
55	6,0	6,0	-	70	8,6	2,9
56	4,0	4,0	-	62	6,4	1,1
57	10,0	-	100	-	-	-
58	31,0	-	100	-	-	-
59	245,0	2,5	98	2 600	0,2	0,6
60	2,0	2,0	-	67	3,0	0,5
61	3,5	-	100	-	-	-
62	6,0	-	100	-	-	-
63	6,0	-	100	-	-	-
64	15,0	4,0	73	195	2,0	1,0
65	3,0	1,5	50	105	1,4	0,5
66	7,0	4,0	43	70	5,7	1,4
67	3,5	2,0	43	25	8,0	0,4
68	4,0	1,0	75	67	1,5	0,3
69	44,0	22,0	50	500	4,4	4,0
70	4,5	4,5	-	97	4,6	1,8
71	7,0	7,0	-	1 575	0,4	0,8
72	15,0	-	100	-	-	-
73	9,0	-	100	-	-	-
74	5,5	-	100	-	-	-
75	7,0	-	100	-	-	-
76	5,0	5,0	-	120	4,1	1,8
77	6,5	3,0	54	50	6,0	0,5
78	3,0	1,0	66	142	2,8	0,3
79	2,0	-	100	-	-	-
80	4,0	2,0	50	35	5,7	0,4
81	1,5	-	100	-	-	-
82	42,0	34,0	19	355	9,5	7,3
83	2,5	2,5	-	12	20,8	0,5
84	1,5	1,5	-	12	12,5	0,5
85	20,0	-	100	-	-	-
86	3,5	2,0	43	47	4,2	0,6
87	56,0	14,0	75	362	3,8	2,3
88	2,0	-	100	-	-	-
89	4,0	4,0	-	127	3,1	1,4
90	6,0	1,5	75	105	1,4	0,4
91	3,0	3,0	-	60	5,0	1,0
92	3,5	1,5	57	32	4,6	0,4
93	4,0	2,5	37	72	3,5	0,5
94	24,0	10,0	58	332	3,0	2,1
95	4,0	-	100	-	-	-
96	36,0	-	100	-	-	-
97	11,0	-	100	-	-	-
98	4,0	2,0	50	95	2,1	0,8
99	54,0	44,0	18	482	9,1	6,0
100	6,0	-	100	-	-	-
101	13,5	1,5	89	287	0,5	0,5
102	4,5	-	100	-	-	-
103	24,0	-	100	-	-	-
104	10,5	4,0	62	67	5,9	1,0
105	27,0	25,0	7	462	5,4	6,1
106	9,0	9,0	-	67	13,4	1,1
107	32,0	32,0	-	482	6,6	8,9
108	3,5	3,5	-	75	4,6	0,7
TOTAL	1 625,0	475,0				109,0

Chapter 13

Quaternary Sub-catchment No: W224

Name: Ntinini (principal river)
Fig. No: 41

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  300 km^2
- Range in altitude.
  1 598 to 780 m above sea level
- Physiographic regions (Turner, 1967).
  region 11 (Babanango Block)
  region 26 (Nondweni-White Mfolozi Plain)
- Geology (Geological Survey Dept., pers. comm.).
  major bedrock types: Archaean granite and Dwyka tillite
  less dominant types: Karoo dolerite, shale
- Soils (Fitzpatrick, 1978).
  Yellow and red apedal, freely drained dystrophic soils characterise the uplands; whereas the lowlands are covered by a mantle of weakly developed soils which are either sandy or plinthic in nature.

  Soil maps for part of the area, prepared by van der Eyk, *et al.*, (1969) are also available. The extent of erosion in this area is shocking, and especially as, until recently, all of the land was under the jurisdiction of white farmers.
- Veld types (Acocks, 1953).
  veld type 44a (Highland Sourveld)
  veld type 66 (Natal Sand Sourveld)
  veld type 10 (Lowveld)
- Bioclimatic regions (Phillips, 1973).
  region 4 (highland-submontane)
  region 8a (dry upland)
  region 10 (riverine-interior lowland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 745 mm
  Range (Schulze, 1982): 600 to 900 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  16 million cubic metres/year

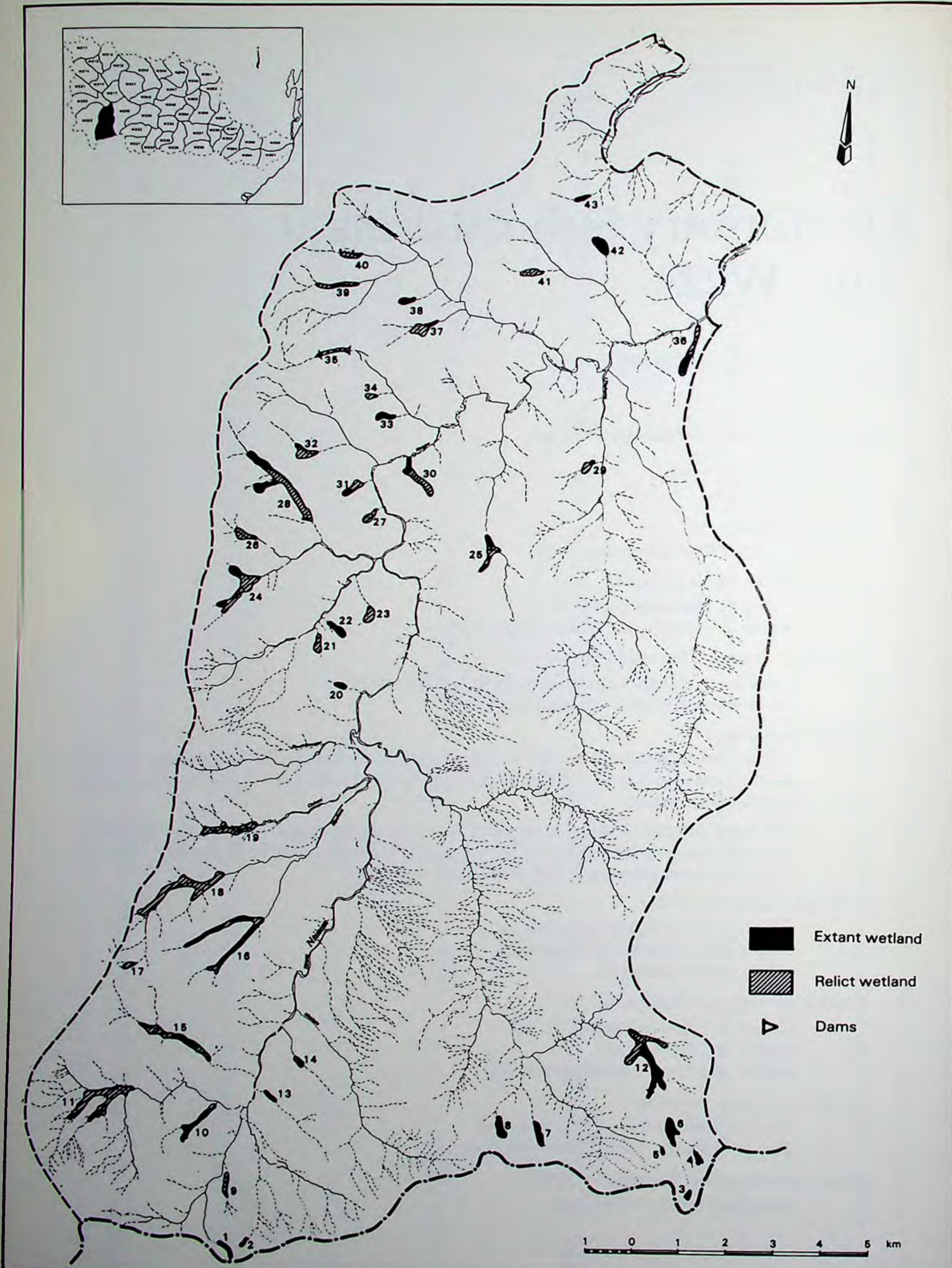


Fig. 41: The distribution of wetlands in quaternary sub-catchment W224. These data were derived from Job 849 of 1981.

- Land use (Nanni, 1982).

  The land is presently owned by the Department of Development Aid, and is in the process of being handed over to KwaZulu. Although it is to be used for resettlement purposes, a good proportion may be set aside for conservation (Lagerwall, pers. comm.).

Wetland inventory (Table 16)

- Wetland distribution (Pre Iron Age).

  No. of wetlands: 43

  Size range : 1,5 to 30 (ha)

  Area of sub-catchment under wetland: 353 ha (1,2%)

- Wetland status (at present).

  Area of sub-catchment under wetland: 117 ha (0,4%)

- Wetland losses: 236 ha (67%)

- Further details:

  Sub-catchment W224 fringes on those areas in the White Mfolozi catchment which for geomorphological reasons, are inherently lacking in wetlands. For inventory purposes, therefore, none of the remaining wetlands or fragments of wetland in this region warranted further description.

Table 16: The present status of wetlands in quaternary sub-catchment W224 (Fig. 41). Where wetland losses have amounted to 100%, no further data are provided.

Wetland No:	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	2,5	2,5	-	18	13,8	1,0
2	1,5	1,5	-	9	16,6	0,5
3	1,5	1,5	-	22	6,8	0,4
4	2,5	2,5	-	25	10,0	0,7
5	1,5	1,5	-	19	7,8	0,5
6	8,0	8,0	-	195	4,1	1,3
7	5,0	5,0	-	80	6,2	1,2
8	5,0	5,0	-	75	6,6	1,1
9	3,0	-	100	-	-	-
10	7,0	4,5	35	140	3,2	1,4
11	27,0	-	100	-	-	-
12	30,0	16,0	46	537	2,9	2,8
13	2,0	1,5	25	157	0,9	0,4
14	2,5	-	100	-	-	-
15	14,5	4,5	69	412	1,1	1,0
16	17,0	10,5	38	332	3,1	5,5
17	3,0	-	100	-	-	-
18	28,0	-	100	-	-	-
19	16,5	-	100	-	-	-
20	2,0	2,0	-	50	4,0	0,6
21	4,0	-	100	-	-	-
22	5,0	5,0	-	47	10,6	1,0
23	6,0	-	100	-	-	-
24	21,0	3,0	85	67	4,4	0,8
25	7,0	2,5	64	267	0,9	0,6
26	7,5	-	100	-	-	-
27	4,0	-	100	-	-	-
28	26,5	10,5	60	362	2,9	1,2
29	3,0	-	100	-	-	-
30	10,0	3,5	65	95	3,8	0,8
31	6,0	2,0	66	55	3,6	0,4
32	7,0	-	100	-	-	-
33	3,0	3,0	-	57	5,2	0,8
34	2,0	-	100	-	-	-
35	4,5	-	100	-	-	-
36	20,0	4,0	80	52	7,7	1,0
37	8,0	2,5	68	147	1,7	0,6
38	3,0	3,0	-	52	5,7	0,7
39	8,0	3,0	62	175	1,7	0,6
40	4,5	-	100	-	-	-
41	4,5	-	100	-	-	-
42	6,0	6,0	-	32	18,7	0,8
43	2,5	2,5	-	85	2,9	0,6
TOTAL	353,0	117,0				28,3

Chapter 14

Quaternary Sub-catchment No: W225

Name: Nsubeni (principal river)
Fig. No: 42

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  355 km^2
- Range in altitude.
  1 542 to 700 m above sea level
- Physiographic regions (Turner, 1967)
  region 11 (Babanango Block)
  region 26 (Nondweni-White Mfolozi Plain)
  region 31 (Middleveld of Zululand)
  region 37 (Lowveld of Zululand)
- Geology (Geological Survey Dept., pers. comm.).
  major bedrock type: Archaean granite
  less dominant types: Shale (Pietermaritzburg formation), dolerite and various rocks of volcanic origin (Pongola sequence).
- Soils (Fitzpatrick, 1978).
  Yellow and red apedal, freely drained dystrophic soils characterize the uplands; whereas the lowlands are covered in a mantle of weakly developed soils which are either sandy or plinthic in nature.
- Veld types (Acocks, 1953).
  veld type 44a (Highland Sourveld)
  veld type 65 (Southern Tall Grassveld)
  veld type 66 (Natal Sand Sourveld)
  veld type 64 (Northern Tall Grassveld)
  veld type 10 (Lowveld)
- Bioclimatic regions (Phillips, 1973).
  region 4 (highland-sub-montane)
  region 8a (dry upland)
  region 10 (riverine-interior lowland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 840 mm
  Range (Schulze, 1982): 600 to 1 200 mm

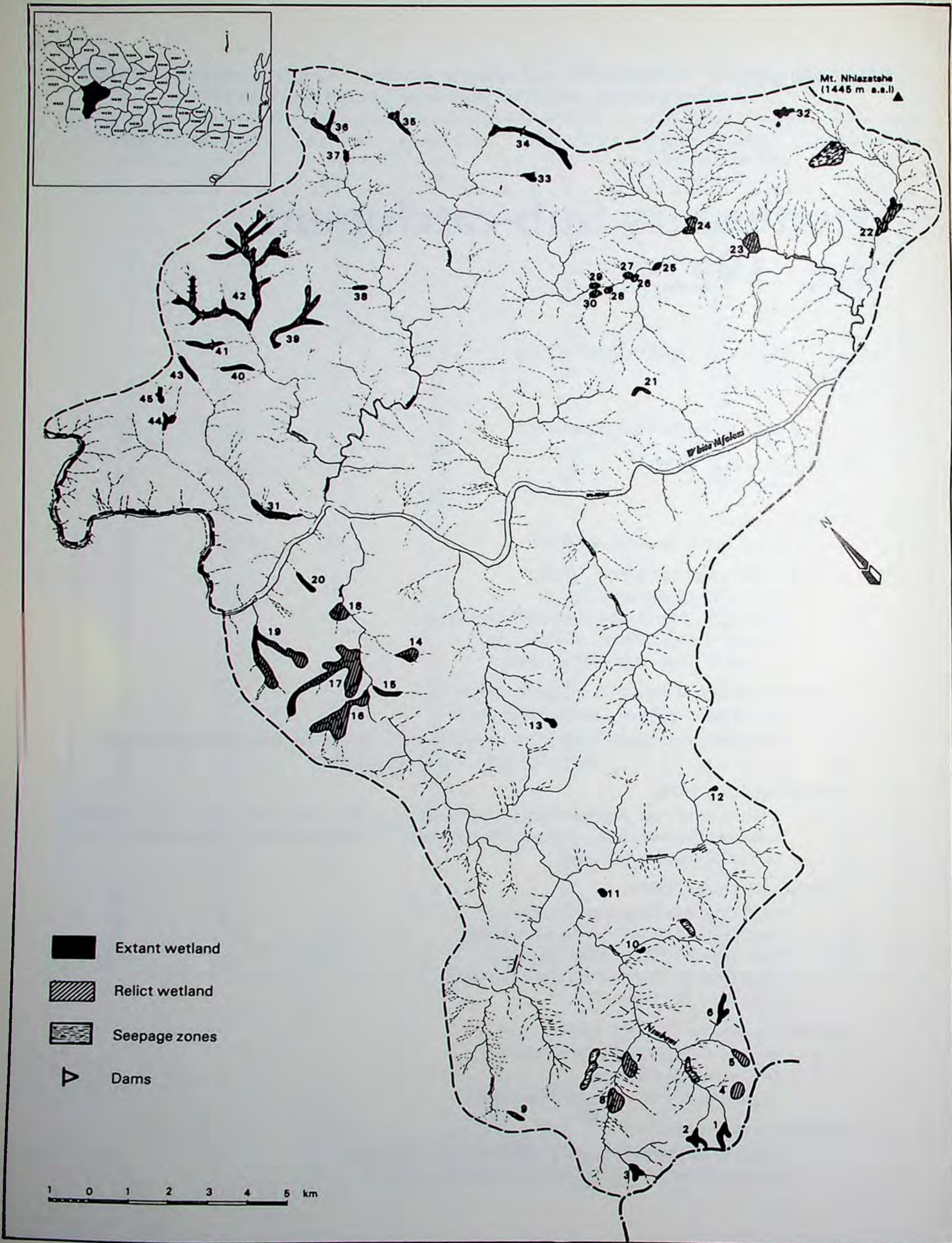


Fig. 42: The distribution of wetlands in quaternary sub-catchment W225. These data were derived from Job 672 of 1970.

- Mean annual run-off (Pitman *et al.*, 1981).
  31 million cubic metres/year
- Land use (Nanni, 1982).
  Much of the land is white-owned farmland. Where owned by timber companies (e.g. NTE) the land is destined to be used for the growing of pine trees and gum trees.

Wetland inventory (Table 17)

- Wetland distribution (Pre Iron Age).
  No. of wetlands: 45
  Size range : 2 to 103 (ha)
  Area of sub-catchment under wetland: 572 ha (1,6%)
- Wetland status (at present).
  Area of sub-catchment under wetland: 85 ha (0,2%)
- Wetland losses: 487 ha (85%)
- Further details:
  Despite the relatively high rainfall in this region, the area is naturally poor in wetlands for geomorphological reasons. However, gully erosion has taken a severe toll of wetlands that exist, and only 12 sites (the largest being 10 ha) have escaped alteration. For inventory purposes, none of these warrant further description.

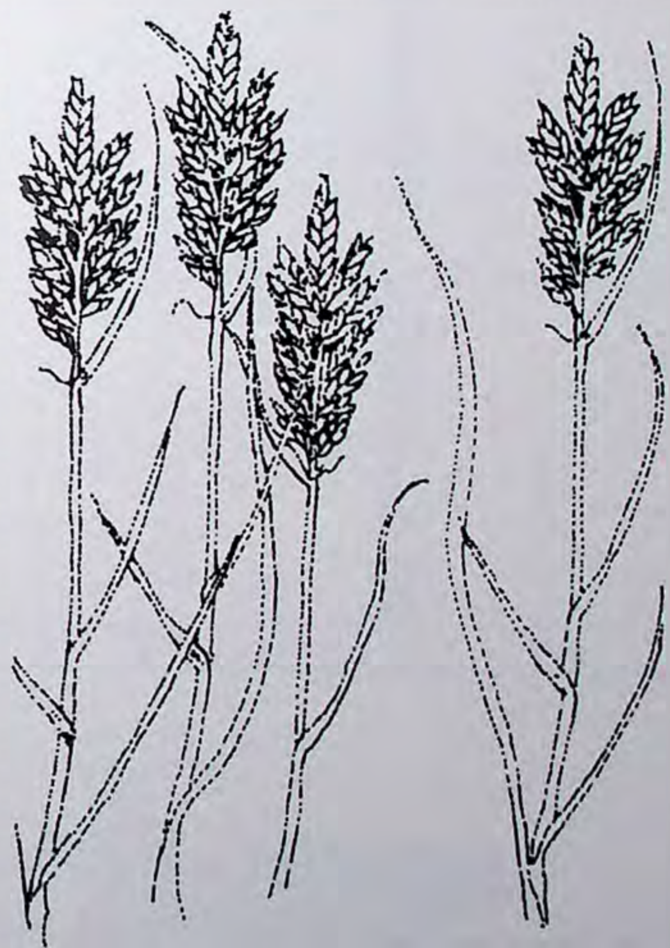


Table 17: The present status of wetlands in quaternary sub-catchment W225 (Fig. 42). Where wetland losses have amounted to 100%, no further data are provided.

Wetland No:	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	10,0	10,0	-	52	19,2	1,8
2	8,0	8,0	-	45	17,7	1,4
3	8,0	8,0	-	75	10,6	1,1
4	11,0	-	100	-	-	-
5	9,0	-	100	-	-	-
6	8,0	8,0	-	75	10,6	1,6
7	15,0	-	100	-	-	-
8	17,0	-	100	-	-	-
9	3,0	1,5	50	50	3,0	0,3
10	2,0	2,0	-	17	11,7	0,4
11	3,5	3,5	-	52	6,7	0,6
12	2,0	2,0	-	22	9,1	0,4
13	4,0	4,0	-	45	8,8	0,7
14	11,0	-	100	-	-	-
15	8,0	-	100	-	-	-
16	52,0	-	100	-	-	-
17	73,0	5,0	93	312	1,6	1,1
18	12,0	-	100	-	-	-
19	36,0	3,0	91	335	0,9	0,6
20	5,0	5,0	-	65	7,7	1,2
21	3,0	3,0	-	45	6,6	1,0
22	16,0	3,0	81	1 030	0,3	0,5
23	15,0	-	100	-	-	-
24	9,0	-	100	-	-	-
25	2,0	-	100	-	-	-
26	2,0	-	100	-	-	-
27	2,0	-	100	-	-	-
28	2,5	-	100	-	-	-
29	2,0	-	100	-	-	-
30	3,5	-	100	-	-	-
31	12,0	-	100	-	-	-
32	6,0	6,0	-	50	12,0	1,1
33	4,0	4,0	-	57	7,0	1,0
34	17,0	6,0	65	270	2,2	1,3
35	6,5	-	100	-	-	-
36	12,0	-	100	-	-	-
37	3,0	-	100	-	-	-
38	2,0	-	100	-	-	-
39	27,0	-	100	-	-	-
40	5,0	1,5	70	55	2,7	0,4
41	5,5	1,5	73	80	1,8	0,4
42	103,0	-	100	-	-	-
43	7,0	-	100	-	-	-
44	4,5	-	100	-	-	-
45	3,5	-	100	-	-	-
TOTAL	572,0	85,0				16,9

Chapter 15

Quaternary Sub-catchment No: W226

Name: Mhlahlane (principal river)
Fig. No: 43

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  340 km^2
- Range in altitude.
  1 445 to 490 m above sea level
- Physiographic regions (Turner, 1967).
  region 11 (Babanango Block)
  region 31 (Middleveld of Zululand)
  region 37 (Lowveld of Zululand)
- Geology (Geological Survey Dept., pers. comm.).
  major bedrock types: Tillite, sandstone and shales the Karoo system
  less dominant types: Volcanic rocks of the Pongola system
- Soils (Fitzpatrick, 1978).
  Weakly developed soils (lithocutanic B) in the Middleveld; and red clays and duplex soils in the Lowveld.
- Veld types (Acocks, 1953).
  veld type 44a (Highland Sourveld)
  veld type 65 (Southern Tall Grassveld)
  veld type 66 (Natal Sand Sourveld)
- Bioclimatic regions (Phillips, 1973).
  region 4 (highland sub-montane)
  region 8a (dry upland)
  region 10 (riverine-interior lowland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 809 mm
  Range (Schulze, 1982): 700 to 1 000 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  25 million cubic metres/year
- Land use (Nanni, 1982).
  Most of the land within sub-catchment W226 lies in KwaZulu, and falls within the jurisdiction of Chief Mbatheni (NTRPC, pers. comm.). In the western portion white

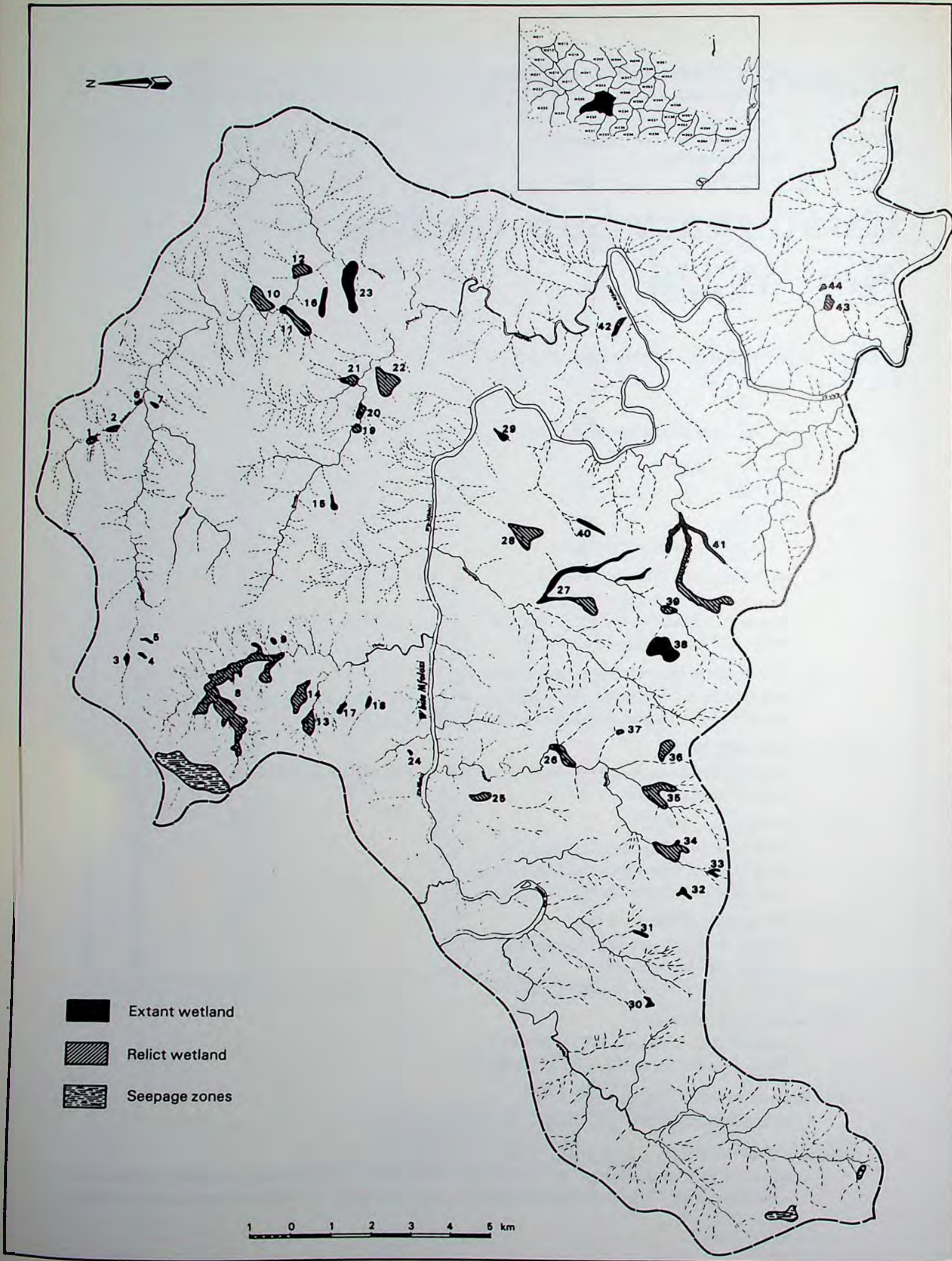


Fig. 43: The distribution of wetlands in quaternary sub-catchment W226. These data were derived from Job 672 of 1970.

owned farmlands occur, a number of which have been purchased by NTE, for the purpose of growing timber (Lagerwall, pers. comm.).

Wetland inventory (Table 18)

- Wetland distribution (Pre Iron Age).
  No. of wetlands: 44
  Size range : 1,5 to 103 (ha)
  Area of sub-catchment under wetland: 565 ha (1,6%)
- Wetland status (at present).
  Area of sub-catchment under wetland: 193 ha (0,6%)
- Wetland losses: 372 ha (66%)
- Further details:

  For geomorphological reasons wetlands are sparsely distributed in quaternary sub-catchment W226. The ecological similarity between this sub-catchment and sub-catchment W225 (Chap. 14) is striking. Even the original extent of wetland cover (1,6% in both regions) is identical. However, for inventory purposes, none of the remaining wetlands warrant detailed description.

Table 18: The present status of wetlands in quaternary sub-catchment W226 (Fig. 43). Where wetland losses have amounted to 100%, no further data are provided.

Wetland No:	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	2,0	-	100	-	-	-
2	3,0	-	100	-	-	-
3	2,0	2,0	-	232	0,8	0,5
4	1,5	1,5	-	12	12,5	0,4
5	2,5	2,5	-	25	10,0	0,6
6	2,0	2,0	-	60	3,3	0,4
7	2,5	2,5	-	20	12,5	0,5
8	103,0	1,0	99	-	-	0,3
9	1,0	1,0	-	5	20,0	0,3
10	20,0	-	100	-	-	-
11	13,0	-	100	-	-	-
12	10,0	-	100	-	-	-
13	9,0	-	100	-	-	-
14	18,0	-	100	-	-	-
15	3,0	3,0	-	45	6,6	0,7
16	8,5	8,5	-	55	15,4	1,6
17	3,0	3,0	-	15	20,0	0,6
18	3,0	3,0	-	72	4,1	0,6
19	3,0	-	100	-	-	-
20	3,5	-	100	-	-	-
21	7,5	-	100	-	-	-
22	25,0	-	100	-	-	-
23	34,0	34,0	-	105	32,3	2,8
24	1,5	1,5	-	14	10,7	0,4
25	6,5	-	100	-	-	-
26	10,0	-	100	-	-	-
27	51,0	40,0	21	1 012	7,2	7,0
28	24,0	-	100	-	-	-
29	7,0	7,0	-	40	17,5	1,1
30	3,5	3,5	-	32	10,9	0,6
31	3,0	3,0	-	37	8,1	0,7
32	4,5	4,5	-	40	11,2	0,9
33	2,5	2,5	-	12	20,8	0,7
34	19,0	2,0	89	312	2,9	0,5
35	25,0	-	100	-	-	-
36	12,0	-	100	-	-	-
37	2,0	-	100	-	-	-
38	33,5	33,5	-	107	31,3	2,0
39	5,0	-	100	-	-	-
40	5,0	5,0	-	50	10,0	1,5
41	61,0	25,0	59	537	4,6	5,9
42	3,5	-	100	-	-	-
43	4,0	-	100	-	-	-
44	1,5	1,5	-	9	16,6	0,4
TOTAL	565,0	193,0				31,0

Chapter 16

Quaternary Sub-catchment No: W231

Name: Mzinhlanga (principal river)
Fig. No: 44

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  165 km^2
- Range in altitude.
  1 200 to 680 m above sea level
- Physiographic regions (Turner, 1967).
  region 11 (Babanango Block)
  region 30 (Melmoth-Nkandla Block)
  region 37 (Lowveld of Zululand)
- Geology (Geological Survey Dept., pers. comm., Fig 45).
  major bedrock types: Dwyka tillite and granite
  less dominant types: Table Mountain Sandstone and dolerite
- Soils (Fitzpatrick, 1978).
  Black clays occur in the south and yellow and red, humic, freely drained, dystrophic soils in the east. Elsewhere the soils are weakly developed lithocutanic forms.
- Veld types (Acocks, 1953).
  veld type 44a (Highland Sourveld)
  veld type 64 (Northern Tall Grassveld)
  veld type 10 (Lowveld)
- Bioclimatic regions (Phillips, 1973).
  region 4 (highland-submontane)
  region 8a (dry upland)
  region 10 (riverine-interior lowland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 904 mm
  Range (Schulze, 1982): 700 to 1 000 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  18 million cubic metres/year
- Land use (Nanni, 1982).
  Most of the land in sub-catchment W231 comprises either large white-owned farms, or farms that have been purchased by timber companies (such as NTE and HL & H) for afforestation purposes.

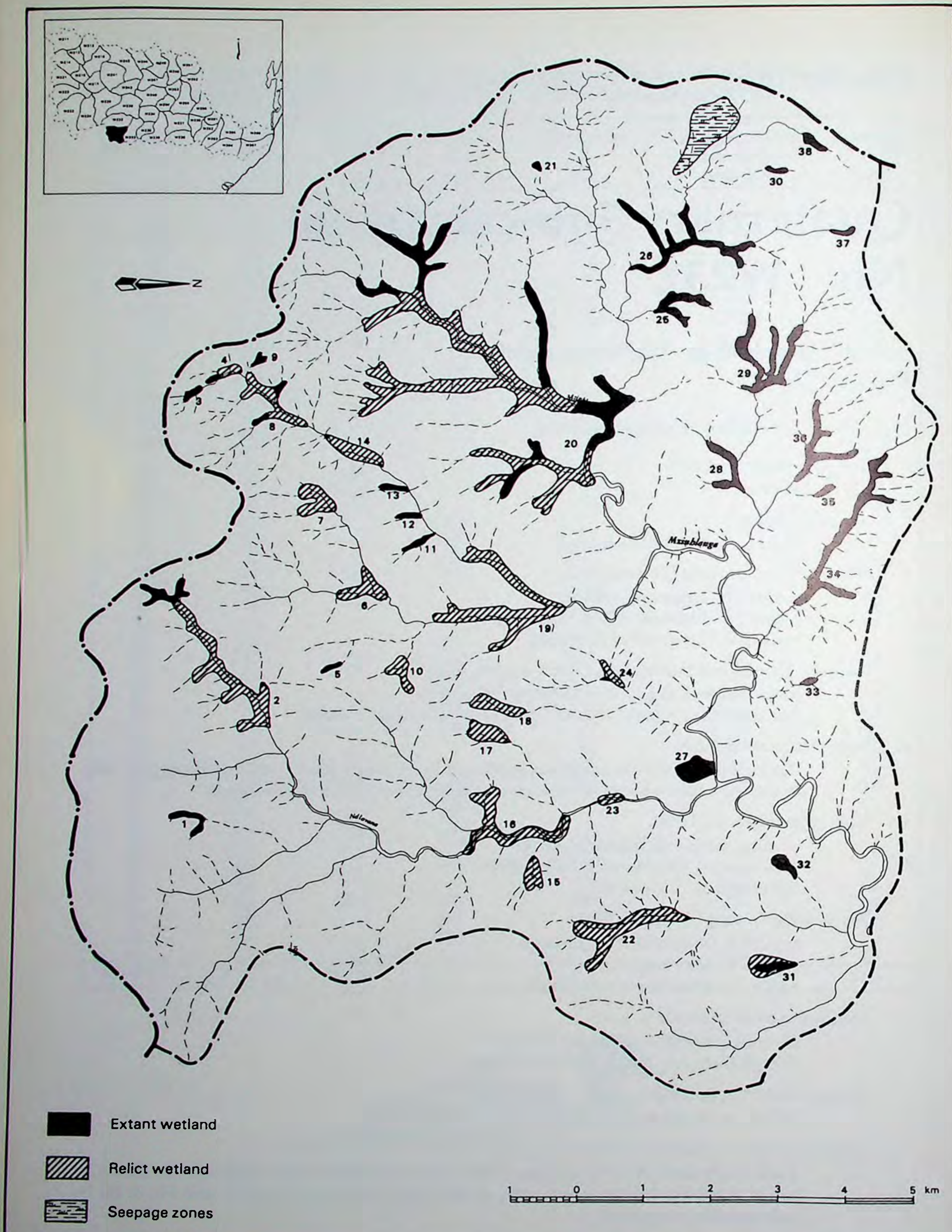
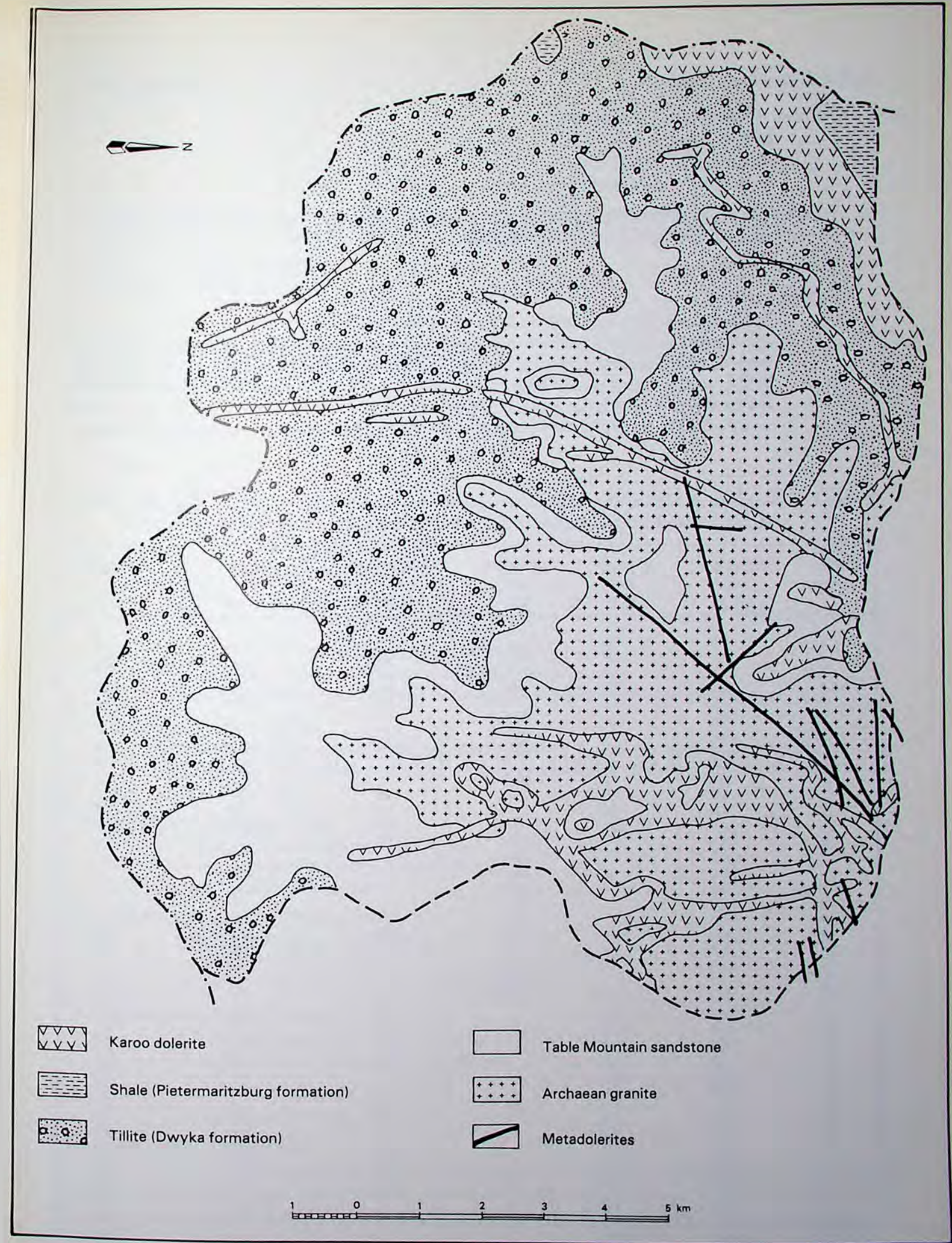


Fig. 44: **The distribution of wetlands in quaternary sub-catchment W231. These data were derived from Job 672 of 1970.**



Source: Dept. of Geological Survey

Fig. 45: The geology of quaternary sub-catchment W231.

Wetland inventory (Table 19)

- Wetland distribution (Pre Iron Age).
  No. of wetlands: 38
  Size range : 1,5 to 329 (ha)
  Area of sub-catchment under wetland: 883 ha (5,4%)
- Wetland status (at present).
  Area of sub-catchment under wetland: 327 ha (2%)
- Wetland losses: 556 ha (63%)
- Further details:
  For inventory purposes, wetland No. 20 (Mzinhlanga vlei) warrants attention, because this system (originally 329 ha in size) could well be suitable for reclamation. Even in its present badly eroded form, Mzinhlanga vlei is the largest wetland in sub-catchment W231, and because of the importance attributed to management of the Mpembeni catchment as a whole (i.e. sub-catchments W231 and W232, Chap. 17), the preparation of a feasibility report on the prospect of reclaiming Mzinhlanga vlei is recommended.

Table 19: The present status of wetlands in quaternary sub-catchment W231 (Fig. 44). Where wetland losses have amounted to 100%, no further data are provided.

Wetland No:	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	7,0	7,0	-	95	7,3	1,3
2	57,5	11,5	80	470	2,4	1,7
3	3,5	3,5	-	27	12,9	0,6
4	5,0	2,0	60	92	5,9	0,3
5	2,0	2,0	-	18	11,1	0,6
6	13,0	-	100	-	-	-
7	18,0	-	100	-	-	-
8	19,5	3,5	82	325	3,2*	0,7
9	1,5	1,5	-	18	8,3	0,3
10	9,0	-	100	-	-	-
11	5,0	5,0	-	45	11,1	1,1
12	4,0	4,0	-	37	10,8	0,8
13	4,5	4,5	-	37	12,1	0,9
14	14,0	-	100	-	-	-
15	10,0	-	100	-	-	-
16	36,0	-	100	-	-	-
17	16,0	-	100	-	-	-
18	10,0	-	100	-	-	-
19	59,0	-	100	-	-	-
20	329,0	90,0	73	4 300	2,1	14,8
21	1,5	1,5	-	24	6,2	0,3
22	46,0	-	100	-	-	-
23	4,0	-	100	-	-	-
24	6,0	1,0	83	150	0,6	0,2
25	12,0	12,0	-	87	13,7	2,4
26	40,0	40,0	-	1 037	3,8*	8,2
27	15,0	15,0	-	75	20,0	1,4
28	12,0	12,0	-	670	6,2*	2,7
29	30,0	30,0	-	437	6,8	6,9
30	2,0	2,0	-	32	6,2	0,6
31	17,0	5,0	70	80	6,2	1,1
32	6,0	6,0	-	17	35,3	0,7
33	2,0	2,0	-	50	4,0	0,4
34	38,0	38,0	-	425	8,9	7,0
35	2,0	2,0	-	13	15,3	0,6
36	19,0	19,0	-	282	6,7	4,0
37	3,5	3,5	-	45	7,7	0,8
38	3,5	3,5	-	82	4,2	0,8
TOTAL	883,0	327,0				60,0

* includes upstream wetlands.

Chapter 17

Quaternary Sub-catchment No: W232

Name: Mpembeni (principal river)
Fig. No: 46

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  230 km^2
- Range in altitude.
  1 400 to 480 m above sea level
- Physiographic regions (Turner, 1967).
  region 11 (Babanango Block)
  region 37 (Lowveld of Zululand)
- Geology (Geological Survey Dept., pers. comm., Fig 47).
  major bedrock types: Granite and Karoo dolerite
  less dominant types: Dwyka tillite and shale (Pietermaritzburg formation)
- Soils (Fitzpatrick, 1978).
  These vary from yellow and red, freely drained dystrophic soils in the west (highlands) to weakly developed soils (lithocutanic B) and some red clays and duplex soils in the east (lowlands).
- Veld types (Acocks, 1953).
  veld type 44a (Highland Sourveld)
  veld type 64 (Northern Tall Grassveld)
  veld type 10 (Lowveld)
- Bioclimatic regions (Phillips, 1973).
  region 4 (highland-submontane)
  region 8a (dry upland)
  region 10 (riverine-interior lowland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 898 mm
  Range (Schulze, 1982): 700 to 1 200 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  26 million cubic metres/year
- Land use (Nanni, 1982).
  Most of sub-catchment W232 is comprised of large, white-owned farms. However, in recent times, many of these have been purchased by timber companies such as NTE (Lagerwall, pers. comm.). In the vicinity of the Mpembeni and White Mfolozi junction

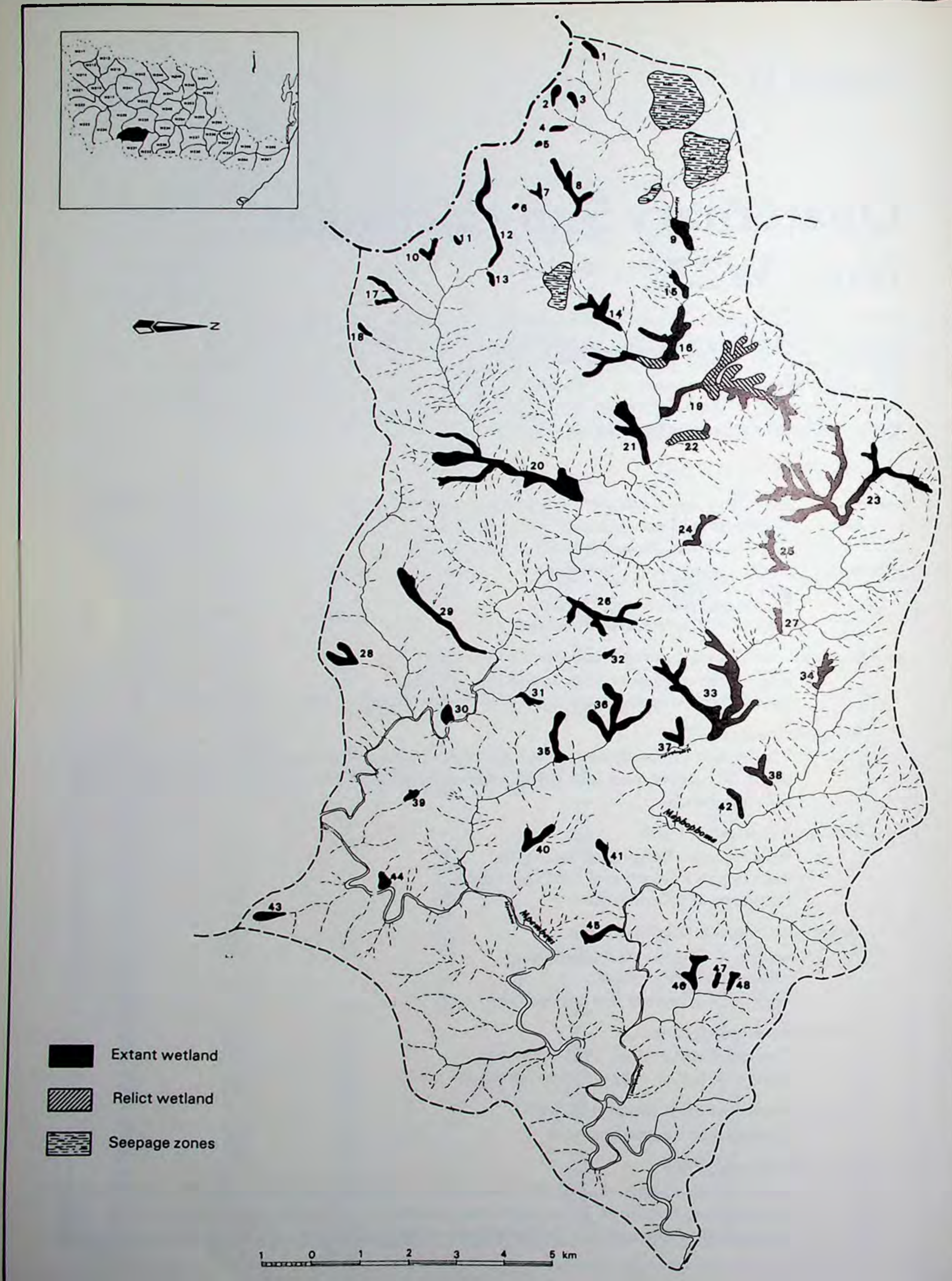
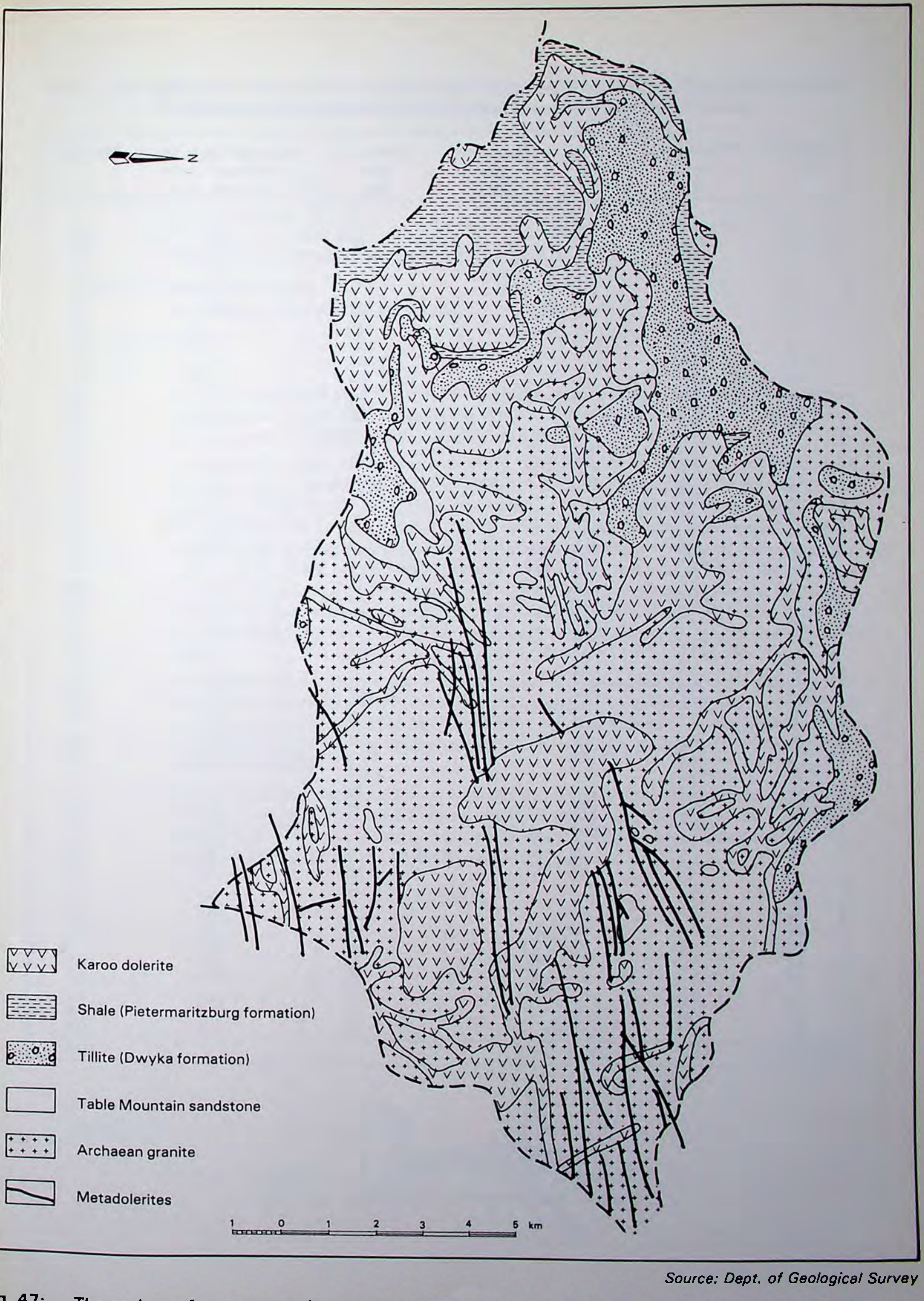


Fig. 46: The distribution of wetlands in quaternary sub-catchment W232. These data were derived from Job 672 of 1970.



Source: Dept. of Geological Survey

Fig. 47: The geology of quaternary sub-catchment W232.

Table 20: The present status of wetlands in quaternary sub-catchment W232 (Fig. 46). Where wetland losses have amounted to 100%, no further data are provided.

Wetland No:	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	4,5	4,5	-	23	19,5	0,9
2	5,0	5,0	-	12	41,6	0,8
3	3,0	3,0	-	14	21,4	0,7
4	2,5	2,5	-	18	13,8	0,6
5	1,0	1,0	-	9	11,1	0,2
6	1,0	1,0	-	10	10,0	0,3
7	3,0	3,0	-	90	3,3	0,8
8	16,0	16,0	-	120	13,3	3,3
9	11,0	11,0	-	1 310	2,0	1,7
10	4,5	4,5	-	52	8,6	1,2
11	1,5	1,5	-	14	10,7	0,3
12	21,0	21,0	-	100	21,0	4,9
13	2,5	2,5	-	30	8,3	0,6
14	16,0	16,0	-	807	4,6	3,2
15	6,5	6,5	-	1 545	2,1	1,3
16	50,5	44,0	13	2 950	3,8	7,0
17	6,5	6,5	-	77	8,4	1,9
18	3,0	3,0	-	24	12,5	0,7
19	94,0	29,0	69	570	5,1	6,0
20	81,0	81,0	-	2 367	5,0	11,7
21	24,0	24,0	-	3 787	4,4	3,7
22	13,5	1,5	88	135	1,1	0,4
23	100,0	100,0	-	887	1,3	18,1
24	10,0	10,0	-	155	6,4	2,0
25	11,5	11,5	-	182	6,3	2,4
26	23,0	23,0	-	240	9,6	5,3
27	5,0	5,0	-	95	5,2	1,1
28	15,5	15,5	-	62	25,0	2,4
29	33,0	33,0	-	290	11,3	5,3
30	6,5	6,5	-	18	36,1	0,8
31	5,5	5,5	-	25	22,0	0,8
32	2,0	2,0	-	16	12,5	0,5
33	86,0	86,0	-	2 437	8,3	12,1
34	8,0	8,0	-	80	10,0	1,3
35	13,0	13,0	-	57	22,8	2,4
36	32,0	32,0	-	200	16,0	5,2
37	8,0	8,0	-	60	13,3	1,5
38	8,5	8,5	-	97	8,7	1,6
39	3,5	3,5	-	50	7,0	0,6
40	14,0	14,0	-	165	8,4	2,1
41	5,0	5,0	-	35	14,2	1,1
42	7,0	7,0	-	72	9,7	1,3
43	8,0	8,0	-	65	12,3	1,4
44	7,0	7,0	-	45	15,5	0,9
45	7,5	7,5	-	47	15,9	1,7
46	11,0	11,0	-	77	14,2	1,7
47	3,0	3,0	-	14	21,4	0,6
48	4,0	4,0	-	20	21,0	0,9
TOTAL	809,0	725,0				127,0

(Fig. 46), the land is presently owned by the Department of Development Aid, but destined to be handed over to KwaZulu.

Wetland inventory (Table 20)

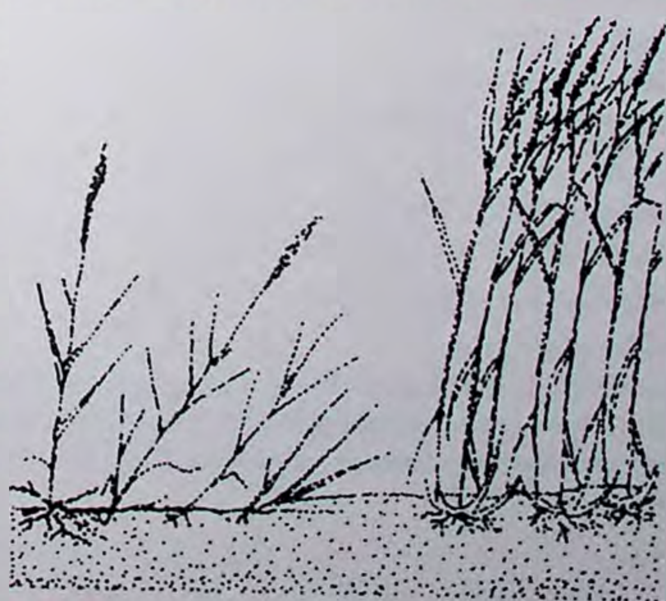
- Wetland distribution (Pre Iron Age).
  No. of wetlands: 48
  Size range : 1 to 100 (ha)
  Area of sub-catchment under wetland: 809 ha (3,5%)
- Wetland status (at present).
  Area of sub-catchment under wetland: 725 ha (3,1%)
- Wetland losses: 84 ha (10%)
- Further details:

Unlike the approach adopted elsewhere in this report, where, for inventory purposes, important wetlands are singled out for further description, all the wetlands of sub-catchment W232 should be regarded as important.

The reason for this is the extraordinarily high amount of wetland occupying each catchment of sub-catchment W232. The data in Table 20 suggest that with few exceptions (e.g. wetland Nos. 9, 15, 22 & 23) the proportion of wetland within the catchment of each site can vary from 5 - 41%. This, together with the considerable edge length that these wetlands collectively present (127 km), and the small amount of wetland disruption that has occurred (10%) suggest that the wetlands of sub-catchment W232 have a high potential to intercept and attenuate run-off. If this is the case, benefits such as prolonged stream flow, flood damage reduction, water quality improvement, sediment trapping, and drought alleviation should all be important hydrological attributes of sub-catchment W232.

Although based on an untested assumption, it is therefore recommended that land use within sub-catchment W232 is carefully planned. For example, the ploughing of overlying steep slopes and the planting of trees too close to wetlands and streams in this area could have serious hydrological/soil loss implications unless such activities are carefully examined.

Finally, for management purposes, it would be ideal if both sub-catchments W232 and W231 were regarded as one, because together they comprise the whole Mpembeni catchment, and between them contain 1 052 ha of well dispersed, extant wetland in a critical, well-watered region of the Mfolozi catchment.



Chapter 18

Quaternary Sub-catchment No: W233

Name: Mkumbane (principal river)
Fig. No: 48

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  170 km^2
- Range in altitude.
  1 160 to 440 m above sea level
- Physiographic regions (Turner, 1967).
  region 30 (Melmoth-Nkandhla Block)
  region 37 (Lowveld of Zululand)
- Geology (Geological Survey Dept., pers. comm.).
  major bedrock types: Granite and Table Mountain Sandstone
  less dominant type: Karoo dolerite
- Soils (Fitzpatrick, 1978).
  Yellow and red apedal, humic, freely drained, dystrophic soils in the highlands; and red clays and duplex soils in the lowveld.
- Veld types (Acocks, 1953).
  veld type 44a (Highland Sourveld)
  veld type 5 (Nongoni Veld)
  veld type 10 (Lowveld)
- Bioclimatic regions (Phillips, 1973).
  region 4 (highland-submontane)
  region 10 (riverine-interior lowland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 796 mm
  Range (Schulze, 1982): 700 to 1 000 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  13 million cubic metres/year
  Major tributaries include the Nzololo River. Gauging weir W2M05 on the White Mfolozi is situated on the edge of sub-catchment W233. This means that run-off data (since 1960) exist, the most outstanding feature of which (Fig. 11) is the extraordinarily high variability (Looser, *et al.*, 1985).

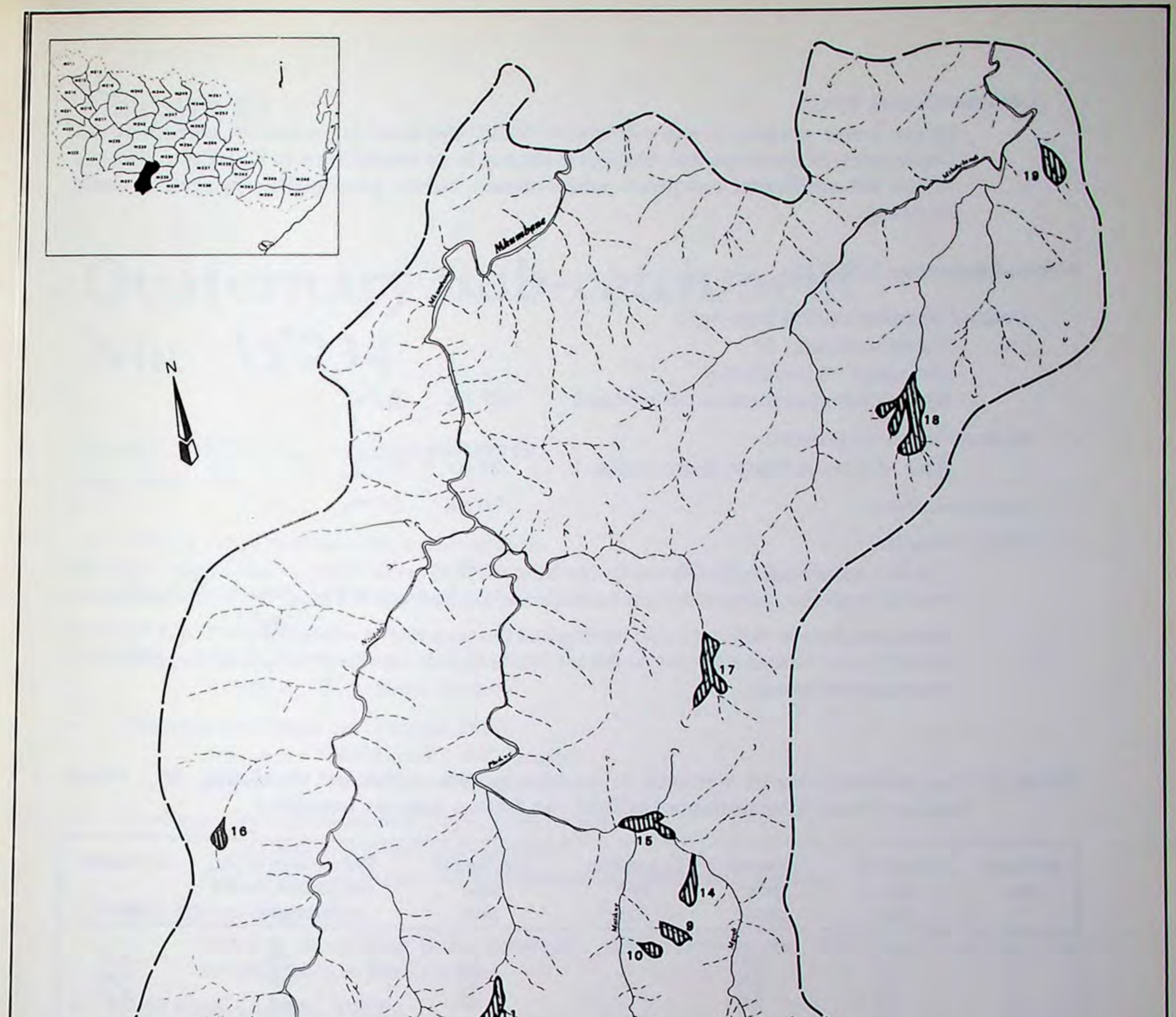


Fig. 48: The distribution of wetlands in quaternary sub-catchment W233. These data were derived from Job 672 of 1970.

- Land use (Nanni, 1982).

  In the lower portion of sub-catchment W233, the land is presently owned by the Department of Development Aid, but is shortly to be transferred to KwaZulu. The rest of the sub-catchment comprises white-owned farms, principally engaged in cattle ranching.

Wetland inventory (Table 21)

- Wetland distribution (Pre Iron Age).

  No. of wetlands: 19

  Size range : 1,5 to 25 (ha)

  Area of sub-catchment under wetland: 127 ha (0,7%)

- Wetland status (at present).

  Area of sub-catchment under wetland: 29 ha (0,2%)

- Wetland losses: 98 ha (77%)

- Further details:

  The few remaining wetlands in sub-catchment W233 occur in high-lying areas where the rainfall is greater, the soils are less erodible and the bedrock is Table Mountain Sandstone.

  Being deficient in wetlands, and having lost the majority of what little wetland formerly occurred, no further attention to the wetlands of sub-catchment W233 is warranted for inventory purposes.

Table 21: The present status of wetlands in quaternary sub-catchment W233 (Fig. 48). Where wetland losses have amounted to 100%, no further data are provided.

Wetland No:	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	1,5	1,5	-	72	2,0	0,5
2	2,0	2,0	-	25	8,0	0,4
3	3,0	3,0	-	67	4,4	1,6
4	7,5	7,5	-	410	2,3	2,3
5	2,0	2,0	-	127	1,5	0,5
6	3,0	3,0	-	32	9,3	1,2
7	4,0	4,0	-	80	5,0	1,5
8	6,0	6,0	-	67	8,9	1,7
9	6,0	-	100	-	-	-
10	3,0	-	100	-	-	-
11	9,0	-	100	-	-	-
12	4,5	-	100	-	-	-
13	9,0	-	100	-	-	-
14	6,0	-	100	-	-	-
15	9,5	-	100	-	-	-
16	4,0	-	100	-	-	-
17	16,0	-	100	-	-	-
18	25,0	-	100	-	-	-
19	6,0	-	100	-	-	-
TOTAL	127,0	29,0				9,7

Chapter 19

Quaternary Sub-catchment No: W234

Name: Mbilane (principal river)
Fig. No: 49

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  185 km^2
- Range in altitude.
  1 030 to 420 m above sea level
- Physiographic regions (Turner, 1967).
  region 31 (Middleveld of Zululand)
  region 37 (Lowveld of Zululand)
- Geology (Geological Survey Dept., pers. comm.).
  major bedrock type: Dwyka tillite
  less dominant types: Table Mountain Sandstone and dolerite
- Soils (Fitzpatrick, 1978).
  Weakly developed (lithocutanic B), plinthic soils in the Middleveld; red clays and duplex soils in the Lowveld.
- Veld types (Acocks, 1953).
  From north to south
  veld type 44a (Highland Sourveld)
  veld type 64 (Northern Tall Grassveld)
  veld type 10 (Lowveld)
- Bioclimatic regions (Phillips, 1973).
  From north to south
  region 4 (highland-sub-montane)
  region 8a (dry upland)
  region 10 (riverine-interior lowland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 821 mm
  Range (Schulze, 1982): 700 to 900 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  15 million cubic metres/year
- Land use (Nanni, 1982).
  Other than a small portion of land lying south of the White Mfolozi (Fig. 49), the entire area lies in KwaZulu, and within the jurisdiction of Chief Mpungose

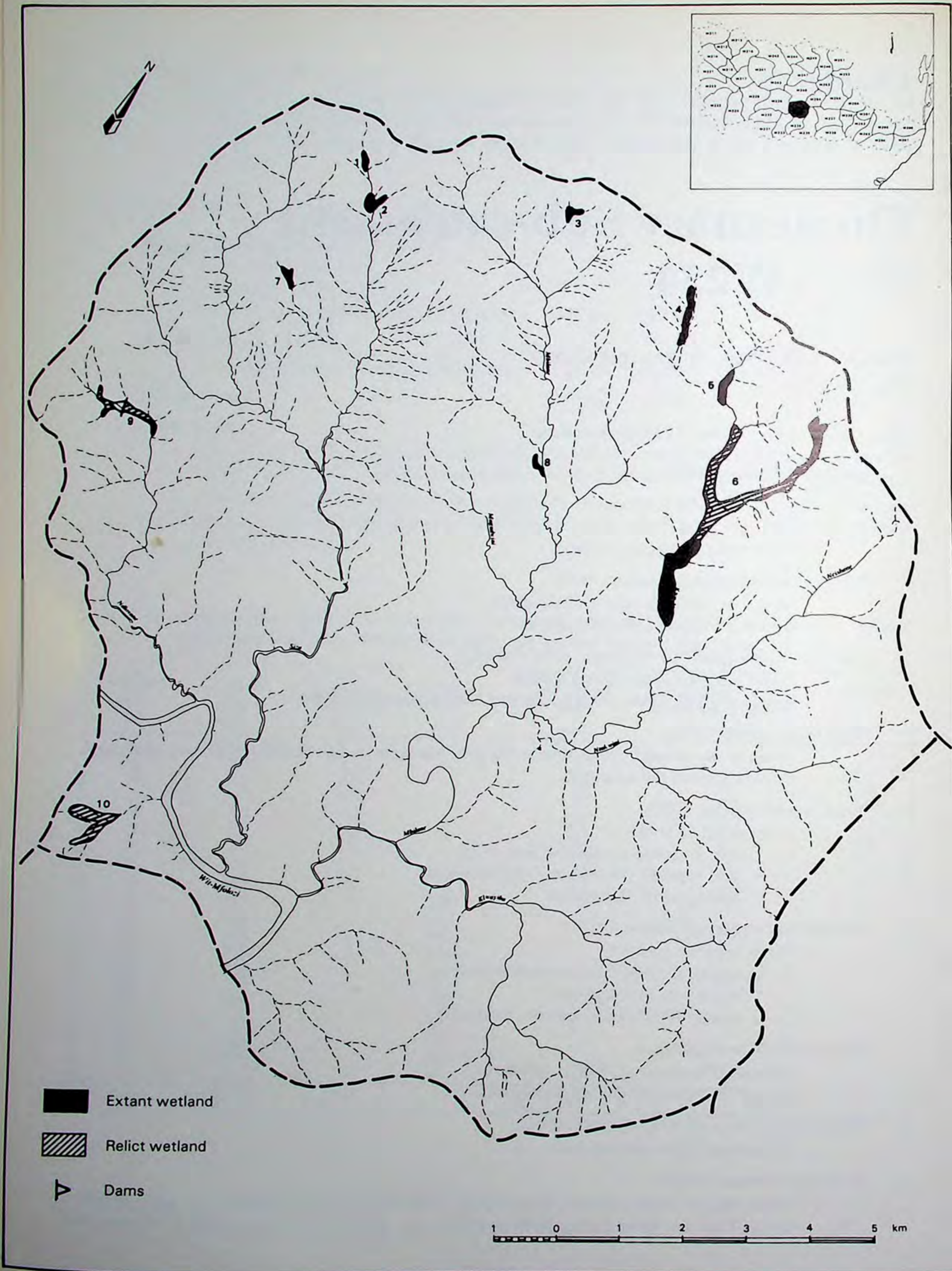


Fig. 49: The distribution of wetlands in quaternary sub-catchment W234. These data were derived from Job 672 of 1970.

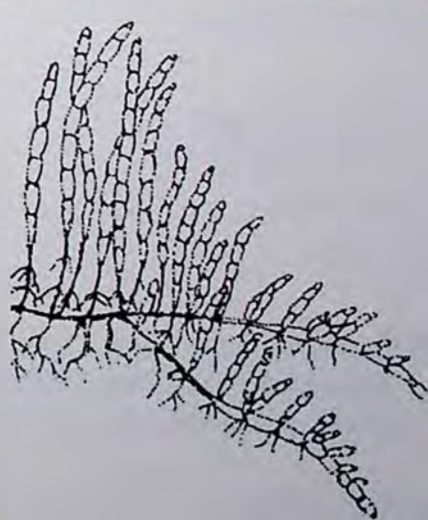
(NTRPC, pers. comm.). It contains the capital town of Ulundi (population in 1985: 4 320 KwaZulu Govt., pers. comm.).

Wetland inventory (Table 22)

- Wetland distribution (Pre Iron Age).
  No. of wetlands: 10
  Size range : 2 to 84 (ha)
  Area of sub-catchment under wetland: 138 ha (0,7%)
- Wetland status (at present).
  Area of sub-catchment under wetland: 62 ha (0,3%)
- Wetland losses: 76 ha (55%)
- Further details:
  The low incidence and small size of the remaining wetlands in sub-catchment W234 suggests that there is no necessity to describe these systems further. However, a correlation between the areas of greater wetland concentration and the high lying : high rainfall : dolerite rich areas of the catchment was noted.

Table 22: The present status of wetlands in quaternary sub-catchment W234 (Fig. 49). Where wetland losses have amounted to 100%, no further data are provided.

Wetland No:	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	2,0	2,0	-	47	4,2	0,5
2	5,0	5,0	-	142	3,5	1,0
3	2,5	2,5	-	35	7,1	0,6
4	5,0	5,0	-	150	3,3	1,8
5	5,0	5,0	-	195	2,5	1,1
6	84,0	37,0	56	1 370	2,7	4,8
7	3,5	3,5	-	62	5,6	0,8
8	2,0	2,0	-	15	13,3	0,7
9	11,0	-	100	-	-	-
10	18,0	-	100	-	-	-
TOTAL	138,0	62,0				11,3



Chapter 20

Quaternary Sub-catchment No: W235

Name: Opathe (principal river)
Fig. No: 50

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  110 km^2
- Range in altitude.
  980 to 400 m above sea level
- Physiographic regions (Turner, 1967).
  region 30 (Melmoth-Nkandhla Block)
  region 37 (Lowveld of Zululand)
- Geology (Geological Survey Dept., pers. comm.).
  major bedrock types: Granite and Table Mountain Sandstone
  less dominant types: Dwyka tillite, dolerite
- Soils (Fitzpatrick, 1978).
  Yellow and red apedal, humic, freely drained dystrophic soils in the upland area; red clays and duplex soils in the lowlands.
- Veld types (Acocks, 1953).
  veld type 44a (Highland Sourveld)
  veld type 10 (Lowveld)
- Bioclimatic regions (Phillips, 1973).
  region 2 (coast hinterland)
  region 10 (riverine-interior lowland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 806 mm
  Range (Schulze, 1982): 800 to 1 000 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  8 million cubic metres/year
- Land use (Nanni, 1982).
  East of the White Mfolozi River (Fig. 50) the area lies in KwaZulu, and falls within the jurisdiction of Chiefs Mpungose and Ximba (NTRPC, pers. comm.). West of the river the land is presently owned by the Department of Development Aid.

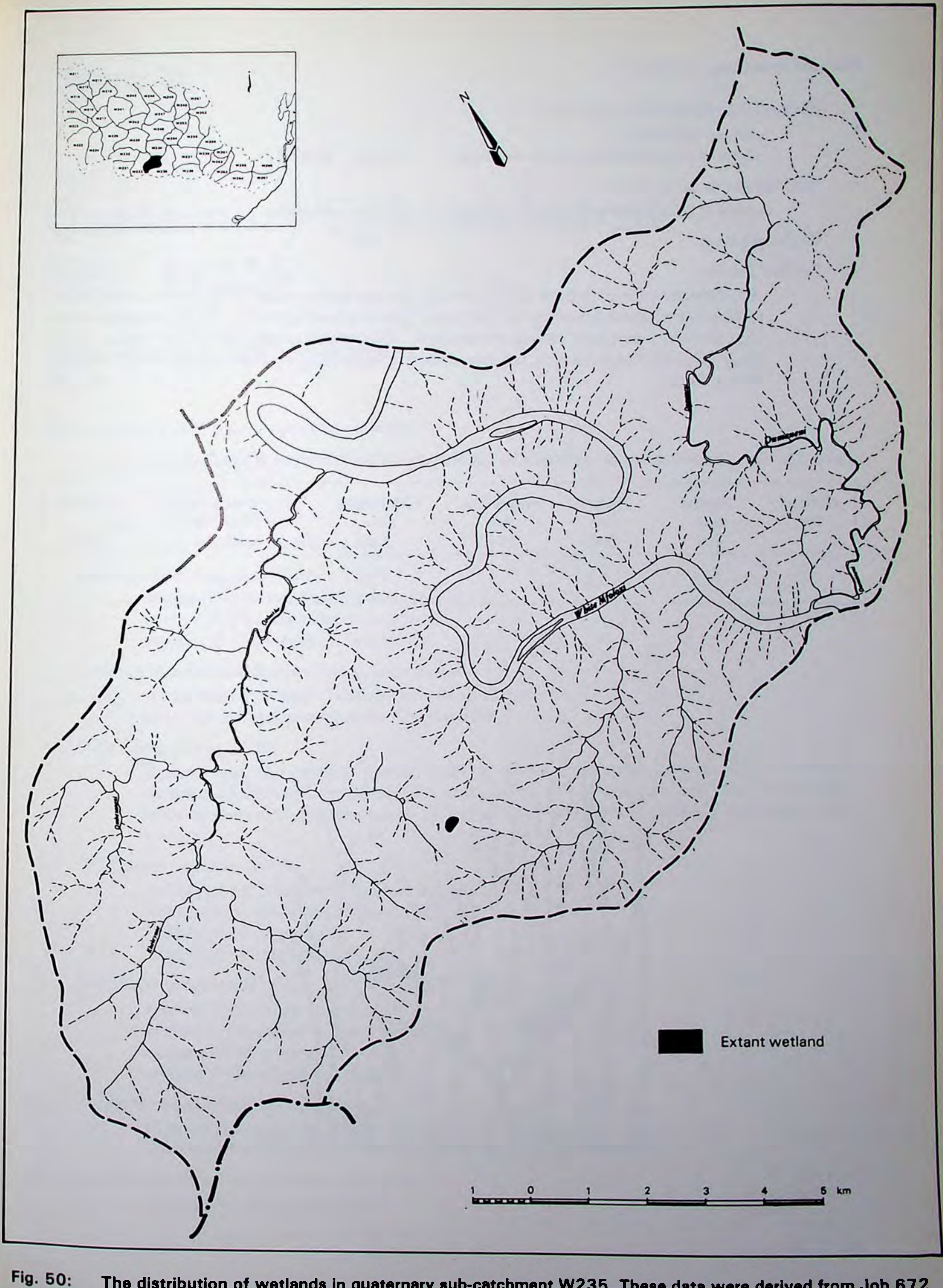


Fig. 50: **The distribution of wetlands in quaternary sub-catchment W235. These data were derived from Job 672 of 1970.**

Wetland inventory (Table 23)

- Wetland distribution (Pre Iron Age).
  No. of wetlands: 1
  Area of sub-catchment under wetland: 2,5 ha (0,02%)
- Wetland status (at present).
  Area of sub-catchment under wetland: 2,5 ha (0,02%)
- Wetland losses: Nil
- Further details:
  Quaternary sub-catchment W235 has the lowest proportion of wetland cover in the whole of the Mfolozi catchment. Only one 2,5 ha wetland occurs in the whole area, which for inventory purposes can be overlooked. This situation appears to be typical of the Lowveld of Zululand which, for climatological reasons, (i.e. aridity), is generally lacking in wetland.

Table 23: The present status of wetlands in quaternary sub-catchment W235 (Fig. 50).

Wetland No:	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	2,5	2,5	-	10	25,0	0,4

Chapter 21

Quaternary Sub-catchment No: W236

Name: Khwibi (principal river)
Fig. No: 51

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  245 km^2
- Range in altitude.
  1 030 to 210 m above sea level
- Physiographic regions (Turner, 1967).
  region 30 (Melmoth-Nkandhla Block)
  region 31 (Middleveld of Zululand)
  region 37 (Lowveld of Zululand)
- Geology (Geological Survey Dept., pers. comm.).
  major bedrock type: Table Mountain Sandstone
  less dominant types: Granite, Dwyka tillite
- Soils (Fitzpatrick, 1978).
  Yellow and red apedal, humic, freely drained, dystrophic soils as well as weakly developed (lithocutanic B), duplex and plinthic soil in uplands; red clays and duplex soils in lowveld. Further north (in the Middleveld) a tract of weakly developed soils occurs.
- Veld types (Acocks, 1953).
  veld type 64 (Northern Tall Grassveld)
  veld type 6 (Zululand Thornveld)
  veld type 10 (Lowveld)
  veld type 5 (Ngongoni Veld)
- Bioclimatic regions (Phillips, 1973).
  region 2 (coast hinterland)
  region 10 (riverine-interior lowland)
  region 8a (dry upland)
  region 9 (lowland-upland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 814 mm
  Range (Schulze, 1982): 700 to 900 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  18 million cubic metres/year

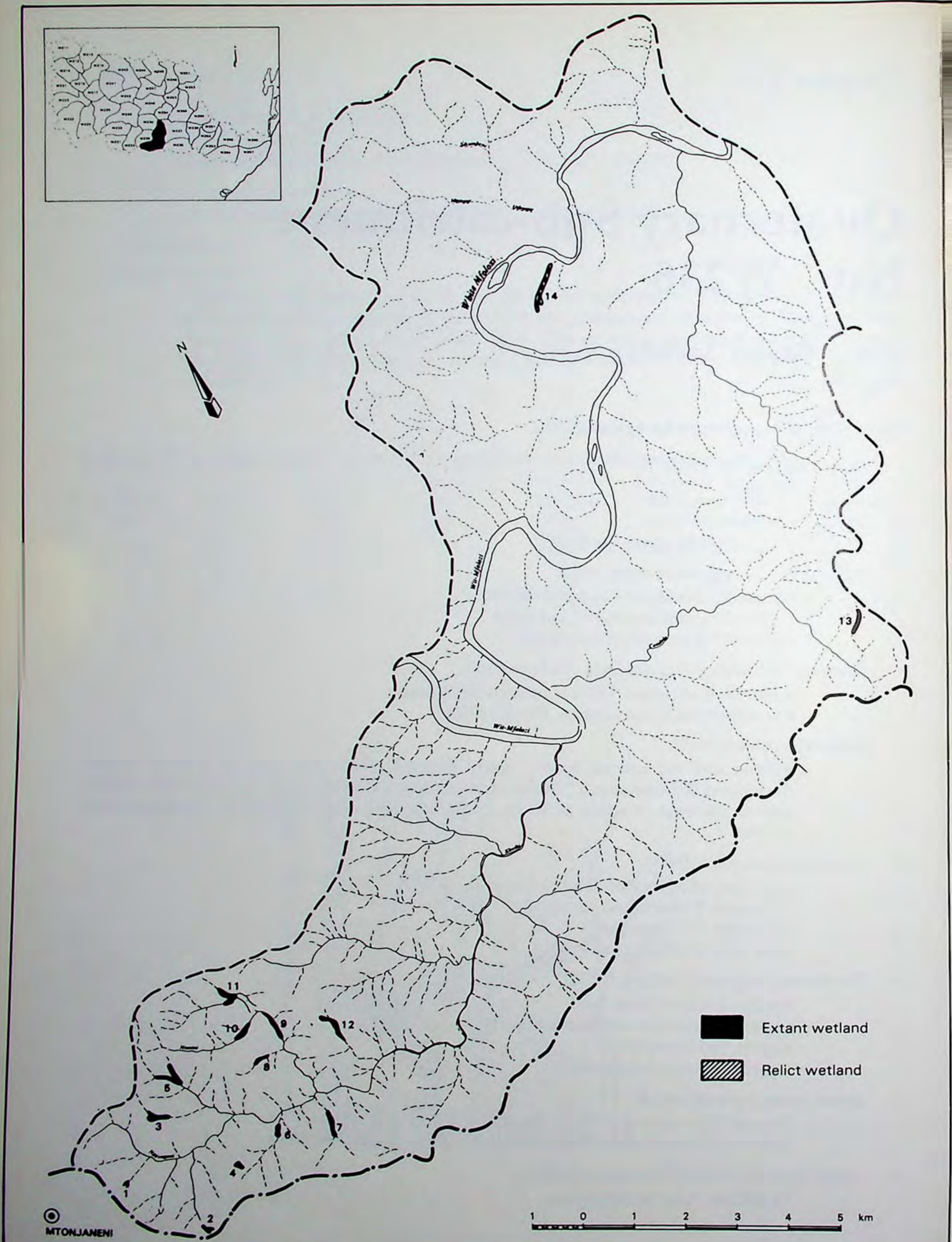


Fig. 51: **The distribution of wetlands in quaternary sub-catchment W236. These data were derived from job 672 of 1970 and Job 608 of 1970.**

- Land use (Nanni, 1982).

  Except for that area which extends south-westwards towards Mtonjaneni (Fig. 51), the rest of quaternary sub-catchment W236 lies in KwaZulu, and falls within the jurisdiction of Chief Ximba (NTRPC, pers. comm.).

Wetland inventory (Table 24)

- Wetland distribution (Pre Iron Age).

  No. of wetlands: 14

  Size range : 1 to 6 (ha)

  Area of sub-catchment under wetland: 39 ha (0,1%)

- Wetland status (at present).

  Area of sub-catchment under wetland: 33 ha (0,1%)

- Wetland losses: 6 ha (15%)

- Further details:

  85% of the wetlands in sub-catchment W236 occur near the source of the Khwibi River in the highest (wetter?) portion of the catchment. Although this bestows an important value upon this particular area, because of the small individual size of these wetlands, none warrant further description, for inventory purposes.

Table 24: The present status of wetlands in quaternary sub-catchment W236 (Fig. 51). Where losses have amounted to 100%, no further data are provided.

Wetland No:	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	1,0	1,0	-	32	3,1	0,3
2	1,5	1,5	-	10	15,0	0,5
3	3,0	3,0	-	30	10,0	0,8
4	1,5	1,5	-	12	12,5	0,4
5	4,0	4,0	-	57	7,0	1,4
6	2,0	2,0	-	130	2,7	0,5
7	3,0	3,0	-	120	2,5	1,0
8	2,5	2,5	-	45	5,5	0,6
9	3,0	3,0	-	375	2,2	1,3
10	2,5	2,5	-	130	1,9	0,8
11	3,0	3,0	-	152	1,9	0,9
12	3,5	3,5	-	20	17,5	1,4
13	2,5	2,5	-	15	16,6	0,9
14	6,0	-	100	-	-	-
TOTAL	39,0	33,0				10,8

Chapter 22

Quaternary Sub-catchment No: W237

Name: Nhlungwane (principal river)
Fig. No: 52

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  275 km^2
- Range in altitude.
  800 to 130 m above sea level
- Physiographic regions (Turner, 1967).
  A small portion of the Melmoth-Nkandhla Block (physiographic region 30) occurs in the south-west; the rest of the area comprises the Lowveld of Zululand (region 37).
- Geology (Geological Survey Dept., pers. comm.).
  major bedrock type: Dwyka tillite
  less dominant types: Table Mountain Sandstone, sandstone and shale (of Vryheid formation).
- Soils (Fitzpatrick, 1978).
  Red clays and duplex soils dominate the area, except in the south-west where weakly developed soils (lithocutanic B) prevail.
- Veld types (Acocks, 1953).
  veld type 6 (Zululand Thornveld)
  veld type 10 (Lowveld)
- Bioclimatic regions (Phillips, 1973).
  region 10 (riverine-interior lowland)
  region 9 (lowland-upland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 779 mm
  Range (Schulze, 1982): 700 to 900 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  18 million cubic metres/year
- Land use (Nanni, 1982).
  A portion of the UGR (which is State land controlled by the Natal Parks Board) lies in the east of quaternary sub-catchment W237. The rest of the area lies in KwaZulu, within the jurisdiction of Chief Ximba (NTRPC, pers. comm.).

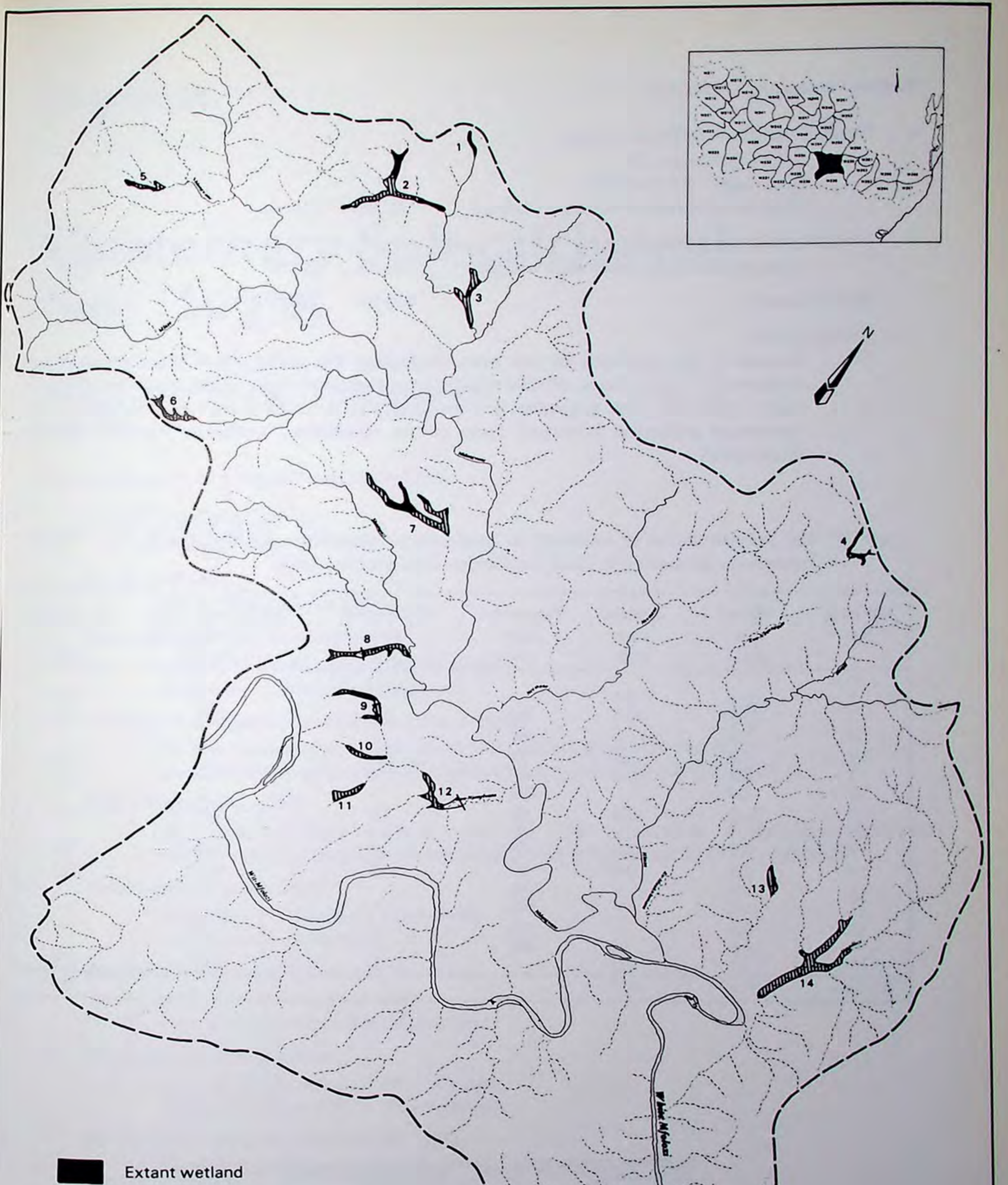


Fig. 52: The distribution of wetlands in quaternary sub-catchment W237. These data were derived from Job 608 of 1970.

Wetland inventory (Table 25)

- Wetland distribution (Pre Iron Age).
  No. of wetlands: 15
  Size range : 2,5 to 43 (ha)
  Area of sub-catchment under wetland: 167 ha (0,6%)
- Wetland status (at present).
  Area of sub-catchment under wetland: 39 ha (0,1%)
- Wetland losses: 128 ha (76%)
- Further details:
  Several of the wetlands in this area (including the relict sites) have small dams constructed within them, around which large concentrations of people have settled. Crop cultivation has accounted for most of the wetland losses experienced. For inventory purposes, however, none of the remaining wetlands warrant further description.

Table 25: The present status of wetlands in quaternary sub-catchment W237 (Fig. 52). Where losses have amounted to 100%, no further data are provided.

Wetland No:	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	2,5	2,5	-	30	8,3	0,9
2	23,5	10,5	55	352	2,9	2,1
3	9,0	-	100	-	-	-
4	7,0	5,0	28	200	2,5	1,6
5	6,0	3,0	50	95	6,0	0,7
6	7,0	-	100	-	-	-
7	24,0	10,0	58	237	4,2	2,2
8	12,0	-	100	-	-	-
9	9,0	4,0	55	87	1,1	0,9
10	4,0	0,5	87	57	0,8	0,2
11	5,0	-	100	-	-	-
12	6,5	-	100	-	-	-
13	5,0	-	100	-	-	-
14	43,0	-	100	-	-	-
15	4,0	4,0	-	25	16,0	1,0
TOTAL	167,0	39,0				9,6

Chapter 23

Quaternary Sub-catchment No: W238

Name: Munywana (principal river)
Fig. No: 53

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  185 km^2
- Range in altitude.
  750 to 120 m above sea level
- Physiographic regions (Turner, 1967).
  region 30 (Melmoth-Nkandhla Block)
  region 37 (Lowveld of Zululand)
- Geology (Geological Survey Dept., pers. comm.).
  major bedrock types: Table Mountain Sandstone and Dwyka tillite
  less dominant types: Shale (Pietermaritzburg formation) and dolerite
- Soils (Fitzpatrick, 1978).
  Red clays and duplex soils, together with black clays, red structured clays and duplex soils in the lowveld; weakly developed soils (lithocutanic B) in the highlands.
- Veld types (Acocks, 1953).
  veld type 6 (Zululand Thornveld)
  veld type 10 (Lowveld)
- Bioclimatic regions (Phillips, 1973).
  region 9 (lowland-upland)
  region 10 (riverine-interior lowland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 801 mm
  Range (Schulze, 1982): 700 to 900 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  14 million cubic metres/year
- Land use (Nanni, 1982).
  At the confluence of the Munywana River and the White Mfolozi (in the north-east of sub-catchment W238) a small portion of the UGR (State land) is incorporated. The rest of the area lies in KwaZulu, and within the jurisdiction of Chief Biyela (NTRPC, pers. comm.).

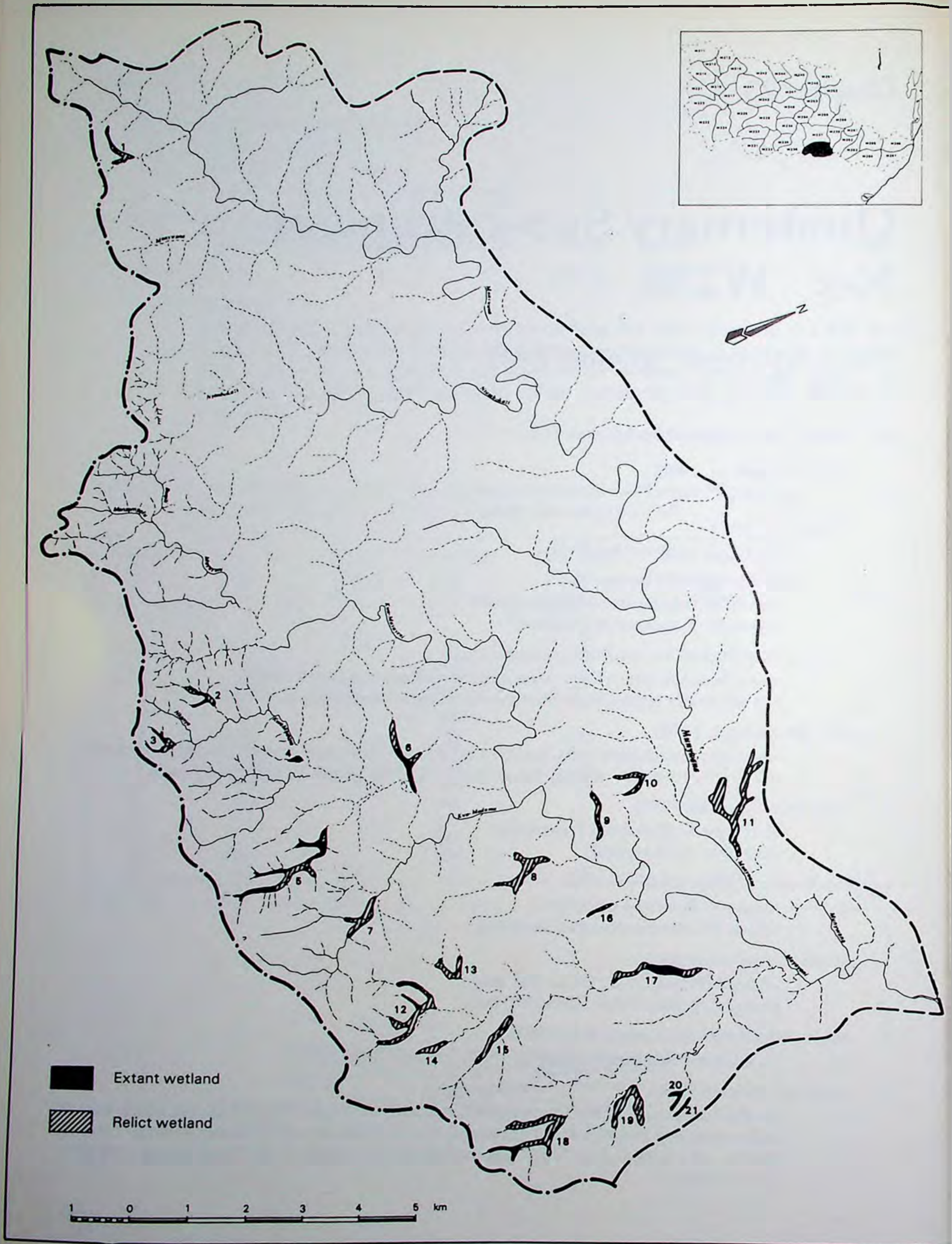


Fig. 53: **The distribution of wetlands in quaternary sub-catchment W238. These data were derived from Job 608 of 1970.**

Wetland inventory (Table 26)

- Wetland distribution (Pre Iron Age).
  No. of wetlands: 21
  Size range : 2 to 22 (ha)
  Area of sub-catchment under wetland: 170 ha (0,9%)
- Wetland status (at present).
  Area of sub-catchment under wetland: 44 ha (0,2%)
- Wetland losses: 126 ha (74%)
- Further details:
  With the exception of wetland No. 1 (Fig. 53) all of the wetlands in sub-catchment W238 (most of which are relict systems) lie in the eastern portion of the catchment. None of these sites warrant further description for inventory purposes, due to their degraded condition and small size.

Table 26: The present status of wetlands in quaternary sub-catchment W238 (Fig. 53). Where losses have amounted to 100%, no further data are provided.

Wetland No:	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	5,5	2,0	63	37	5,4	0,7
2	4,5	2,0	44	77	2,6	0,8
3	3,5	1,5	43	47	3,2	1,0
4	2,0	2,0	-	55	3,6	0,5
5	17,0	12,0	29	250	4,8	4,0
6	10,5	6,5	38	87	7,4	1,7
7	9,0	-	100	-	-	-
8	12,0	-	100	-	-	-
9	4,0	-	100	-	-	-
10	4,5	-	100	-	-	-
11	22,0	-	100	-	-	-
12	12,5	2,5	80	217	1,1	1,2
13	5,0	-	100	-	-	-
14	3,5	-	100	-	-	-
15	8,0	-	100	-	-	-
16	2,5	1,0	60	42	2,3	0,4
17	12,5	5,5	48	1 337	0,6	1,1
18	15,0	4,0	73	175	2,3	1,3
19	11,5	-	100	-	-	-
20	3,0	3,0	-	17	17,6	1,2
21	2,0	2,0	-	17	11,7	0,9
TOTAL	170,0	44,0				14,8

Chapter 24

Quaternary Sub-catchment No: W239

Name: Mpafa (principal river)
Fig. No: 54

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  140 km^2
- Range in altitude.
  365 to 85 m above sea level
- Physiographic region (Turner, 1967).
  region 37 (Lowveld of Zululand)
- Geology (Geological Survey Dept., pers. comm.).
  major bedrock types: Sandstone (Vryheid formation) and Karoo dolerite.
  less dominant type: Shale (Pietermaritzburg formation)
- Soils (Fitzpatrick, 1978).
  Although broadly shown as an area covered in "red clays and duplex soils", detailed soil maps of the UGR and of an area adjacent to the reserve (Watson, pers. comm.*) are available. The lack of any hydromorphic forms is noteworthy.
- Veld types (Acocks, 1953).
  veld type 6 (Zululand Thornveld)
  veld type 10 (Lowveld)
  Watson and MacDonald (1983) provide far more specific information on vegetation cover in the UGR.
- Bioclimatic regions (Phillips, 1973).
  region 9 (lowland-upland)
  region 10 (riverine-interior lowland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 758 mm
  Range (Schulze, 1982): 700 to 900 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  8 million cubic metres/year.

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* H Watson: Geography Department, University of Durban-Westville, Durban.

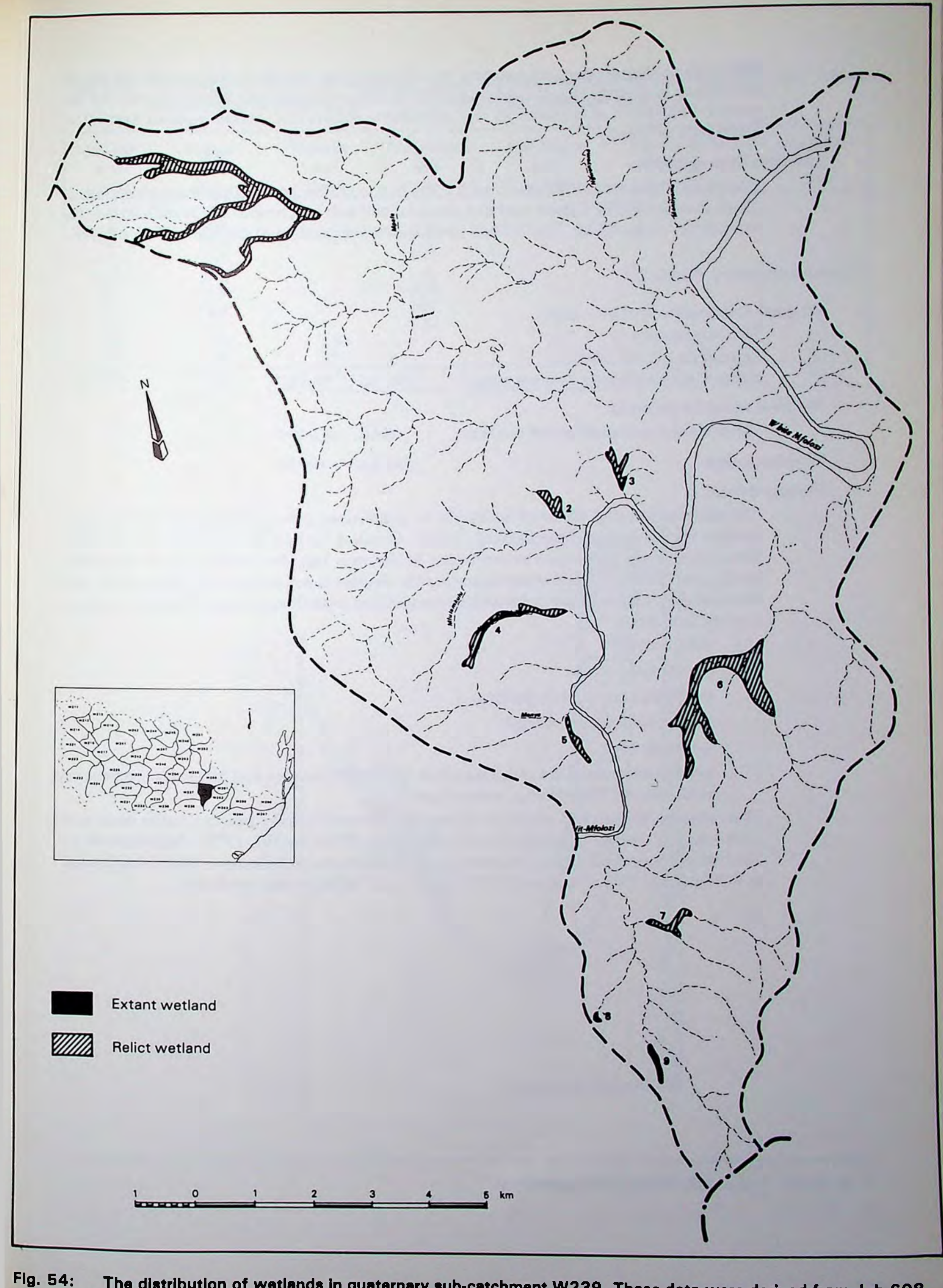

Fig. 54: The distribution of wetlands in quaternary sub-catchment W239. These data were derived from Job 608 of 1970.

Although no longer operable, gauging weir W2M03 (on the White Mfolozi River) lay on the eastern boundary of sub-catchment W239. This weir provided flow records for the period 1947-1955, at a point in the catchment where the mean annual run-off is c. 225 mill. m^3/year.

- Land use (Nanni, 1982).

  Except for a tiny area in the south which lies in KwaZulu, and within the jurisdiction of Chief Thenjini (NTRPC, pers. comm.), the whole of sub-catchment W239 falls within the boundaries of the UGR. This is State Land under the control of the Natal Parks Board.

Wetland inventory (Table 27)

- Wetland distribution (Pre Iron Age).

  No. of wetlands: 9

  Size range : 2,5 to 120 (ha)

  Area of sub-catchment under wetland: 250 ha (1,8%)

- Wetland status (at present).

  Area of sub-catchment under wetland: 6 ha (0,04%)

- Wetland losses: 244 ha (97%)

- Further details:

  The distribution and status of wetlands in quaternary sub-catchment W239 has been known for some time (MacDonald, 1979). Grassed wetlands are not only the most threatened of the vegetation communities in the area, but also were far more extensive in the past (Table 27). The main reason for the decline is lowering of the watertable and the changing soil moisture characteristics associated with this process. This predicament has resulted from :

  - donga erosion
  - poorly sited roads
  - poor grass cover (overgrazing)
  - poor infiltration of rainfall
  - untimely fires
  - prior settlement in the area associated with bush clearing and tsetse fly eradication in the early 1930's (Porter, pers. comm.*).

  The radically altered soil moisture regime has allowed woody plants (*Acacia karoo* and *Dichrostachys cinerea*) to invade the wetland areas (MacDonald, 1979). Information on the bird and mammal species affected by the habitat change (Deanne, 1966; MacDonald & Birkenstock, 1979; Anderson, 1979; MacDonald, 1984) is also available.

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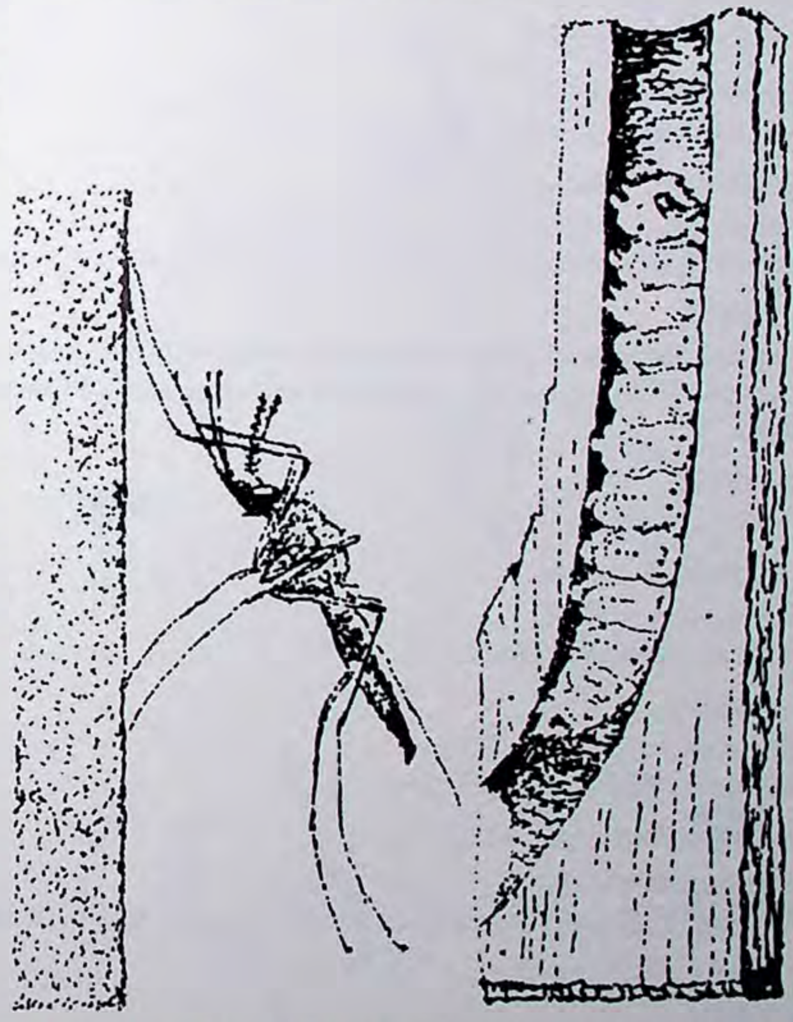
* R. Porter: Natal Parks Board, Pietermaritzburg.

Table 27: The present status of wetlands in quaternary sub-catchment W239 (Fig. 54). Where losses have amounted to 100%, no further data are provided.

Wetland No:	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	120,0	-	100	-	-	-
2	9,0	-	100	-	-	-
3	4,5	-	100	-	-	-
4	20,0	-	100	-	-	-
5	5,0	-	100	-	-	-
6	81,0	-	100	-	-	-
7	5,0	-	100	-	-	-
8	2,5	2,5	-	12	8,3	0,5
9	3,5	3,5	-	50	7,0	1,4
TOTAL	250,0	6,0				1,9



Chapter 25

Quaternary Sub-catchment No: W262

Name: Mfuyeni (principal river)
Fig. No.: 55

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  170 km^2
- Range in altitude.
  355 to 50 m above sea level
- Physiographic region (Turner, 1967).
  region 37 (Lowveld of Zululand)
- Geology (Geological Survey Dept., pers. comm.).
  major bedrock type: Sandstone (Vryheid formation)
  less dominant types: Sandstone (Emakwezini formation) and dolerite.
- Soils (Fitzpatrick, 1978).
  Black clays, red structured clays and duplex soils broadly cover the area, but detailed soil maps of the UGR and of an adjacent area are available (Downing, 1980; Watson, pers. comm.).
- Veld type (Acocks, 1953).
  veld type 10 (Lowveld)
- Bioclimatic regions (Phillips, 1973).
  region 9 (lowland-upland)
  region 10 (riverine-interior lowland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 760 mm
  Range (Schulze, 1982): 700 to 900 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  5 million cubic metres/year
  Sub-catchment W262 impinges on the confluence of the Black and the White Mfolozi Rivers.
- Land use (Nanni, 1982).
  The southern and north-eastern portions of sub-catchment W262 extend into KwaZulu, but elsewhere the area incorporates part of the UGR. This is State land under the control of the Natal Parks Board.

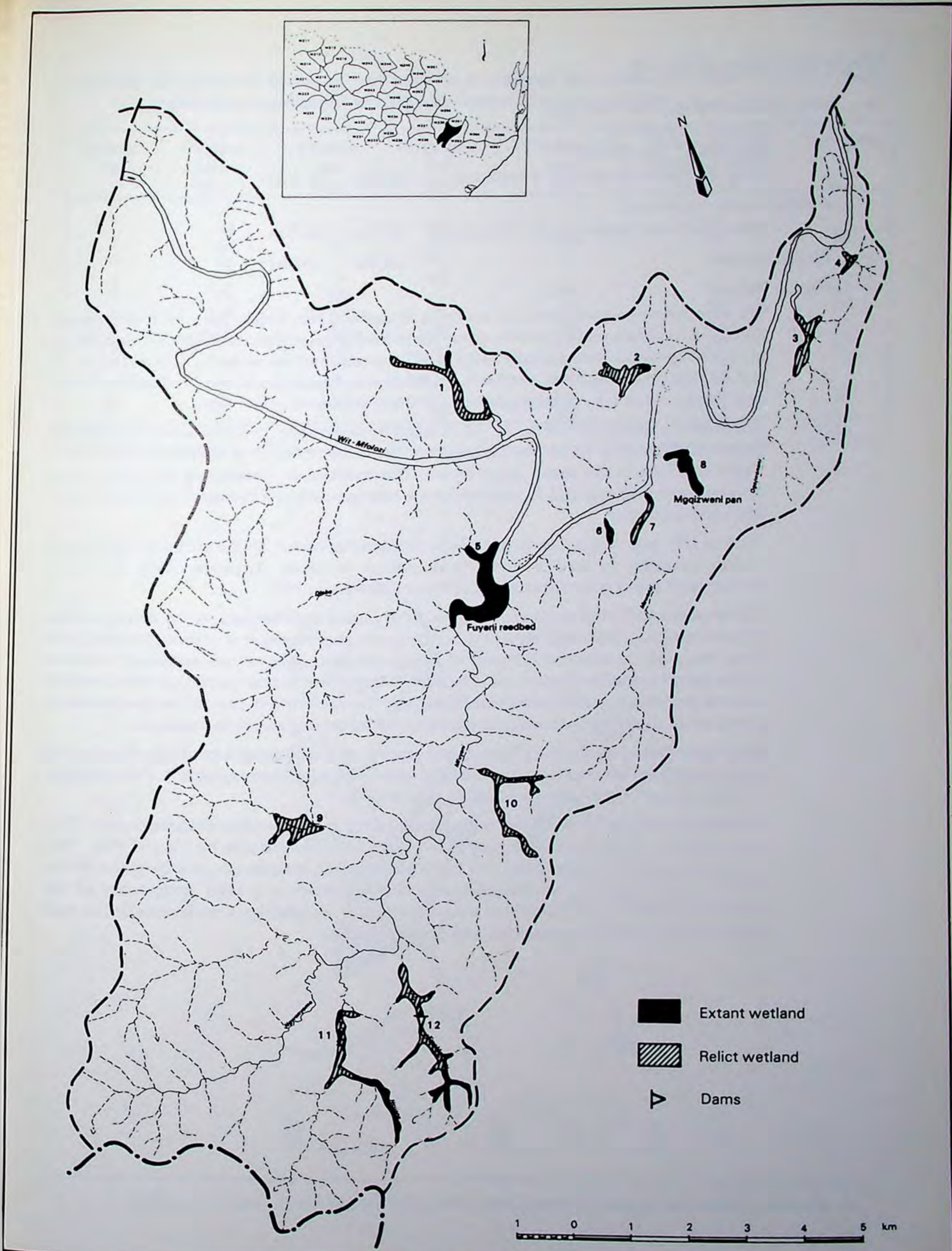


Fig. 55: The distribution of wetlands in quaternary sub-catchment W262. These data were derived from Job 608 of 1970.

Wetland inventory (Table 28)

- Wetland distribution (Pre Iron Age).
  - No. of wetlands: 12
  - Size range : 2 to 74 (ha)
  - Area of sub-catchment under wetland: 246 ha (1,4%)
- Wetland status (at present).
  - Area of sub-catchment under wetland: 117 ha (0,7%)
- Wetland losses: 129 ha (52%)
- Further details:

The most important wetland in this region is wetland No. 5 (Fig. 55) which occupies an alluvial area 74 ha in extent at the confluence of the Mfuyeni and the White Mfolozi Rivers at a point known as the Makhamisa bend. That portion of the wetland covered by reeds, is called the Fuyeni reedbed, and has been studied by MacDonald and Schneedbeli (1981) and Frankland (1982). A brief synthesis of these studies is given below :

The Fuyeni reedbed (28° 24′ S, 31° 54′ E) is fed by water from the Dlaba and the Mfuyeni Rivers, and covers c. 15 ha. At the height of the rainy season it is flooded by water to a depth of 25 cm in the lower lying areas. The reedbed is dominated by two species, *Phragmites mauritianus* and *P. australis*, and is surrounded by riverine forest and "lawns" of *Cynodon dactylon*.

During July and August each year Zulu women harvest c. 10 ha of the reedbed, and before removing the reeds completely strip them of leaves. Approximately 108 metric tons of reed stems were removed in 1980, and 79 tons in 1981.

The studies conducted suggest that this activitiy has a high impact on the ecology of the Fuyeni reedbed. Although regrowth occurs in the short term, it was thought that in the long term, the continuous removal of plant material without subsequential nutrient replacement could be deleterious. The harvesting of reeds also displaced certain of the animal species associated with the reedbed, and the reed cutters created footpaths which could act as drainage channels and lead to gradual drying out of the system.

The Natal Parks Board have allowed reed cutting to continue on a controlled basis, and have limited the off-take to under 50 metric tons (Whateley, pers. comm.*). For example, in 1985, 36 tons were harvested, and 48 tons in 1986.

Wetland No. 8 (Fig. 53) is known as the Mgquizweni pan (open water surface area = 7 ha) and surveys of the fish population in this pan, have been made by Pike (1979). The catchment area behind the pan (1135 ha) is undisturbed, and floodwater from the White Mfolozi periodically flows into the pan. It is regarded as a vital component of the Umfolozi Game Reserve, acting as a source of water, as a refuge area for crocodiles and hippo, many species of waterfowl and indigenous fish.

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* A. Whateley: Senior Technician, Research Centre, Hluhluwe Game Reserve, Natal Parks Board.

Table 28: **The present status of wetlands in quaternary sub-catchment W262 (Fig. 55). Where losses have amounted to 100%, no further data are provided.**

Wetland No:	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	24	-	100	-	-	-
2	13	2,0	84	245	0,8	0,5
3	16	-	100	-	-	-
4	3	-	100	-	-	-
5	74	74,0	-	7 250	1,0	6,7
6	2	1,0	50	50	2,0	0,4
7	5	0,5	90	60	0,8	0,1
8	17	17,0	-	1 135	1,5	2,5
9	16	-	100	-	-	-
10	19	-	100	-	-	-
11	26	10,0	61	537	1,8	3,1
12	31	13,0	58	287	4,5	4,9
TOTAL	246	117,0				18,2

Chapter 26

Quaternary Sub-catchment No: W242

Name: Upper Black Mfolozi (principal river)
Fig. No: 56

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  415 km^2
- Range in altitude.
  1 560 to 426 m above sea level
- Physiographic regions (Turner, 1967).
  region 12 (Hlobane-Manyini-Ceza Block)
  region 31 (Middleveld of Zululand)
  region 37 (Lowveld of Zululand)

  Geology (Geological Survey Dept., pers. comm., Fig 57).
  major bedrock type: Shale, sandstone and tillite
  less dominant types: Nsuze volcanics
- Soils (Fitzpatrick, 1978).
  Yellow and red apedal, freely drained dystrophic soils in uplands; weakly developed soils (lithocutanic B), plinthic and red/black clays and duplex soils in the lowlands.
- Veld types (Acocks, 1953).
  veld type 8 (North-eastern Mountain Sourveld)
  veld type 63 (Piet Petief Sourveld)
  veld type 64 (Northern Tall Grassveld)
  veld type 10 (Lowveld)
- Bioclimatic regions (Phillips, 1973).
  region 3 (mistbelt)
  region 6a (moist uplands)
  region 8a (dry uplands)
  region 10 (interior-riverine lowland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 922 mm
  Range (Schulze, 1982): 700 to 1 200 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  53 million cubic metres/year.
  Major tributaries include the Mgobhozi, the Nkweme and the Kwa Mbizankulu Rivers. Gauging weir W2M08 is situated in sub-catchment W242. Although the seven year

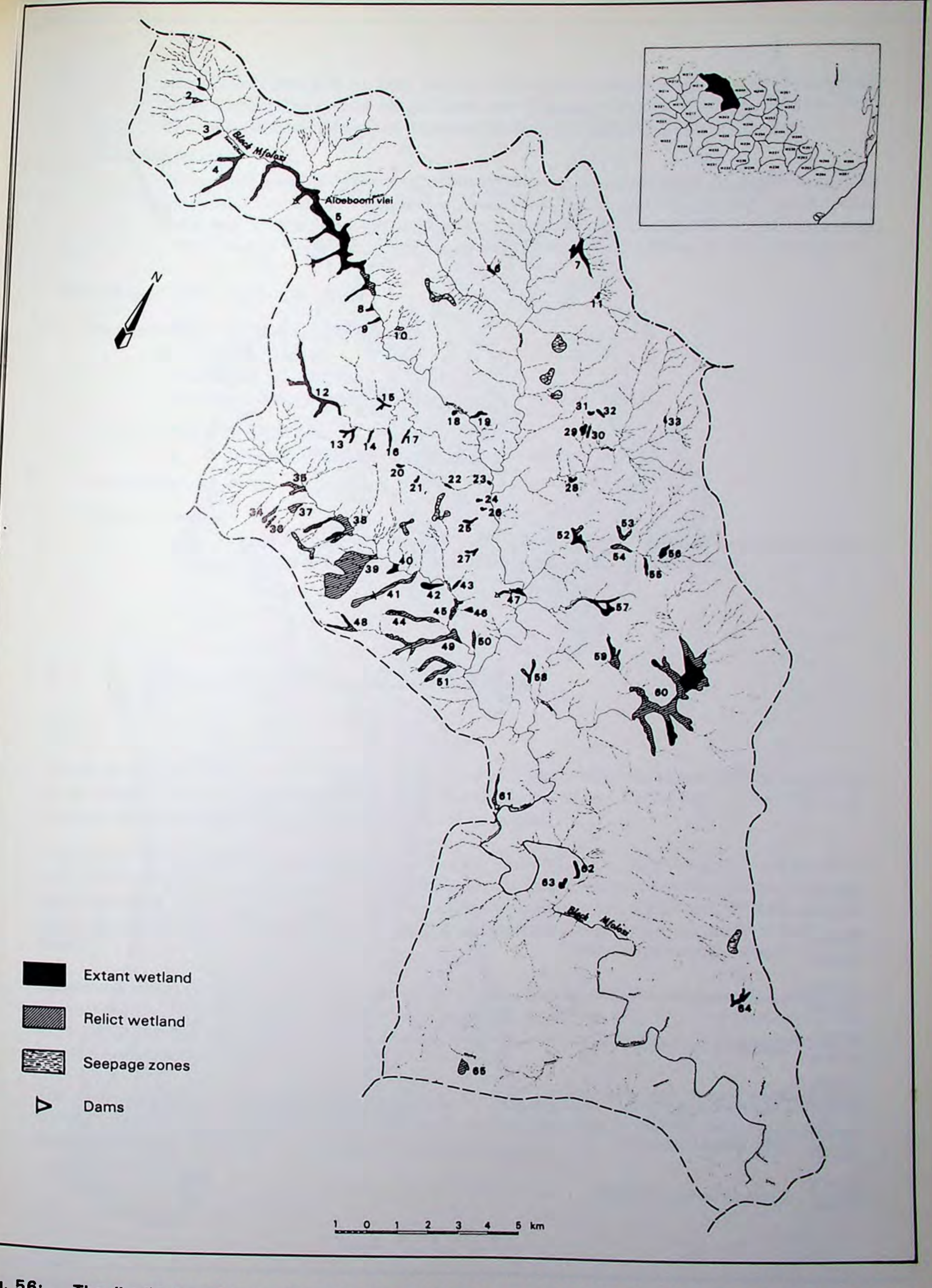
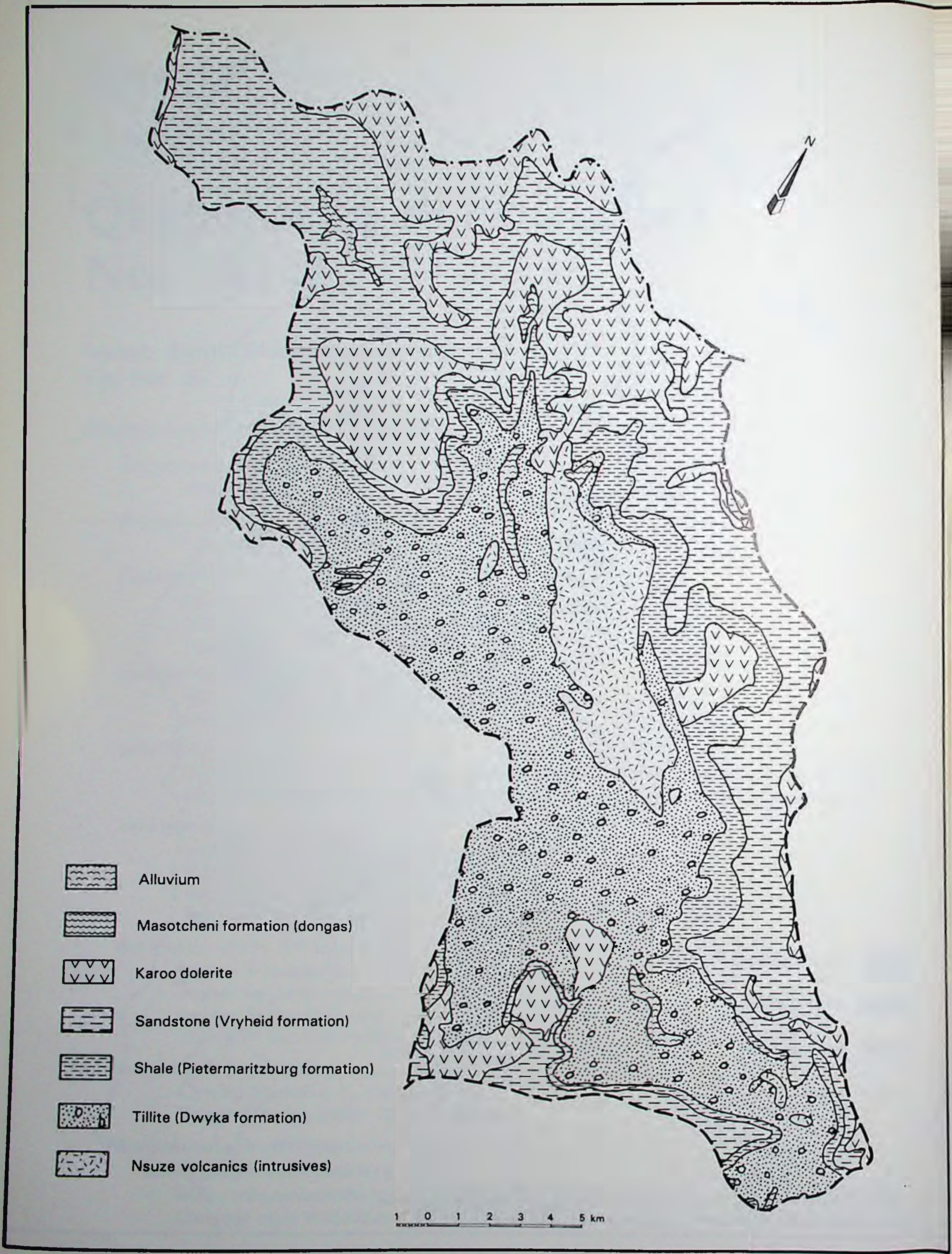


Fig. 56: The distribution of wetlands in quaternary sub-catchment W242. These data were derived from Job 773 of 1976.



Source: Dept. of Geological Survey

Fig. 57: The geology of quaternary sub-catchment W242.

observation period (Oct. 1965-Sept. 1972) is neither complete nor extensive, the monthly flows during this period ranged from zero (July-Aug. 1968) to 23 million m^3 (Feb. 1972). The mean annual run-off at this point in the catchment is 30 million m^3/year.

- Land use (Nanni, 1982).

  Virtually the whole of sub-catchment W242 comprises large white owned farms used for the production of cattle and maize. In addition, a great deal of wattle is grown in upland areas and several large coal mines occur. In the south-east of the sub-catchment a small portion lies in KwaZulu, within the jurisdiction of Chief Ndebele (NTRPC, pers. comm.).

Wetland inventory (Table 29)

- Wetland distribution (Pre Iron Age).

  No. of wetlands: 65
  Size range : 1 to 202 (ha)
  Area of sub-catchment under wetland: 911 ha (2,2%)

- Wetland status (at present).

  Area of sub-catchment under wetland: 426 ha (1%)

- Wetland losses: 485 ha (53%)

- Further details:

  For the reasons given in Chap. 26.1 the only wetland in sub-catchment W242 which warrants further description for inventory purposes is "Aloeboom vlei".

26.1 Aloeboom vlei (Wetland No. 5, Fig. 56)

Form

Aloeboom vlei (27° 50′ S; 31° 06′ E) lies on the floor of a valley which is surrounded by mountains on all sides, 5 km from the headwaters of the Black Mfolozi River. Excluding c. 12 ha (8%) in its lowermost reaches (a relict portion), the vlei is 142 ha in size.

Aloeboom vlei extends for 6 km on either side of the Black Mfolozi. The average slope is less than 0,4%, but in its upper reaches slopes of over 2,0% are encountered, where a tributary enters Aloeboom vlei from the south. The elevation at the head of this re-entrant is at 1 188 m a.s.l., whereas the vlei outlet is at 1 135 m a.s.l. The vlei is 350 m across at its widest point, and its perimeter is 19,3 km in length.

Aloeboom vlei is surrounded by sandstone of the Vryheid formation and coincides with a large tract of land mapped as alluvium on the floodplain of the Black Mfolozi (Fig. 57). The structure of the keypoint is unclear as the nearest sill of erosion-resistant Karoo dolerite lies c. 2 km downstream of the vlei outlet.

The soils comprising Aloeboom vlei vary from wet, organically rich Champagne forms to Katspruit soils in the more steeply sloping areas. Both of these soil types signify that the water table is high, and that drainage is impeded in this portion of the catchment.

Table 29: The present status of wetlands in quaternary sub-catchment W242 (Fig 56). Where wetland losses have amounted to 100%, no further data are provided.

Wetland No:	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	2,5	-	100	-	-	-
2	3,5	-	100	-	-	-
3	4,0	2,0	50	267	0,7	0,5
4	23,0	23,0	-	375	6,1	4,4
5	154,0	142,0	8	4 775	3,5	19,3
6	2,5	2,5	-	332	0,7	0,7
7	16,0	16,0	-	485	3,3	3,5
8	2,0	2,0	-	10	20,0	0,4
9	2,5	2,5	-	95	2,6	0,9
10	3,0	-	100	-	-	-
11	1,5	1,5	-	97	1,5	0,4
12	28,0	28,0	-	735	3,8	8,0
13	4,5	4,5	-	67	6,7	1,6
14	2,0	2,0	-	52	3,8	0,9
15	3,0	3,0	-	245	1,2	1,3
16	2,5	2,5	-	28	8,9	1,1
17	2,0	2,0	-	22	9,1	1,0
18	1,0	1,0	-	17	5,9	0,2
19	3,0	3,0	-	40	7,5	0,8
20	2,0	2,0	-	17	11,7	0,5
21	1,0	1,0	-	14	7,1	0,3
22	1,5	1,5	-	175	2,5	0,4
23	1,0	1,0	-	18	5,5	0,3
24	2,0	2,0	-	21	9,5	0,5
25	2,5	2,5	-	35	7,1	0,9
26	1,5	1,5	-	15	10,0	0,4
27	2,5	2,5	-	19	13,1	0,8
28	2,5	2,5	-	48	5,2	0,6
29	4,5	4,5	-	20	22,5	1,0
30	3,5	3,5	-	12	29,1	0,8
31	1,5	1,5	-	11	13,6	0,4
32	2,0	2,0	-	17	11,7	0,8
33	1,0	1,0	-	24	4,1	0,4
34	5,5	5,5	-	33	16,6	1,5
35	10,0	-	100	-	-	-
36	2,0	2,0	-	18	11,1	1,0
37	6,0	-	100	-	-	-
38	32,0	13,0	59	2 087	1,0	3,1
39	121,0	-	100	-	-	-
40	6,0	6,0	-	34	17,6	1,0
41	24,0	-	100	-	-	-
42	7,0	7,0	-	42	16,6	1,5
43	2,0	2,0	-	36	5,5	0,7
44	17,5	-	100	-	-	-
45	7,0	-	100	-	-	-
46	3,5	3,5	-	21	16,6	0,7
47	5,5	5,5	-	58	9,4	1,3
48	8,5	-	100	-	-	-
49	38,0	-	100	-	-	-
50	2,5	-	100	-	-	-
51	27,0	-	100	-	-	-
52	10,5	7,5	28	1 337	1,1	1,6
53	6,5	-	100	-	-	-
54	6,0	-	100	-	-	-
55	3,0	3,0	-	42	7,1	1,2
56	4,0	4,0	-	55	7,3	0,7
57	15,0	15,0	-	222	6,7	3,2
58	7,0	-	100	-	-	-
59	12,0	5,0	58	255	1,9	1,4
60	202,0	64,0	68	3 000	2,3	3,1
61	5,5	-	100	-	-	-
62	5,0	5,0	-	42	11,9	1,1
63	4,5	4,5	-	28	16,1	0,8
64	7,0	7,0	-	120	5,8	2,0
65	8,5	-	100	-	-	-
TOTAL	911,0	426,0				79,0

Macroclimate

Lying in the "mistbelt" region of the Upper Black Mfolozi, the macroclimate of Aloeboom vlei (Phillips, 1973; Schulze, 1982) is indicated in the table below :

• mean annual precipitation	=	1 000-1 200 mm	
• relative humidity	=	70-75 %	
• temperature			
mean annual	=	17,5 °C	
		Maximum (°C)	Minimum (°C)
mean daily	=	25	-11
extreme daily	=	39	- 6
• mean annual potential evapotranspiration	=	1550 mm	

The nearest weather station, with records extending back to 1921, is Langkrans (station 373/80) (Pitman, *et al.*, 1981).

Hydrology

Aloeboom vlei receives the run-off from a 4775 ha catchment, of which 3,5% is occupied by wetland. Judging from the variability of streamflow at gauging weir W2M08 (which lies 18 km below Aloeboom vlei) the flow of the river is far from sustained (Pitman, *et al.*, 1981).

There are signs of ditches and drains within Aloeboom vlei, and throughout its length a channel containing the Black Mfolozi River is evident. However, in the middle reaches of the vlei a zone occurs in which the flow of the river is less confined and signs of attenuation (diffuse flow patterns) are evident. This, together with the flat terrain (0,4% slope), the dense vegetation (Plate 17) and widespread occurrence of hydromorphic soils suggests that Aloeboom vlei probably plays an important role in attenuating run-off from this steep headwater region of the Mfolozi catchment.

Plate 17: An impression of the plant community in the lower reaches of Aloeboom vlei showing the extent of domination by *Juncus effusus*, and tree ferns in the foreground.

Vegetation

The plant cover of Aloeboom vlei is unlike that of any other wetland seen in the Mfolozi catchment. It is dominated by sedges, the principal species being *Juncus effusus*. The abnormally wet condition of the vlei is also evident from the occurrence of moss growing beneath the sedge community, by emergent plant species such as tree-ferns (*Alsophila dregei*) and water loving plants such as *Isolepis fluitans*, in certain areas.

Various hygrophilous grass species (e.g. *Miscanthus* sp.) occur, particularly in the upper reaches of the vlei, where conditions seem to be drier, and more agricultural disturbances are evident. A moderately dense cover of dryland grasses and pasture grasses surround the vlei in this locality.

The level of plant community interspersion is high. This suggests that Aloeboom vlei could be an important wildlife habitat, although there are no data available to support this.

Afforestation of the catchment has led to wattle trees having encroached to the vlei edge, and in the lower reaches, plantations of wattles have been established on the edge of the river. A few poplars (*P. deltoides*) have also been planted in the middle of the vlei.

Land Tenure

Aloeboom vlei is privately owned by 9 persons (Fig. 58), each of whom use the vlei differently. The uses range from no utilization to intensive usage centred upon cattle and pasture production (Plate 18).

Land use

Most of the land surrounding Aloeboom vlei is used for the growing of wattle trees, but added to this farming and the mining of coal feature as prominent activities in the catchment.

Plate 18: The utilization of Aloeboom vlei in its upper reaches is geared towards cattle production. Notice the poplar trees in the middle distance.

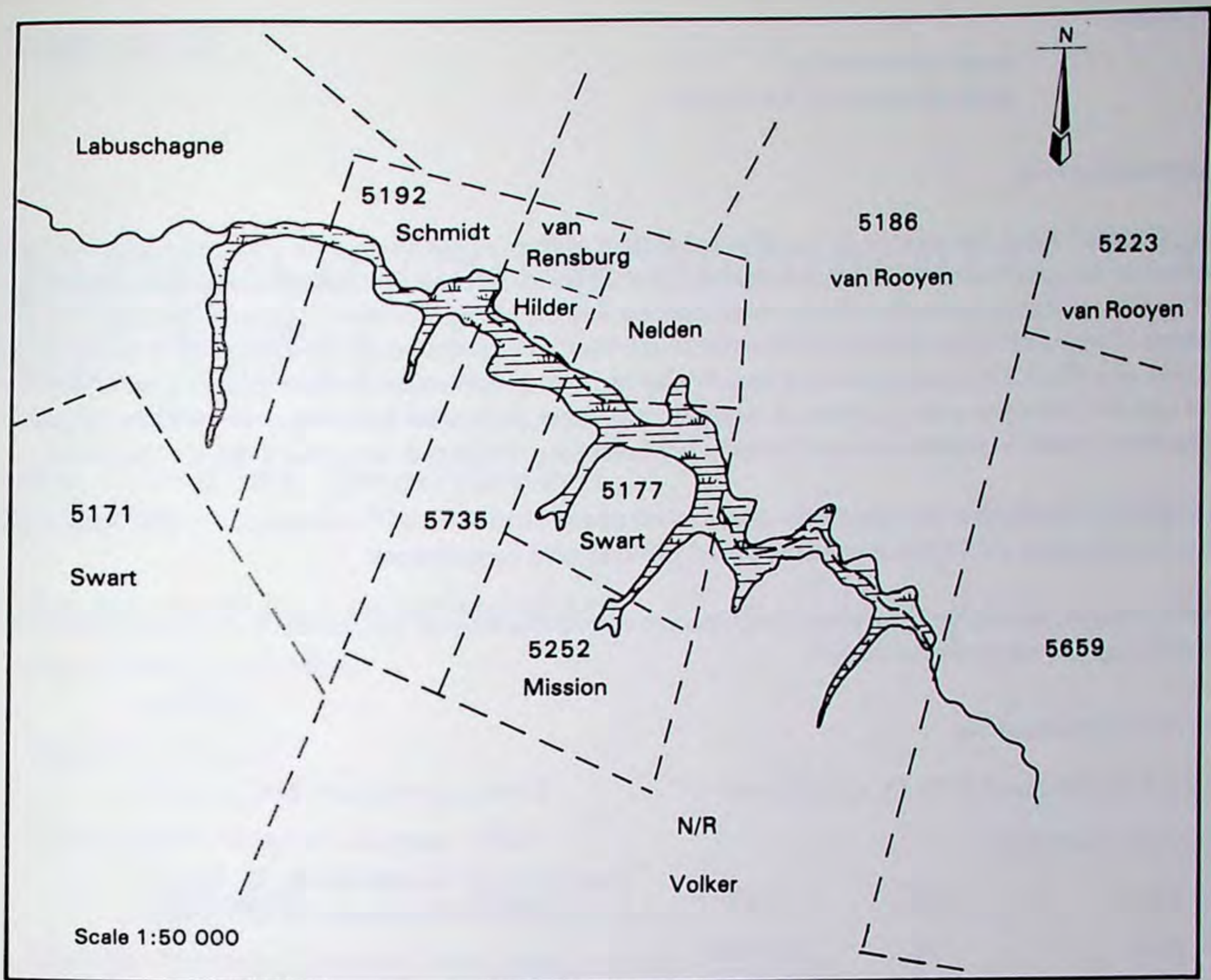


Fig. 58: The landownership of Aloeboom vlei, showing the identification number of the farm (according to the local extension officer) and, where known, the owner's name.

Various interferences are evident within Aloeboom vlei, but as yet none of these appear to have become sufficiently serious to have destroyed the wetland.

The disturbances identified include:

Those associated with cattle farming:

- grazing
- burning
- pasture production
- dam construction
- irrigation
- ditching
- channelling
- stock watering

Those associated with coal mining:

- acidification (lime additions)
- sulphate contamination
- rail construction

Others:

- road construction
- encroachment of alien trees

Recommendations

Being situated near the source of the Black Mfolozi River, Aloeboom vlei commands an influential position in the catchment. It seems reasonable to assume that the vlei would regulate streamflow by storing water during periods of high flow, and by augmenting low flow periods through the release of water. As run-off from the coal mines above the vlei is contaminated, it is also likely that Aloeboom vlei acts as a filter, and protects water quality by reducing upstream pollutants. It would serve as an ideal site for future research aimed at quantifying these potential benefits, and will be of particular importance when a classification of Natal's wetlands is attempted, at some stage in the future.

Ecologically Aloeboom vlei supports an unusual plant (and animal?) community, and because of its value as a pasture for cattle, is of undoubted agricultural importance.

Aloeboom vlei should therefore be recognised as one of the critical wetlands in the Mfolozi catchment, and managed with extreme care.

Sources of information

Maps: 1:50 000 sheet 2731 CC Gluckstadt

Aerial photographs:

Year	Job	Scale	Strip No.	Photo Nos.
1943	16	1:25 000}		
1961	455	1:36 000}	no record	
1969	607	1:36 000}		
1973	773	1:50 000		
1976	773	1:30 000	13 14	8238-8239 8577-8579

Chapter 27

Quaternary Sub-catchment No: W241

Name: Hlonyana (principal river)
Fig. No: 59

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  340 km^2
- Range in altitude.
  1 524 to 564 m above sea level
- Physiographic regions (Turner, 1967).
  region 31 (Middleveld of Zululand)
  region 12 (Hlobane-Manyini Ceza block)
- Geology (Geological Survey Dept., pers. comm.).
  major bedrock type: Dwyka tillite
  less dominant types: Dolerite, shale, Nsuze volcanics
- Soils (Fitzpatrick, 1978).
  The distribution of soils in sub-catchment W241 is uniform. These comprise the weakly developed (lithocutanic B), plinthic and some red-black clays and duplex soils.
- Veld types (Acocks, 1953).
  veld type 63 (Piet Retief Sourveld)
  veld type 64 (Northern Tall Grassveld)
  veld type 66 (Natal Sand Sourveld)
  veld type 10 (Lowveld)
- Bioclimatic regions (Phillips, 1973).
  region 6a (moist upland)
  region 8a (dry upland)
  region 10 (interior-riverine lowland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 849 mm
  Range (Schulze, 1982): 700 to 1 000 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  30 million cubic metres/year.
  Run-off data have been recorded at station W2MO7 since 1965. This comprises a gauge plate on the kwaMbizankulu River, a tributary of the Hlonyana. Between 1965 and 1975 the mean annual run-off ranged from 3,5 to 26,5 mill. m^3.

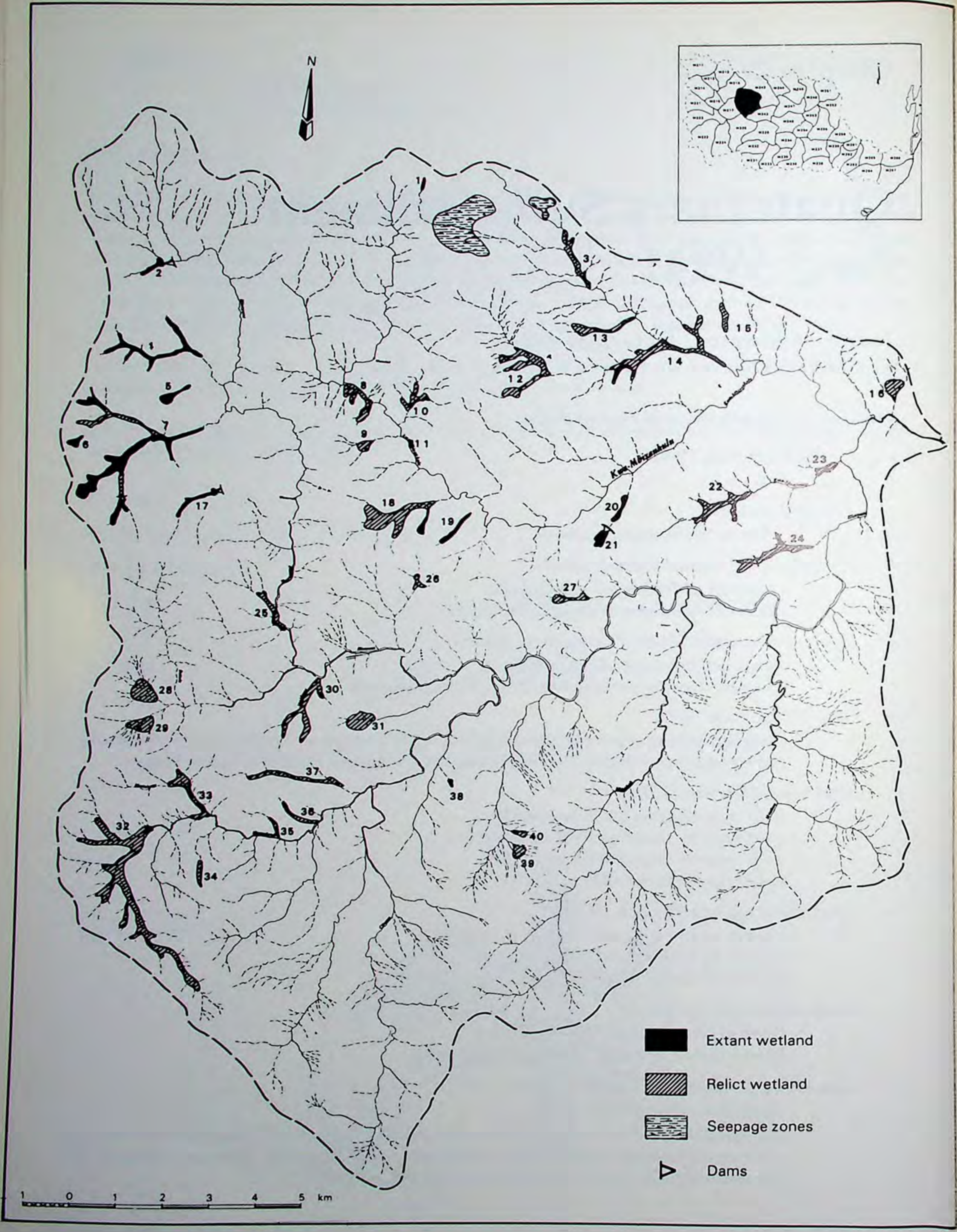


Fig. 59: The distribution of wetlands in quaternary sub-catchment W241. These data were derived from Job 773 of 1976 and Job 672 of 1970

- Land use (Nanni, 1982).

  The whole of sub-catchment W241 is occupied by white farmers involved primarily with cattle ranching.

Wetland inventory (Table 30)

- Wetland distribution (Pre Iron Age).

  No. of wetlands: 40

  Size range : 1 to 91 (ha)

  Area of sub-catchment under wetland: 606 ha (1,8%)

- Wetland status (at present).

  Area of sub-catchment under wetland: 125 ha (0,4%)

- Wetland losses: 481 ha (79%)

- Further details:

  Because of their small size and degraded condition, none of the remaining wetlands, or fragments of wetlands, in sub-catchment W241 warrant further description for inventory purposes. However, the tendency for extant wetlands to occur in bioclimatic region 6 (in the north-west portion of sub-catchment W241) is attributed to the higher rainfall in this moist, shale dominated upland area.

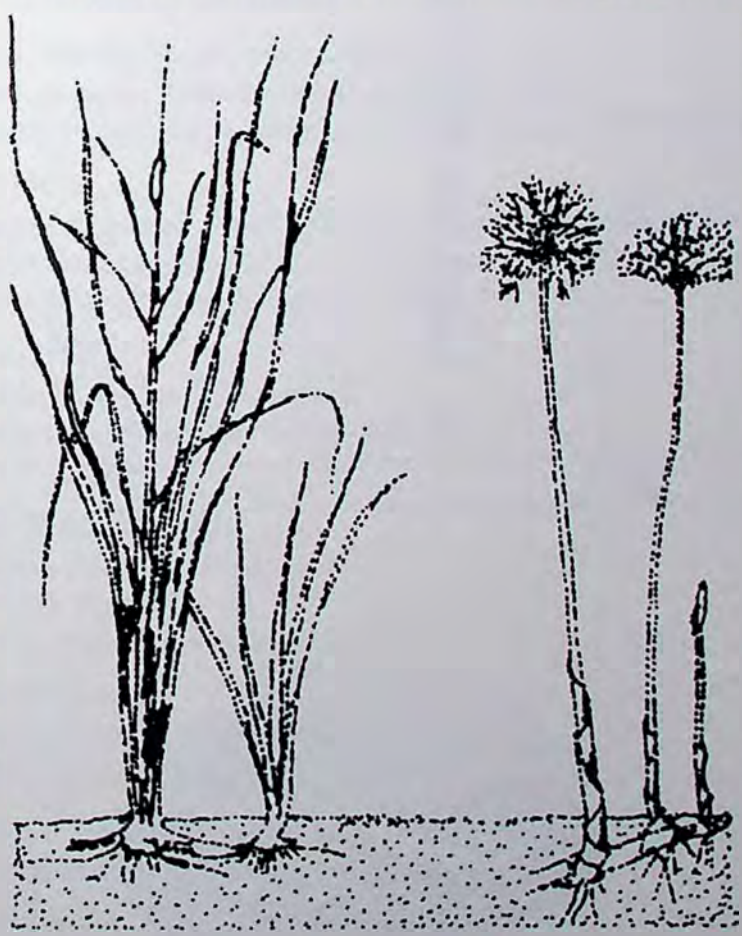


Table 30: The present status of wetlands in quaternary sub-catchment W241 (Fig. 59). Where wetland losses have amounted to 100%, no further data are provided.

Wetland No:	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	2,0	2,0	-	17	11,7	0,6
2	4,5	4,5	-	392	1,1	1,2
3	14,0	-	100	-	-	-
4	23,5	23,5	-	400	5,8	7,0
5	7,0	7,0	-	50	14,0	1,7
6	4,0	4,0	-	23	17,4	0,8
7	73,0	54,5	25	825	7,1	10,0
8	13,0	-	100	-	-	-
9	5,5	-	100	-	-	-
10	8,0	-	100	-	-	-
11	1,0	1,0	-	13	7,7	0,3
12	31,0	-	100	-	-	-
13	14,0	-	100	-	-	-
14	38,0	3,0	92	2 625	0,2	0,8
15	6,5	-	100	-	-	-
16	13,5	-	100	-	-	-
17	6,5	6,5	-	275	2,4	2,4
18	38,0	4,0	89	300	1,3	1,2
19	5,0	5,0	-	50	10,0	2,0
20	4,0	4,0	-	105	8,5	1,3
21	5,0	5,0	-	42	11,9	0,8
22	21,5	-	100	-	-	-
23	5,5	-	100	-	-	-
24	15,0	-	100	-	-	-
25	9,5	-	100	-	-	-
26	4,0	-	100	-	-	-
27	6,5	-	100	-	-	-
28	22,0	-	100	-	-	-
29	15,0	-	100	-	-	-
30	24,0	-	100	-	-	-
31	19,0	-	100	-	-	-
32	91,0	-	100	-	-	-
33	15,5	-	100	-	-	-
34	4,5	-	100	-	-	-
35	2,5	-	100	-	-	-
36	5,0	-	100	-	-	-
37	17,5	-	100	-	-	-
38	1,5	1,5	-	20	7,5	0,3
39	7,0	-	100	-	-	-
40	3,0	-	100	-	-	-
TOTAL	606,0	125,0				30,4

Chapter 28

Quaternary Sub-catchment No: W243

Name: Thaka (principal river)
Fig. No: 60

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  210 km^2
- Range in altitude.
  1 140 to 426 m above sea level
- Physiographic regions (Turner, 1967).
  region 31 (Middleveld of Zululand)
  region 10 (Lowveld of Zululand)
- Geology (Geological Survey Dept., pers. comm.).
  major bedrock types: Dwyka tillite (glacial deposit)
  less dominant types: Karoo dolerite and sandstone (Vryheid formation)
- Soils (Fitzpatrick, 1978).
  Yellow and red apedal, freely drained, dystrophic soils in the south; black clays, red structured clays and duplex soils in the east; but elsewhere, weakly developed soils (lithocutanic B) typical of the Middleveld.
- Veld types (Acocks, 1953).
  veld type 44a (Highland Sourveld)
  veld type 64 (Northern Tall Grassveld)
  veld type 10 (Lowveld)
- Bioclimatic regions (Phillips, 1973).
  region 4 (sub-montane highland)
  region 8a (dry upland)
  region 10 (riverine-interior lowland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 825 mm
  Range (Schulze, 1982): 700 to 1 000 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  18 million cubic metres/year.
- Land use (Nanni, 1982).
  The eastern portion of sub-catchment W243 lies in KwaZulu, and falls within the jurisdiction of Chief Ndebele (NTRPC, pers. comm.). Elsewhere the catchment comprises white-owned farmland.

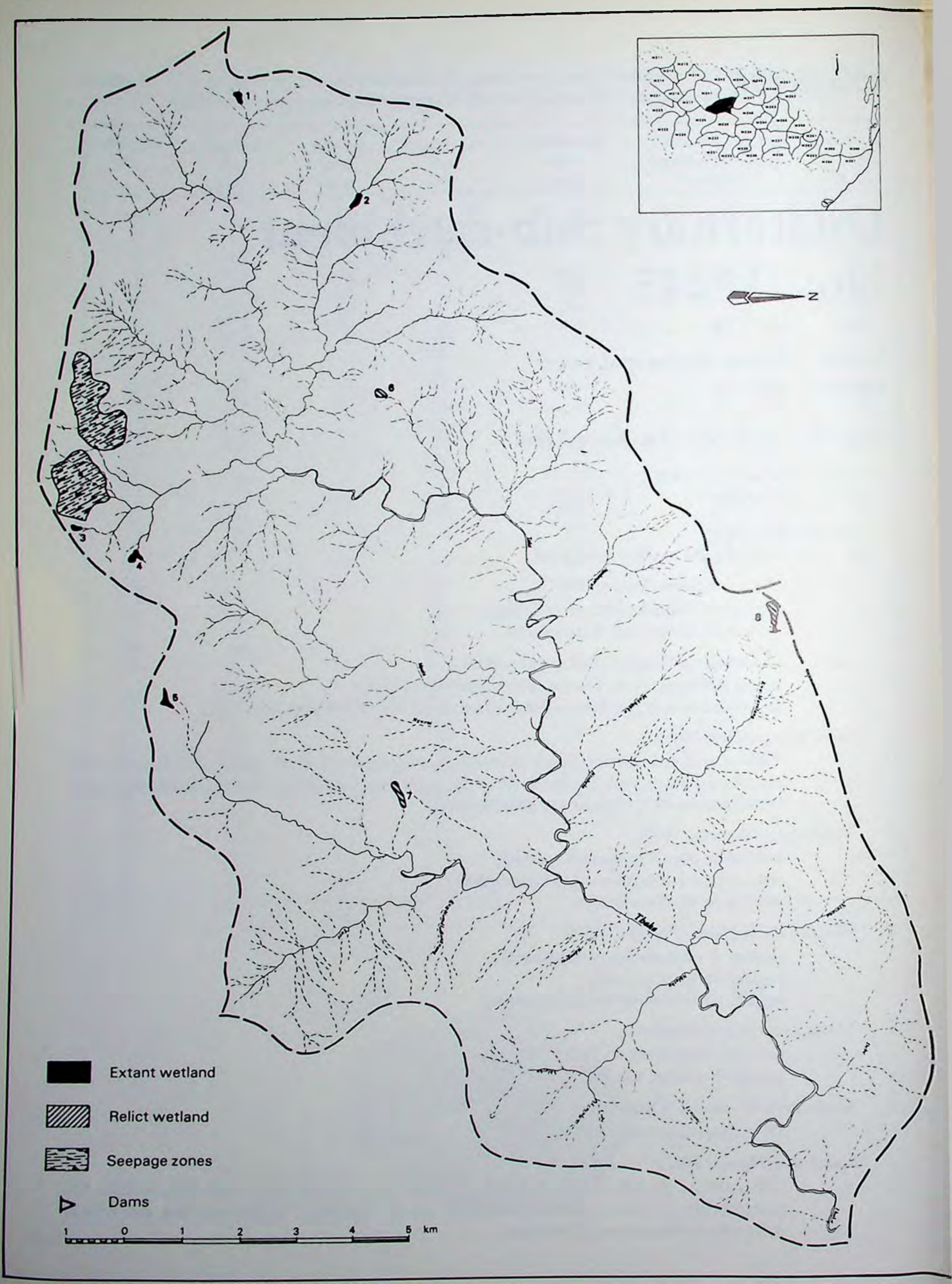


Fig. 60: The distribution of wetlands in quaternary sub-catchment W243. These data were derived from Job 672 of 1970.

Wetland inventory (Table 31)

- Wetland distribution (Pre Iron Age).
  No. of wetlands: 8
  Size range : 1 to 4 (ha)
  Area of sub-catchment under wetland: 19 ha (0,09%)
- Wetland status (at present).
  Area of sub-catchment under wetland: 9 ha (0,04%)
- Wetland losses: 10 ha (53%)
- Further details:

  Because of their small size and probable insignificant influence on the hydrology of sub-catchment W243, none of the remaining wetlands in this region warrant further description for inventory purposes. However, the existence of two large seepage zones (Fig. 60) in the vicinity of wetlands No. 3 and 4 is suspected. Field verification was not possible, but should these areas be shown to exist, the conservation value of this particular portion of the sub-catchment would be greatly enhanced.

Table 31: The present status of wetlands in quaternary sub-catchment W243 (Fig. 60). Where wetland losses have amounted to 100%, no further data are provided.

Wetland No:	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	1,5	1,5	-	22	6,8	0,3
2	2,5	2,5	-	487	0,5	0,6
3	1,0	1,0	-	10	10,0	0,3
4	2,5	2,5	-	37	6,7	0,6
5	2,0	2,0	-	36	5,6	0,6
6	2,0	-	100	-	-	-
7	4,0	-	100	-	-	-
8	3,5	-	100	-	-	-
TOTAL	19,0	9,0				2,4

Chapter 29

Quaternary Sub-catchment No: W244

Name: Sikwebezi (principal river)
Fig. No: 61

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  205 km^2
- Range in altitude.
  1 370 to 365 m above sea level
- Physiographic regions (Turner, 1967).
  region 31 (Hlobane-Manyini-Ceza block)
  region 12 (Middleveld of Zululand)
- Geology (Geological Survey Dept., pers. comm.).
  major bedrock types: Sandstone (Vryheid formation) and Karoo dolerite
  less dominant types: Dwyka tillite, Ecca shale
- Soils (Fitzpatrick, 1978).
  Almost entirely yellow and red apedal, freely drained, dystrophic soils of very high agricultural potential (Edwards and Scotney, 1978).
- Veld types (Acocks, 1953).
  veld type 8 (North-eastern Mountain Sourveld)
  veld type 64 (Northern Tall Grassveld)
- Bioclimatic regions (Phillips, 1973).
  region 3 (mistbelt)
  region 6 (moist upland)
  region 8 (dry upland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 1094 mm
  Range (Schulze, 1982): 900 to 1200 mm
  Excluding the rainfall experienced near the coast, sub-catchment W244 receives the highest mean annual rainfall of any sub-catchment in the Mfolozi.
- Mean annual run-off (Pitman *et al.*, 1981).
  45 million cubic metres/year.
- Land use (Nanni, 1982).
  In the south-east a small portion of sub-catchment W244 lies in KwaZulu, within the jurisdiction of Chief Buthelezi (NTRPC, pers. comm.). Elsewhere the catchment

Fig. 61: The distribution of wetlands in quaternary sub-catchment W244. These data were derived from Job 773 of 1976.

comprises white-owned farms, some large wattle/pine plantations and parts of the Ngome Forest Reserve (State land).

Wetland inventory (Table 32)

- Wetland distribution (Pre Iron Age).
  No. of wetlands: 30
  Size range : 1 to 43 (ha)
  Area of sub-catchment under wetland: 233 ha (1,1%)
- Wetland status (at present).
  Area of sub-catchment under wetland: 157 ha (0,8%)
- Wetland losses: 76 ha (32%)
- Further details:

  Despite the elevated nature of this region and the high rainfall associated with it, both the original and the present extent of wetland is low. This is probably a result of the steep terrain.

  For inventory purposes, therefore, the remaining wetlands in sub-catchment W244 (the largest being only 23 ha in size) do not warrant further description.

Table 32: The present status of wetlands in quaternary sub-catchment W244 (Fig. 61). Where wetland losses have amounted to 100%, no further data are provided.

Wetland No:	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	2,0	2,0	-	24	8,3	1,1
2	6,5	6,5	-	105	8,1	2,1
3	9,0	9,0	-	130	6,9	4,0
4	1,0	1,0	-	15	6,6	0,4
5	1,5	1,5	-	11	13,6	0,5
6	3,0	3,0	-	28	16,0	0,6
7	4,0	4,0	-	35	11,4	0,9
8	2,5	2,5	-	37	6,7	0,9
9	17,5	13,0	26	112	11,6	2,6
10	3,0	3,0	-	33	9,1	0,8
11	1,5	1,5	-	18	8,3	0,7
12	43,0	17,0	60	8 825	0,8	1,8
13	4,0	3,0	25	30	10,0	1,0
14	2,0	2,0	-	19	10,5	0,8
15	3,0	3,0	-	18	16,6	1,0
16	7,5	1,5	80	137	1,1	0,3
17	6,0	2,0	66	145	1,4	0,7
18	2,0	2,0	-	16	12,5	0,7
19	9,0	9,0	-	54	16,6	1,3
20	19,0	19,0	-	200	9,5	4,9
21	4,0	4,0	-	48	8,3	1,0
22	2,0	2,0	-	24	8,3	0,6
23	1,5	1,5	-	17	8,8	0,6
24	13,5	13,5	-	792	2,6	3,0
25	3,5	3,5	-	26	13,4	1,0
26	23,0	23,0	-	912	2,5	2,8
27	29,0	-	100	-	-	-
28	4,5	4,5	-	34	13,2	1,2
29	3,5	-	100	-	-	-
30	2,0	-	100	-	-	-
TOTAL	233,0	157,0				37,3

Chapter 30

Quaternary Sub-catchment No: W245

Name: Bululwane (principal river)
Fig. No: 62

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  285 km^2
- Range in altitude.
  1 127 to 290 m above sea level
- Physiographic regions (Turner, 1967).
  region 12 (Hlobane-Manyini-Ceza block)
  region 31 (Middleveld of Zululand)
  region 37 (Lowveld of Zululand)
- Geology (Geological Survey Dept., pers. comm.. Fig. 63).
  major bedrock types: Shale (Pietermaritzburg formation) and sandstone (Vryheid formation)
  less dominant types: Karoo dolerite, Dwyka tillite
- Soils (Fitzpatrick, 1978).
  Yellow and red apedal, freely drained, dystrophic soils in the highlands; elsewhere black clays, red structured clays and duplex soils.
- Veld types (Acocks, 1953).
  veld type 8 (North-eastern Mountain Sourveld)
  veld type 64 (Northern Tall Grassveld)
  veld type 10 (Lowveld)
- Bioclimatic regions (Phillips, 1973).
  region 3 (mistbelt)
  region 6a (moist upland)
  region 4 (submontane highland)
  region 10 (riverine-interior lowland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 960 mm
  Range (Schulze, 1982): 700 to 1 200 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  45 million cubic metres/year.

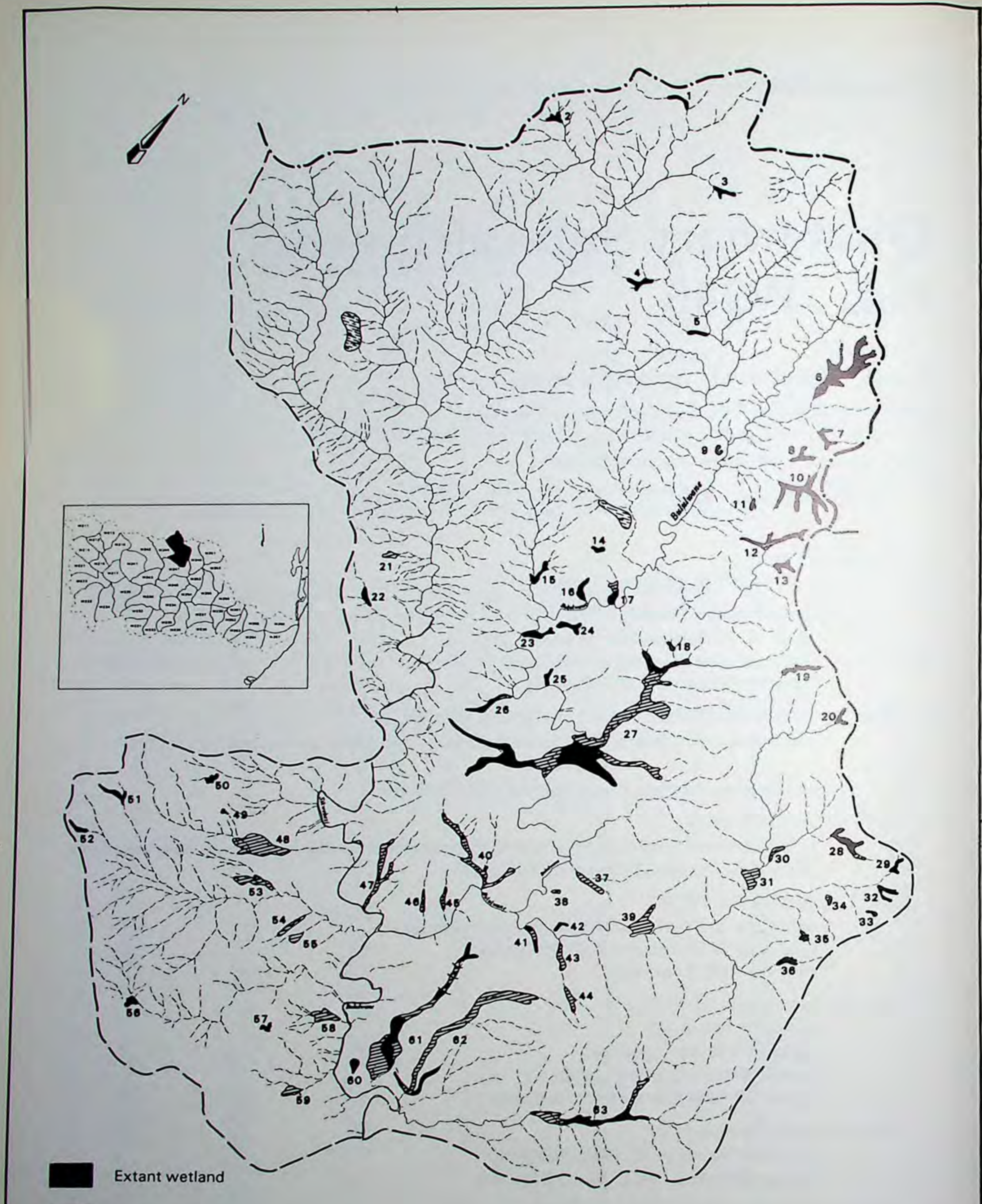
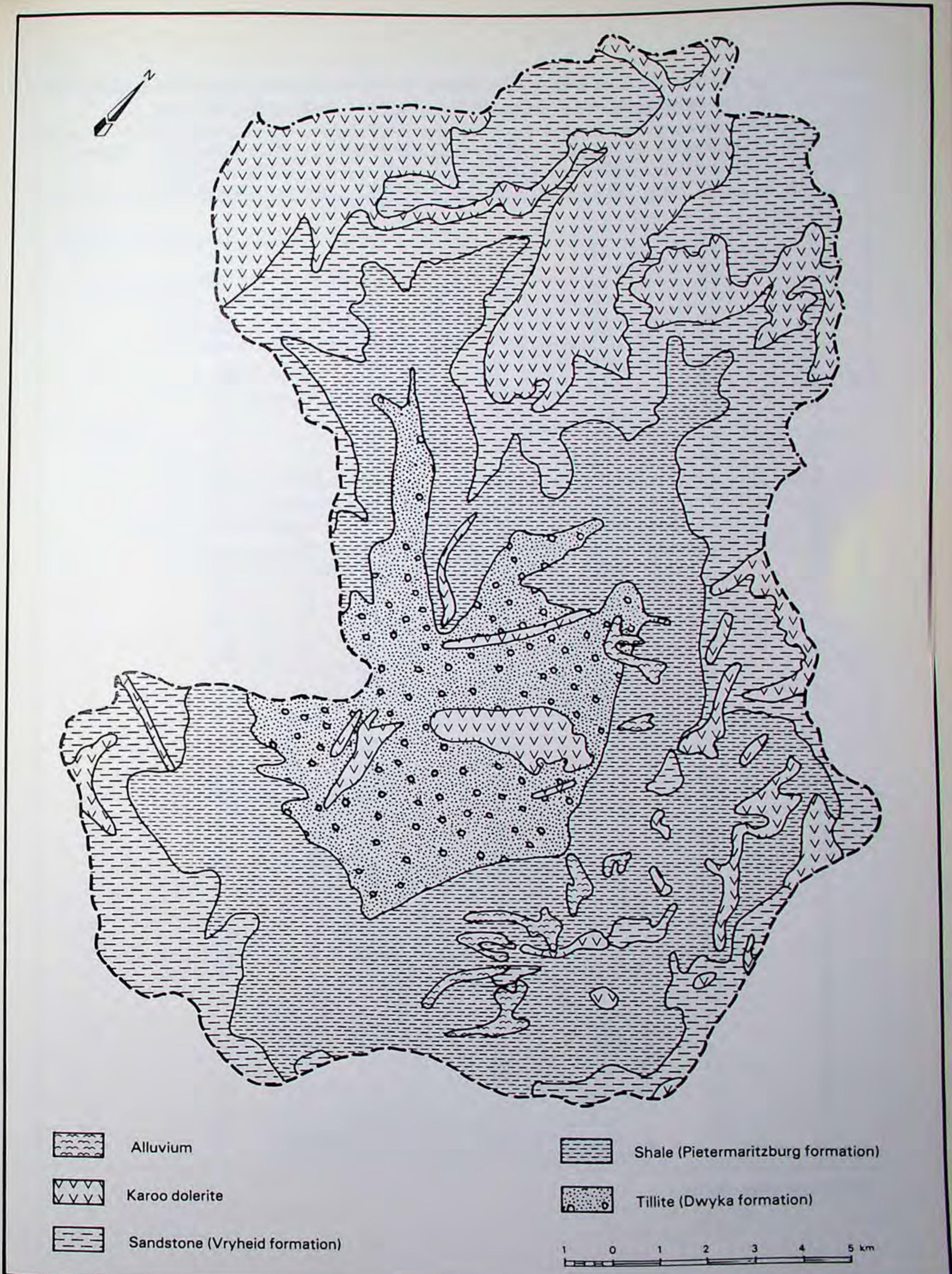


Fig. 62: The distribution of wetlands in quaternary sub-catchment W245. These data were derived from Job 608 of 1970 and Job 773 of 1976.



Source: Dept. of Geological Survey

Fig. 63: The geology of quaternary sub-catchment W245

Table 33: The present status of wetlands in quaternary sub-catchment W245 (Fig. 62). Where wetland losses have amounted to 100%, no further data are provided.

Wetland No:	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	2,5	2,5	-	92	2,7	1,0
2	3,0	3,0	-	45	6,7	0,9
3	3,0	3,0	-	50	6,0	1,0
4	4,5	4,5	-	52	8,6	1,2
5	3,0	3,0	-	85	3,5	0,9
6	28,0	28,0	-	152	18,4	6,5
7	3,5	3,5	-	65	5,3	1,1
8	3,0	3,0	-	25	12,0	1,0
9	1,5	1,5	-	13	11,5	0,5
10	17,5	17,5	-	137	12,7	5,3
11	1,0	1,0	-	12	8,3	0,3
12	9,0	6,0	33	77	7,8	2,9
13	3,0	3,0	-	32	9,4	0,9
14	2,5	2,5	-	30	8,3	0,7
15	4,5	4,5	-	492	0,9	1,2
16	5,0	4,0	20	37	10,8	1,0
17	6,5	4,0	38	55	7,3	0,7
18	1,0	1,0	-	33	3,0	0,3
19	4,0	4,0	-	57	7,0	1,5
20	2,0	2,0	-	20	10,0	0,7
21	2,5	-	100	-	-	-
22	3,0	3,0	-	75	4,0	0,9
23	6,0	6,0	-	26	23,0	1,2
24	5,0	5,0	-	34	14,7	1,0
25	3,0	3,0	-	43	6,9	0,6
26	6,5	5,0	23	62	8,0	1,4
27	142,0	76,0	46	8 050	2,4*	9,8
28	9,5	8,0	16	95	8,4	2,0
29	3,0	3,0	-	20	15,0	1,5
30	3,0	-	100	-	-	-
34	2,0	1,0	50	22	4,5	0,2
35	2,0	1,5	25	12	12,5	0,2
36	3,0	3,0	-	32	9,4	0,7
37	7,0	-	100	-	-	-
38	2,0	-	100	-	-	-
39	14,5	-	100	-	-	-
40	23,0	-	100	-	-	-
41	4,5	3,0	33	35	8,6	0,6
42	2,0	2,0	-	18	11,1	0,6
43	4,0	-	100	-	-	-
44	4,0	-	100	-	-	-
45	3,0	-	100	-	-	-
46	3,0	-	100	-	-	-
47	13,0	-	100	-	-	-
48	27,0	-	100	-	-	-
49	1,0	1,0	-	11	9,1	0,3
50	2,5	2,5	-	20	12,5	0,7
51	4,0	4,0	-	52	7,7	1,4
52	2,5	2,5	-	16	15,6	1,0
53	7,0	-	100	-	-	-
54	4,5	-	100	-	-	-
55	3,0	-	100	-	-	-
56	2,0	2,0	-	157	1,3	0,5
57	1,5	1,5	-	14	21,0	0,5
58	8,5	-	100	-	-	-
59	5,5	-	100	-	-	-
60	3,5	3,5	-	12	29,1	0,7
61	52,0	21,0	60	330	6,4	3,5
62	47,0	10,0	79	462	2,2	2,1
63	30,0	17,0	43	1 150	1,5	3,9
TOTAL	595,0	291,0				66,0

* includes upstream wetlands.

- Land use (Nanni, 1982).

  Most of sub-catchment W245 lies in KwaZulu, and within the jurisdiction of Chiefs Buthelezi and Usuthi (NTRPC, pers. comm.). However, the most high lying region comprises the Ngome Forest Reserve, which is a proclaimed wilderness area under the control of the Department of Environment Affairs (Directorate of Forestry). The forest concerned (3 309 ha) is of the "mist belt mixed *Podocarpus*" variety (Cooper, 1985).

Wetland inventory (Table 33)

- Wetland distribution (Pre Iron Age).

  No. of wetlands: 63
  Size range : 1 to 142 (ha)
  Area of sub-catchment under wetland: 595 ha (2,1%)

- Wetland status (at present).

  Area of sub-catchment under wetland: 291 ha (1%)

- Wetland losses: 304 ha (51%)

- Further details:

  The lack of wetlands in the high-lying Ngome Forest Reserve area is noteworthy since this is not characteristic of mist belt regions elsewhere in the catchment (e.g. sub-catchment W242), but may well be due to the steep terrain. The small size and degraded condition of wetlands in sub-catchment W245 suggests that none of these systems warrant further description for inventory purposes.

Chapter 31

Quaternary Sub-catchment No: W246

Name: Vuna (principal river)
Fig. No: 64

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  260 km^2
- Range in altitude.
  792 to 230 m above sea level
- Physiographic regions (Turner, 1967).
  region 31 (Middleveld of Zululand)
  region 37 (Lowveld of Zululand)
- Geology (Geological Survey Dept., pers. comm.).
  major bedrock type: Sandstone (Vryheid formation)
  less dominant types: dolerite, shale
- Soils (Fitzpatrick, 1978).
  Yellow and red apedal, freely drained, dystrophic soils in the uplands; black clays, red structured clays and duplex soils in the lowlands.
- Veld types (Acocks, 1953).
  mainly veld type 8 (Northern-eastern Mountain Sourveld)
  veld type 64 (Northern Tall Grassveld)
  veld type 10 (Lowveld)
- Bioclimatic regions (Phillips, 1973).
  region 6a (moist upland)
  region 8a (dry upland)
  region 9 (lowland-upland)
  region 10 (riverine-interior lowland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 849 mm
  Range (Schulze, 1982): 700 to 1 000 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  23 million cubic metres/year.
- Land use (Nanni, 1982).
  The whole of sub-catchment W246 lies in KwaZulu, and within the jurisdiction of Chiefs Usuthi and Matheni (NTRPC, pers. comm.). Its eastern boundary embraces the

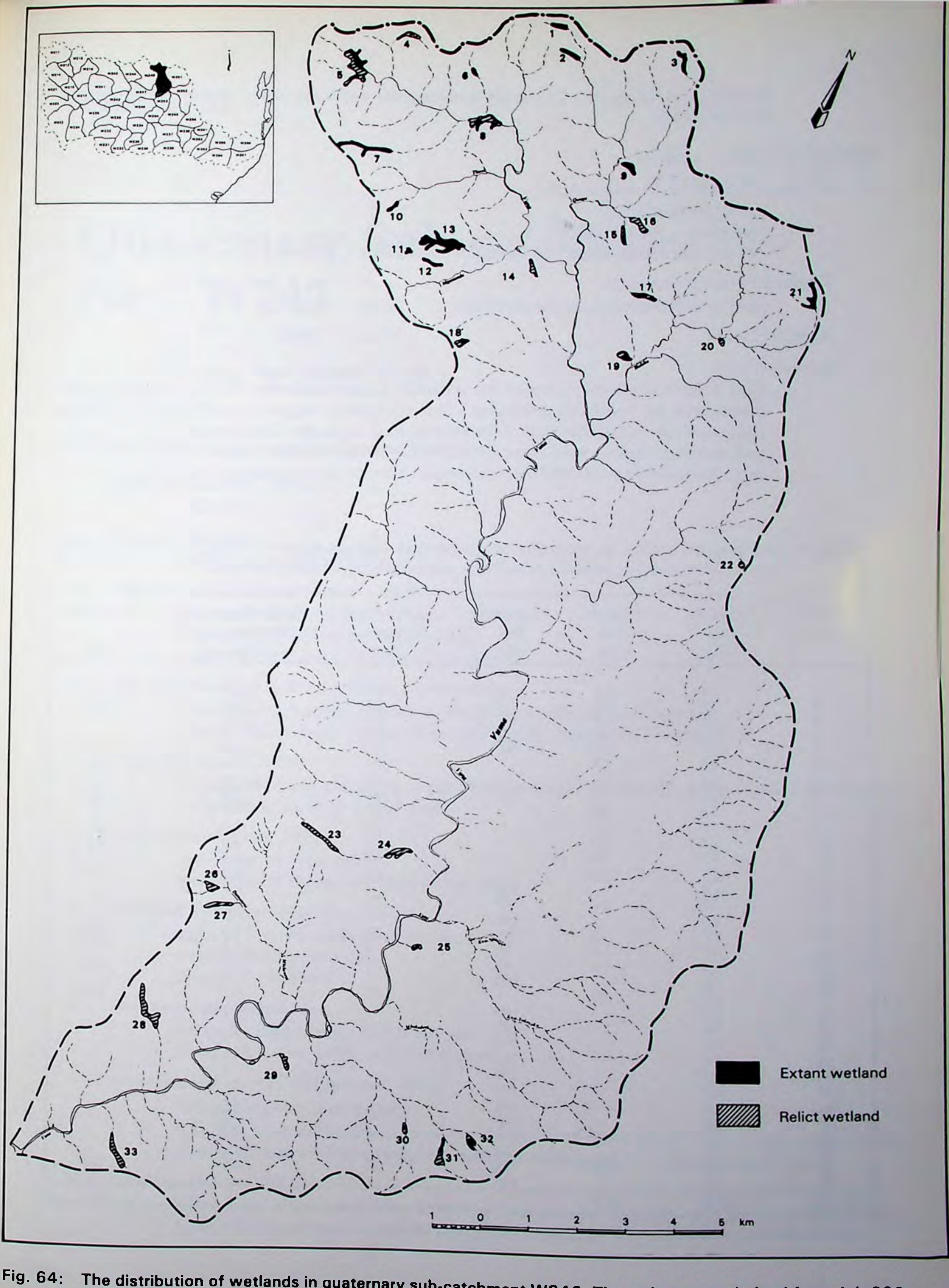


Fig. 64: The distribution of wetlands in quaternary sub-catchment W246. These data were derived from Job 608 of 1970.

township of Nongoma. Generally speaking the terrain is steep, deeply dissected and badly eroded.

Wetland inventory (Table 34)

- Wetland distribution (Pre Iron Age).
  No. of wetlands: 33
  Size range : 1 to 14 (ha)
  Area of sub-catchment under wetland: 130 ha (0,5%)
- Wetland status (at present).
  Area of sub-catchment under wetland: 53 ha (0,2%)
- Wetland losses: 77 ha (59%)
- Further details:
  Due to their small size, none of the wetlands in sub-catchment W246 warrant further description for inventory purposes. However, with regard to wetland distribution (Fig. 64) it was noted that 64% of the sites located lay in the high rainfall upland region, and that these represented almost 100% of the extant wetland in sub-catchment W246. In contrast, those in the arid lowveld region have been lost through gully erosion.

Table 34: The present status of wetlands in quaternary sub-catchment W246 (Fig. 64). Where wetland losses have amounted to 100%, no further data are provided.

Wetland No:	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	3,0	3,0	-	24	12,5	0,7
2	3,0	3,0	-	20	15,0	0,8
3	3,0	3,0	-	22	13,6	1,0
4	3,5	-	100	-	-	-
5	13,5	4,5	66	112	4,0	0,7
6	1,0	1,0	-	29	3,4	0,4
7	6,0	6,0	-	50	12,0	2,6
8	9,5	2,5	74	1 000	1,4*	0,6
9	3,5	3,5	-	22	15,9	0,9
10	1,5	1,5	-	15	10,0	0,6
11	1,0	1,0	-	16	6,2	0,3
12	2,0	2,0	-	42	7,1*	0,8
13	12,0	12,0	-	75	16,0	3,6
14	4,5	-	100	-	-	-
15	3,0	2,0	33	27	7,4	0,5
16	4,0	-	100	-	-	-
17	3,0	1,0	66	45	2,2	0,2
18	2,0	1,0	50	9	11,1	0,2
19	3,0	1,5	50	25	6,0	0,3
20	1,5	-	100	-	-	-
21	4,5	4,5	-	47	9,5	1,6
22	1,0	-	100	-	-	-
23	6,0	-	100	-	-	-
24	4,0	-	100	-	-	-
25	1,5	-	100	-	-	-
26	3,0	-	100	-	-	-
27	3,0	-	100	-	-	-
28	7,0	-	100	-	-	-
29	4,5	-	100	-	-	-
30	1,5	-	100	-	-	-
31	4,0	-	100	-	-	-
32	2,0	0,5	75	37	1,3	0,4
33	5,0	-	100	-	-	-
TOTAL	130,0	53,0				16,2

* includes upstream wetlands

Chapter 32

Quaternary Sub-catchment No: W247

Name: Vunga (principal river)
Fig. No: 65

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  270 km^2
- Range in altitude.
  945 to 215 m above sea level
- Physiographic regions (Turner, 1967).
  region 37 (Lowveld of Zululand)
  region 31 (Middleveld of Zululand)
  region 12 (Hlobane-Manyini-Ceza block)
- Geology (Geological Survey Dept., pers. comm.).
  major bedrock types: Sandstone (Vryheid formation) and dolerite
  less dominant types: Shale (Pietermaritzburg formation), Dwyka tillite.
- Soils (Fitzpatrick, 1978).
  Principally black clays, red structured clays and duplex soils; some weakly developed soils (lithocutanic B) in the west.
- Veld types (Acocks, 1953).
  veld type 10 (Lowveld)
  veld type 64 (Northern Tall Grassveld)
- Bioclimatic regions (Phillips, 1973).
  region 10 (riverine-interior lowland)
  region 8a (dry upland)
  region 3 (mistbelt)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 787 mm
  Range (Schulze, 1982): 700 to 900 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  18 million cubic metres/year.
  Gauging weir W2M06 is situated within sub-catchment W247, from which run-off data dating back to 1965 have been recorded (annual range: 100-220 million m^3/yr.).
- Land use (Nanni, 1982).
  The whole of sub-catchment W247 lies in KwaZulu, and falls within the jurisdiction of Chiefs Buthelezi and Usuthi (NTRPC, pers. comm.).

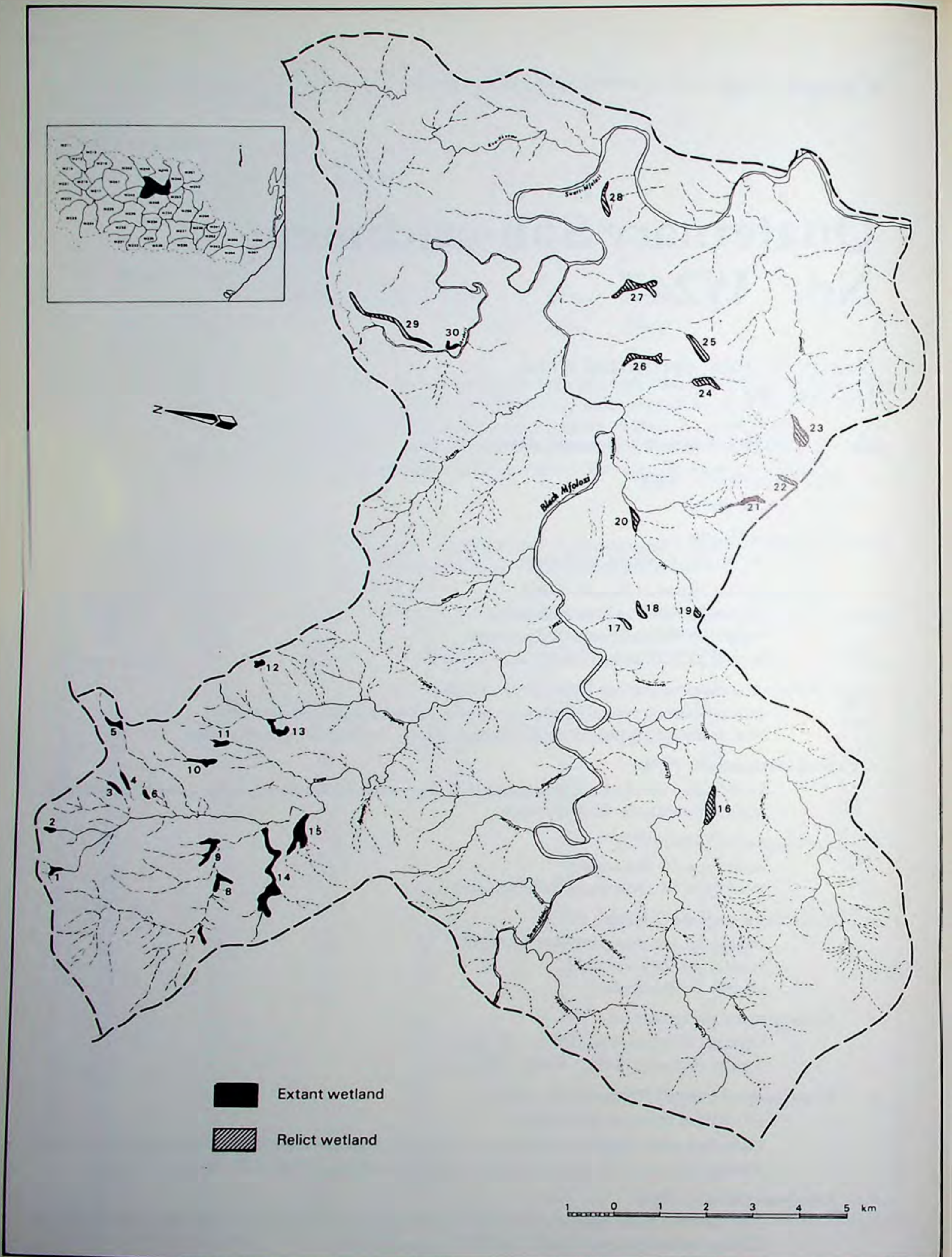


Fig. 65: The distribution of wetlands in quaternary sub-catchment W247. These data were derived from Job 608 of 1970 and Job 672 of 1970.

Wetland inventory (Table 35)

- Wetland distribution (Pre Iron Age).
  No. of wetlands: 30
  Size range : 1,5 to 23 (ha)
  Area of sub-catchment under wetland: 160 ha (0,6%)
- Wetland status (at present).
  Area of sub-catchment under wetland: 77 ha (0,3%)
- Wetland losses: 83 ha (52%)
- Further details:
  For inventory purposes none of the remaining wetlands in sub-catchment W247 warrant further description. However, as in sub-catchment W246, the contrasting relationship between the sparsely distributed, eroded wetlands in the lowveld, and the functional sites in the mist belt region in the north-western corner of sub-catchment W247, is noteworthy.

Table 35: The present status of wetlands in quaternary sub-catchment W247 (Fig. 65). Where wetland losses have amounted to 100%, no further data are provided.

Wetland No:	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	1,5	1,5	-	21	7,1	0,7
2	2,0	2,0	-	11	18,2	0,5
3	1,5	1,5	-	23	6,5	0,7
4	2,0	2,0	-	22	9,1	0,8
5	2,0	2,0	-	97	2,1	1,0
6	1,5	1,5	-	10	15,0	0,5
7	2,0	2,0	-	16	12,5	0,9
8	3,5	3,5	-	887	0,6*	1,3
9	4,0	4,0	-	105	3,8	1,9
10	3,5	3,5	-	112	3,1	1,2
11	2,0	2,0	-	22	9,1	0,8
12	2,0	2,0	-	12	16,6	0,5
13	3,5	3,5	-	32	10,9	1,3
14	23,0	23,0	-	255	9,0	4,5
15	14,0	14,0	-	187	7,5	2,1
16	9,5	-	100	-	-	-
17	2,5	-	100	-	-	-
18	3,0	-	100	-	-	-
19	1,5	-	100	-	-	-
20	5,0	-	100	-	-	-
21	4,5	4,5	-	42	10,7	1,0
22	2,0	-	100	-	-	-
23	10,5	-	100	-	-	-
24	7,0	-	100	-	-	-
25	9,5	-	100	-	-	-
26	7,0	-	100	-	-	-
27	10,0	-	100	-	-	-
28	6,0	-	100	-	-	-
29	12,0	2,5	79	242	1,0	0,9
30	2,0	2,0	-	22	9,1	0,6
TOTAL	160,0	77,0				21,2

* includes upstream wetlands.

Chapter 33

Quaternary Sub-catchment No: W248

Name: Mbhekamuzi (principal river)
Fig. No: 66

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  285 km^2
- Range in altitude.
  975 to 215 m above sea level
- Physiographic regions (Turner, 1967).
  region 31 (Middleveld of Zululand)
  region 37 (Lowveld of Zululand)
- Geology (Geological Survey Dept., pers. comm.).
  major bedrock type: Karoo dolerite
  less dominant types: Dwyka tillite, sandstone (Vryheid formation).
- Soils (Fitzpatrick, 1978).
  Yellow and red apedal, freely drained, dystrophic soils in the uplands; black clays, red structured clays and duplex soils elsewhere.

  Maps prepared by the Department of Geological Survey show large tracts of alluvium on the floodplain of the lower Mbhekamuzi river.
- Veld types (Acocks, 1953).
  veld type 44 (Highland Sourveld)
  veld type 64 (Northern Tall Grassveld)
  veld type 10 (Lowveld)
- Bioclimatic regions (Phillips, 1973).
  region 4 (sub-montane highlands)
  region 8 (dry upland)
  region 10 (riverine-interior lowland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 812 mm
  Range (Schulze, 1982): 700 to 900 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  20 million cubic metres/year.

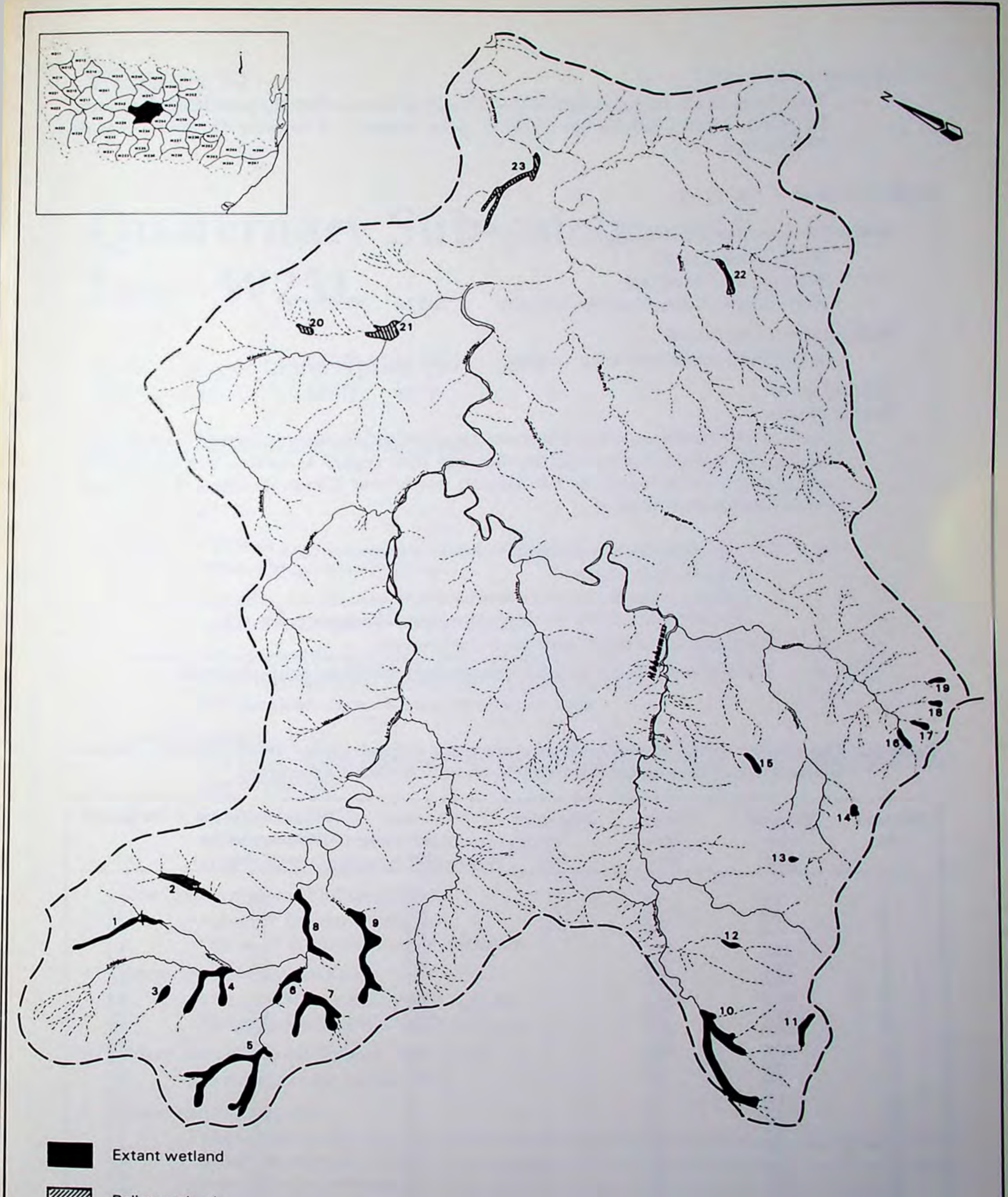


Fig. 66: The distribution of wetlands in quaternary sub-catchment W248. These data were derived from Job 608 of 1970 and Job 672 of 1970.

- Land use (Nanni, 1982).

  The whole of sub-catchment W247 lies in KwaZulu, and within the jurisdiction of Chiefs Buthelezi, Usuthi and Zungu (NTRPC, pers. comm.). It contains the townlands of Mahlabatini.

Wetland inventory (Table 36)

- Wetland distribution (Pre Iron Age).

  No. of wetlands: 23
  Size range : 1 to 40 (ha)
  Area of sub-catchment under wetland: 265 ha (0,9%)

- Wetland status (at present).

  Area of sub-catchment under wetland: 228 ha (0,8%)

- Wetland losses: 37 ha (14%)
- Further details:

  For inventory purposes none of the remaining wetlands in sub-catchment W248 are large enough to warrant further description, but with regard to factors determining the distribution of wetlands in the Mfolozi catchment (Chap. 45.1.2), the following relationships are of interest :

  a. The high incidence of wetlands in headwater areas where
     - the rainfall is higher
     - dolerite is the dominant bedrock type
     - the land is relatively flat (note low stream frequency, Fig. 66)
  b. The incidence of relict wetlands in the lowveld.
  c. The high incidence of extant wetlands in the highland sourveld areas.

Table 36: The present status of wetlands in quaternary sub-catchment W248 (Fig. 66). Where wetland losses have amounted to 100%, no further data are provided.

Wetland No:	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	9,0	9,0	-	172	5,2	2,8
2	15,0	15,0	-	325	4,6	2,3
3	4,0	4,0	-	130	3,1	0,9
4	19,5	19,5	-	862	2,7*	4,3
5	36,0	36,0	-	382	9,4	8,0
6	8,0	8,0	-	770	8,7*	2,1
7	23,0	23,0	-	200	11,5	4,4
8	18,0	18,0	-	2 387	4,9*	3,7
9	30,0	30,0	-	280	10,7	5,2
10	40,0	40,0	-	562	8,2*	7,3
11	6,0	6,0	-	34	17,6	1,4
12	2,0	2,0	-	177	1,1	0,8
13	1,0	1,0	-	24	4,1	0,3
14	1,5	1,5	-	32	4,7	0,3
15	4,5	4,5	-	57	7,9	1,0
16	4,0	4,0	-	100	4,0	1,0
17	2,5	2,5	-	31	8,1	0,8
18	2,0	2,0	-	25	8,0	0,7
19	2,0	2,0	-	28	7,1	0,6
20	3,0	-	100	-	-	-
21	15,0	-	100	-	-	-
22	5,0	-	100	-	-	-
23	14,5	-	100	-	-	-
TOTAL	265,0	228,0				48,0

* includes upstream wetlands

Chapter 34

Quaternary Sub-catchment No: W251

Name: Upper Mona (principal river)
Fig. No: 67

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  255 km^2
- Range in altitude.
  855 to 350 m above sea level
- Physiographic region (Turner, 1967).
  region 31 (Middleveld of Zululand)
- Geology (Geological Survey Dept., pers. comm., Fig. 68).
  major bedrock type: Sandstone (Vryheid formation)
  less dominant types: Karoo dolerite and shale
- Soils (Fitzpatrick, 1978).
  The whole of sub-catchment W251 is characterized by black clays, red structured clays and duplex soils.
- Veld types (Acocks, 1953).
  veld type 64 (Northern Tall Grassveld)
  veld type 6 (Zululand Thornveld)
- Bioclimatic regions (Phillips, 1973).
  region 9 (lowland-upland)
  region 10 (riverine-interior lowland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 826 mm
  Range (Schulze, 1982): 700 to 900 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  26 million cubic metres/year.
- Land use (Nanni, 1982)
  The whole of sub-catchment W251 lies in KwaZulu and falls under the jurisdiction of Chief Mandlakazi (NTRPC, pers. comm.). On its western boundary, i.e. the watershed between sub-catchments W251 and W246 (Chap. 31) is the township of Nongoma.

Fig. 67: The distribution of wetlands in quaternary sub-catchment W251. These data were derived from Job 608 of 1970.

Source: Dept. of Geological Survey

Fig. 68: The geology of quaternary sub-catchment W251

Table 37: The present status of wetlands in quaternary sub-catchment W251 (Fig. 67). Where wetland losses have amounted to 100%, no further data are provided.

Wetland No:	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	8,5	8,5	-	75	11,3	2,2
2	2,5	2,5	-	18	13,8	1,1
3	14,5	14,5	-	282	5,1	3,7
4	2,0	1,0	50	18	5,5	0,4
5	4,5	0,5	78	400	6,7*	0,2
6	2,5	2,5	-	40	6,2	1,0
7	5,0	3,5	30	67	5,2	1,6
8	1,0	1,0	-	14	7,1	0,4
9	2,5	2,5	-	105	2,4	1,0
10	885,0	170,0	81	7 675	2,9*	27,0
11	75,0	17,0	77	942	1,8	3,0
12	2,0	2,0	-	35	5,7	0,7
13	1,5	-	100	-	-	-
14	5,0	-	100	-	-	-
15	4,0	2,0	50	787	0,5*	1,0
16	33,0	4,0	88	1 427	0,6*	0,6
17	8,0	-	100	-	-	-
18	2,5	-	100	-	-	-
19	2,0	-	100	-	-	-
20	4,5	2,5	44	67	3,7	1,0
21	1,5	0,5	66	17	2,9*	0,1
22	28,0	11,0	61	287	3,8	1,4
23	3,0	1,5	50	170	2,9	0,3
24	3,5	3,5	-	52	6,7	1,7
25	24,0	4,0	83	400	1,0	1,6
26	1,5	-	100	-	-	-
27	4,5	2,0	55	52	3,8	0,6
28	3,0	2,0	33	40	5,0	0,2
29	54,0	4,0	93	625	0,6	1,3
30	3,0	-	100	-	-	-
34	8,0	5,0	37	87	5,7	1,3
35	22,0	-	100	-	-	-
36	5,0	-	100	-	-	-
37	2,5	-	100	-	-	-
38	7,0	-	100	-	-	-
39	2,0	2,0	-	85	2,4	0,6
40	11,0	-	100	-	-	-
41	37,0	12,0	67	1 057	1,1	3,0
42	10,5	-	100	-	-	-
43	6,0	3,0	50	70	4,3	0,8
44	2,5	2,5	-	14	17,8	10,2
45	1,0	1,0	-	7	14,3	0,2
46	4,0	4,0	-	32	12,5	0,6
47	6,5	6,5	-	52	12,5	1,8
48	6,0	6,0	-	200	6,2*	2,5
49	8,0	4,0	50	295	2,4*	1,3
50	2,5	2,5	-	32	7,8	1,0
51	45,0	29,0	36	542	5,3	-
52	3,0	-	100	-	-	-
53	28,0	15,0	46	1 662	4,4*	4,5
54	8,0	2,5	68	155	1,6	1,0
55	2,5	2,5	-	20	12,5	0,7
56	2,0	2,0	-	35	5,7	0,4
57	2,0	-	100	-	-	-
58	2,5	0,5	80	52	0,9	0,2
59	3,0	-	100	-	-	-
60	2,0	-	100	-	-	-
61	3,5	-	100	-	-	-
62	2,0	1,0	50	17	5,8	0,5
63	10,5	2,0	81	102	1,9	0,4
TOTAL	1 466,0	367,0				84,0

* includes upstream wetlands

Wetland inventory (Table 37)

- Wetland distribution (Pre Iron Age).
  No. of wetlands: 63
  Size range : 1 to 885 (ha)
  Area of sub-catchment under wetland: 1 466 ha (5,7%)
- Wetland status (at present).
  Area of sub-catchment under wetland: 367 ha (1,4%)
- Wetland losses: 1 099 ha (75%)
- Further details:
  Due to the severe losses of wetland incurred in sub-catchment W251, only one of the remaining systems (Wetland No. 10, Fig. 67) warrants further description for inventory purposes. However, it should be noted that sub-catchment W251 once had the highest proportion of wetland cover in the whole of the Black Mfolozi catchment (Table 52).

34.1 Manzimakulu vlei (Wetland No. 10, Fig. 67)

Form

Manzimakulu vlei comprises a large, badly degraded wetland centred upon co-ordinates 27° 53′S and 31° 43′E, in the upper reaches of quaternary sub-catchment W251. It extends for 15,2 km in a westerly direction along either side of the Manzimakulu River and parts of the Mona River (Fig. 69). It is only 350 m across at its widest point. Prior to its degradation the vlei was 885 ha in extent, but today it has been reduced in size by 81% to a series of widely separated fragments of wetland which total 170 ha. The perimeter of the wetland, which is important from a run-off/interception point of view, has been reduced by 85% from 179 to 27 km.

Although highly variable, the average slope of the vlei is 1%. The outlet is at an altitude of 530 m a.s.l., whereas the headwaters (near Nongoma) lie at an altitude of 685 m a.s.l.

Manzimakulu vlei appears to have formed above an outcrop of Karoo dolerite which arrested downward erosion of the Mona River 5 kms above its confluence with the Mbile River. From the generally eroded condition of Manzimakulu vlei structural damage to this keypoint is suspected.

The main vlei area comprises soils of the Katspruit form (at site A, Fig. 69), of the Valsrivier form (at site B), and of the Dundee form (wet phase) at site C (Carser, pers. comm.). These are soil forms typically found in the bed of seasonal rivers (Downing, 1980).

Macroclimate

With reference to the data provided by Schulze (1982) and Phillips (1973) the macroclimate of this region is indicated in the table below :

• mean annual precipitation	=	925 mm	
• relative humidity	=	65 %	
• temperature			
mean annual	=	20,5°C	
		Maximum (°C)	Minimum (°C)
mean daily	=	26	12
extreme daily	=	41	3
• mean annual potential evaporation	=	850 mm	

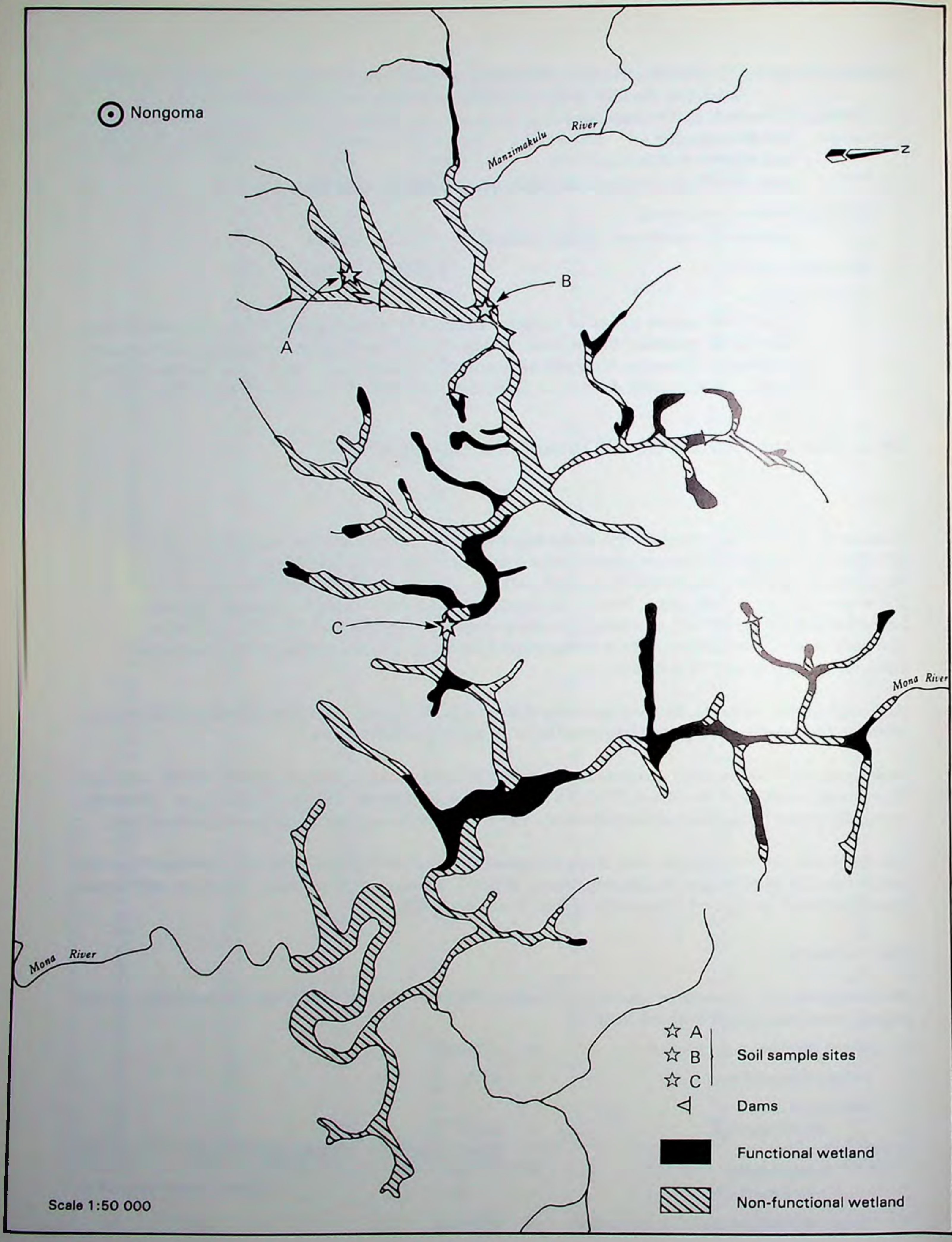


Fig. 69: The form of the Manzimakulu Vlei system

The nearest weather station (ref. 338/668) is at Hlabisa, with records extending over the period 1903-1933 (Pitman, *et al.*, 1981).

Hydrology

The eroded condition of Manzimakulu vlei suggests that the significance of functions such as water storage and flood attenuation have been greatly reduced, but no hydrological data specific to this portion of the Black Mfolozi catchment could be found to substantiate this.

Vegetation

The system is predominantly covered by grassland, but sedge patches (Cyperaceae) occur in the wetter areas. Other than this no further data are available.

Land tenure

Manzimakulu vlei is communally owned by the Zulu tribe living in the vicinity of Nongoma. Control of the tribe is excercised by Chief Mandlakazi (NTRPC, pers. comm.).

Land use

Manzimakulu vlei is used primarily for the grazing of cattle, but it seems that with the lack of any restrictions on the number of stock kept, overstocking and overgrazing has led to gully erosion, and inevitably to severe desiccation of the vlei system (Plate 19).

Plate 19: A view of Manzimkulu vlei looking westwards towards Nongoma, from the vicinity of Site C (Fig. 69).

As indicated below, portions of the vlei have been used for crop cultivation (maize), afforestation (at the outlet of the vlei) and dam construction. There are also a number of cattle dips on the edge of the vlei which could have pollution implications.

	Perceived severity of problem*
• grazing	2
• crop production	1
• dam construction	1
• erosion	3
• road construction	1
• afforestation	1

* 1 = moderately serious
2 = serious
3 = very serious

Conclusions

As Manzimakulu vlei was formerly the largest wetland in the Black Mfolozi catchment, and the distribution of wetlands in the Black Mfolozi catchment is known to be sparse (Table 52) it is strongly recommended that a proper land use plan be prepared for the vlei area, and that serious consideration is given to examining the feasibility of rehabilitating Manzimakulu vlei. State assistance should be sought to undertake a reconaissance survey on the lines suggested by Pienaar (1980), and particularly as the proximity of a potentially large labour force at Nongoma (only 2 - 3 km distant) is a factor favouring this suggestion.

Sources of information

Maps : 1:50 000 sheet 2731 DC Nongoma

Aerial photographs:

Year	Job	Scale	Strip No.	Photo Nos.
1937	117	1:25 000}		
1943	16	1:25 000}		
1954	328	1:30 000}	No record	
1961	455	1:36 000}		
1969	607	1:36 000}		
1970	608	1:20 000	4	4860
			5	1730-1738
			6	1780-1782

Chapter 35

Quaternary Sub-catchment No: W252

Name: Lower Mona (principal river)
Fig. No: 70

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  265 km^2
- Range in altitude.
  750 to 120 m above sea level
- Physiographic regions (Turner, 1967).
  region 31 (Middleveld of Zululand)
  region 37 (Lowveld of Zululand)
- Geology (Geological Survey Dept., pers. comm., Fig. 71).
  major bedrock type: Sandstone (Vryheid formation)
  less dominant types: Dolerite, tillite and shale
- Soils (Fitzpatrick, 1978).
  The whole of sub-catchment W252 is characterized by black clays, structured clays and duplex soils.
- Veld types (Acocks, 1953).
  veld type 64 (Northern Tall Grassveld)
  veld type 6 (Zululand Thornveld)
  veld type 10 (Lowveld)
- Bioclimatic regions (Phillips, 1973).
  region 2 (coast-hinterland)
  region 10 (riverine-interior lowland)
  region 9 (lowland-upland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 836 mm
  Range (Schulze, 1982): 700 to 900 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  30 million cubic metres/year.
- Land use (Nanni, 1982).
  The whole of sub-catchment W252 lies in KwaZulu, and falls within the jurisdiction of Chiefs Usuthi, Mandlakazi and Hlabisa (NTRPC, pers. comm.). The western portion of the sub-catchment is densely populated and intensively cultivated. This may be due to the higher elevation, the higher rainfall and the cooler climatic conditions in this area.

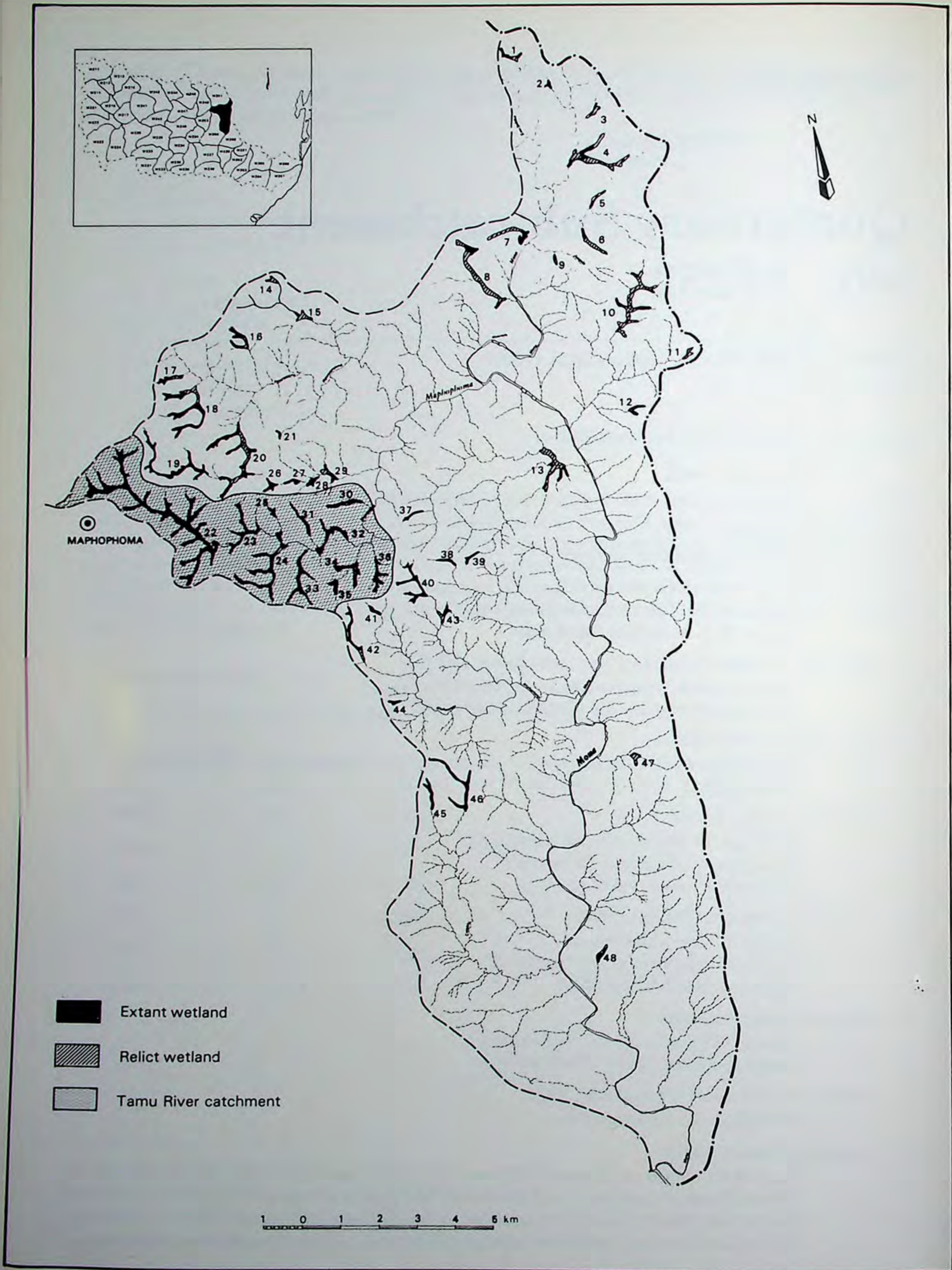
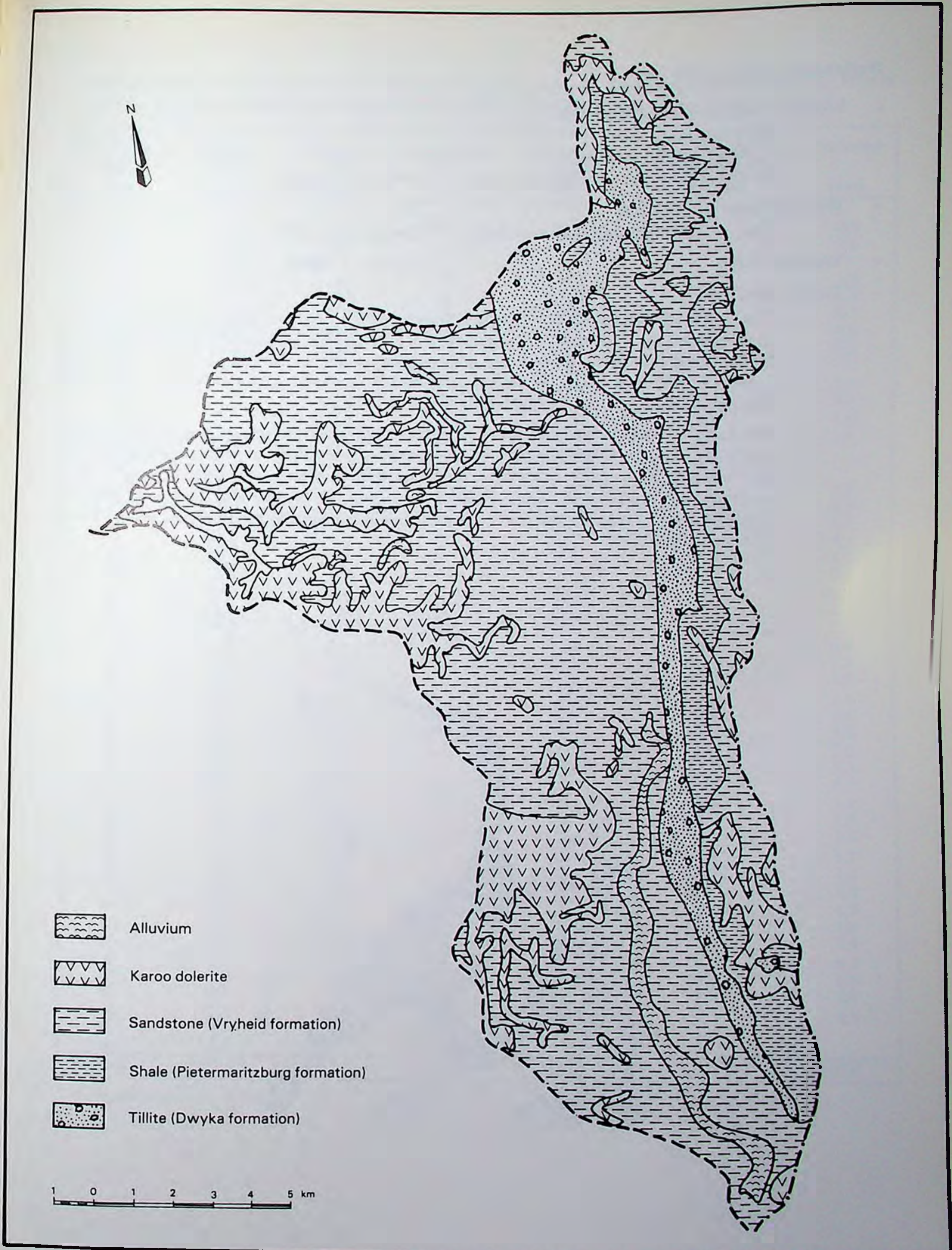


Fig. 70: The distribution of wetlands in quaternary sub-catchment W252. These data were derived from Job 608 of 1970.



Source: Dept. of Geological Survey

Fig. 71: The geology of quaternary sub-catchment W252

Wetland inventory (Table 38)

- Wetland distribution (Pre Iron Age).
  No. of wetlands: 48
  Size range : 1,5 to 79 (ha)
  Area of sub-catchment under wetland: 399 ha (1,5%)
- Wetland status (at present).
  Area of sub-catchment under wetland: 286 ha (1,1%)
- Wetland losses: 113 ha (28%)
- Further details:

  The high incidence of wetlands in the western portion of sub-catchment W252, which is characterised by veld type 64 (Northern Tall Grassveld) was noted, and attributed to higher rainfall in this region. One area in particular, i.e. the Tamu River catchment (which is 1 957 ha in size), warrants attention because it is richer in wetlands than any other area within sub-catchment W252 (Fig. 70).

  The Tamu River catchment contains 11 extant wetlands ranging in size from 2 - 79 ha, and these systems represent 52% of the remaining wetland in sub-catchment W252. Furthermore, 7,5% of this catchment is occupied by wetland, in contrast to the 1,1% of wetland cover in sub-catchment W252 as a whole. It is probable therefore that the hydrology of the Mapopoma River is significantly influenced by wetlands in the Tamu River catchment.

Table 38: The present status of wetlands in quaternary sub-catchment W252 (Fig. 70). Where wetland losses have amounted to 100%, no further data are provided.

Wetland No:	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	4,0	3,0	25	90	3,3	0,9
2	2,0	2,0	-	22	9,1	0,6
3	3,5	-	100	-	-	-
4	19,0	5,5	71	617	1,2	0,8
5	3,0	1,0	66	17	5,9	0,3
6	4,5	1,0	78	32	3,1	0,4
7	8,5	3,5	59	72	4,8	0,9
8	21,0	3,0	86	305	0,9	0,5
9	1,5	-	100	-	-	-
10	17,0	4,0	76	237	1,6	1,6
11	2,0	0,5	75	18	2,7	0,2
12	2,5	2,5	-	27	9,2	1,0
13	14,0	2,5	82	1 242	0,5*	1,0
14	1,5	-	100	-	-	-
15	3,0	-	100	-	-	-
16	5,5	3,5	36	72	4,8	1,7
17	3,0	2,0	33	55	3,6	0,8
18	23,0	19,5	15	205	9,5	4,9
19	18,5	18,5	-	227	8,1	7,2
20	19,0	11,0	42	545	5,2*	4,5
21	1,5	1,5	-	12	12,5	0,6
22	79,0	79,0	-	710	11,1	24,0
23	11,0	11,0	-	907	1,2*	4,6
24	19,5	18,0	8	1 195	9,2*	7,3
25	2,0	2,0	-	22	9,1	0,9
26	3,0	3,0	-	28	10,7	1,2
27	3,0	3,0	-	32	18,7*	1,1
28	2,5	2,5	-	32	7,8	1,0
29	4,0	2,0	50	312	3,3	0,6
30	3,5	2,5	28	47	5,3	1,2
31	4,5	4,5	-	57	7,9	2,0
32	12,0	12,0	-	1 572	8,6*	3,3
33	10,5	9,5	9,5	132	7,2	4,2
34	5,0	3,5	30	232	3,0*	1,8
35	3,5	3,5	-	50	7,0	1,5
36	5,5	3,0	45	92	3,2	1,0
37	2,0	2,0	-	22	9,1	1,1
38	2,5	2,5	-	20	12,5	1,2
39	2,5	2,5	-	17	14,7	1,0
40	10,0	10,0	-	127	7,8	4,7
41	2,5	2,5	-	27	9,3	1,0
42	7,5	5,5	27	82	6,7	2,4
43	3,0	1,0	66	205	5,3*	0,4
44	1,5	1,5	-	16	9,3	0,8
45	4,0	4,0	-	47	8,5	2,0
46	12,0	11,0	8,3	135	8,1	4,9
47	3,0	-	100	-	-	-
48	2,5	-	100	-	-	-
TOTAL	399,0	286,0				103,0

* includes upstream wetlands

Chapter 36

Quaternary Sub-catchment No: W253

Name: Sizinda (principal river)
Fig. No: 72

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  125 km^2
- Range in altitude.
  780 to 170 m above sea level
- Physiographic regions (Turner, 1967).
  region 31 (Middleveld of Zululand)
  region 37 (Lowveld of Zululand)
- Geology (Geological Survey Dept., pers. comm.).
  major bedrock type: Sandstone (Vryheid formation)
  less dominant type: Karoo dolerite
- Soils (Fitzpatrick, 1978).
  The whole of sub-catchment W253 is characterized by black clays, red structured clays and duplex soils.
- Veld types (Acocks, 1953).
  veld type 10 (Lowveld)
  veld type 64 (Northern Tall Grassveld)
- Bioclimatic regions (Phillips, 1973).
  region 9 (lowland-upland)
  region 10 (riverine-interior lowland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 763 mm
  Range (Schulze, 1982): 700 to 800 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  10 million cubic metres/year.
- Land use (Nanni, 1982).
  The whole of sub-catchment W252 lies in KwaZulu, and falls under the jurisdiction of Chiefs Matheni and Zungu (NTRPC, pers. comm.).

Fig. 72: The distribution of wetlands in quaternary sub-catchment W253. These data were derived from Job 608 of 1970.

Wetland inventory (Table 39)

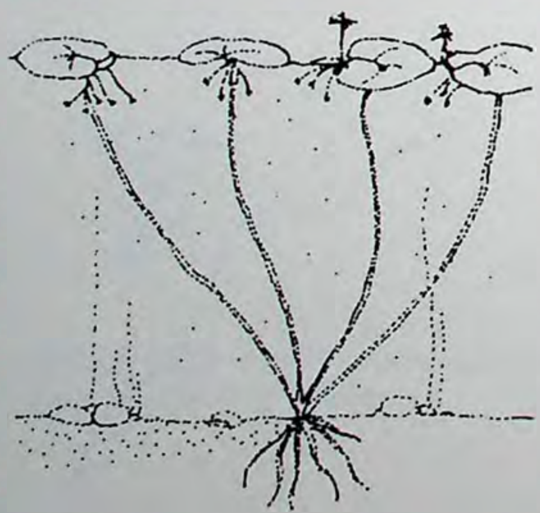
- Wetland distribution (Pre Iron Age).
  No. of wetlands: 12
  Size range : 2 to 28 (ha)
  Area of sub-catchment under wetland: 85 ha (0,7%)
- Wetland status (at present).
  Area of sub-catchment under wetland: 28 ha (0,2%)
- Wetland losses: 57 ha (67%)
- Further details:

  Due to the small size and degraded condition of the remaining wetlands in sub-catchment W253, none warrant further description for inventory purposes. However, it should be noted that those systems that remain are all in headwater situations near the eastern boundary of the sub-catchment.

Table 39: The present status of wetlands in quaternary sub-catchment W253 (Fig. 72). Where wetland losses have amounted to 100%, no further data are provided.

Wetland No:	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	2,0	2,0	-	15	13,3	1,0
2	3,5	3,5	-	62	8,8*	1,7
3	9,0	3,0	66	82	3,6	1,7
4	7,0	7,0	-	75	9,3	2,8
5	3,0	3,0	-	25	12,0	1,2
6	5,0	-	100	-	-	-
7	8,0	3,0	62	325	1,8*	0,8
8	4,0	4,0	-	40	10,0	1,4
9	2,5	2,5	-	37	6,7	1,0
10	6,5	-	100	-	-	-
11	28,0	-	100	-	-	-
12	7,0	-	100	-	-	-
TOTAL	85,0	28,0				11,6

* includes upstream wetlands



Chapter 37

Quaternary Sub-catchment No: W254

Name: Wela (principal river)
Fig. No: 73

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  135 km^2
- Range in altitude.
  690 to 170 m above sea level
- Physiographic regions (Turner, 1967).
  region 31 (Middleveld of Zululand)
  region 37 (Lowveld of Zululand)
- Geology (Geological Survey Dept., pers. comm.).
  major bedrock types: Sandstone and Dwyka tillite
  less dominant types: Dolerite and shale
- Soils (Fitzpatrick, 1978).
  Weakly developed soils (lithocutanic B) are found in the southern half of the catchment; black clays, red structured clays and duplex soils occur elsewhere.
- Veld types (Acocks, 1953).
  Several veld types converge in this area:
  veld type 10 (Lowveld)
  veld type 44 (Highland Sourveld)
  veld type 64 (Northern Tall Grassveld)
  veld type 6 (Zululand Thornveld)
- Bioclimatic regions (Phillips, 1973).
  region 10 (riverine-interior lowland)
  region 9 (lowland-upland)
  region 8 (dry upland)
  region 4 (sub-montane highland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 799 mm
  Range (Schulze, 1982): 700 to 900 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  13 million cubic metres/year.

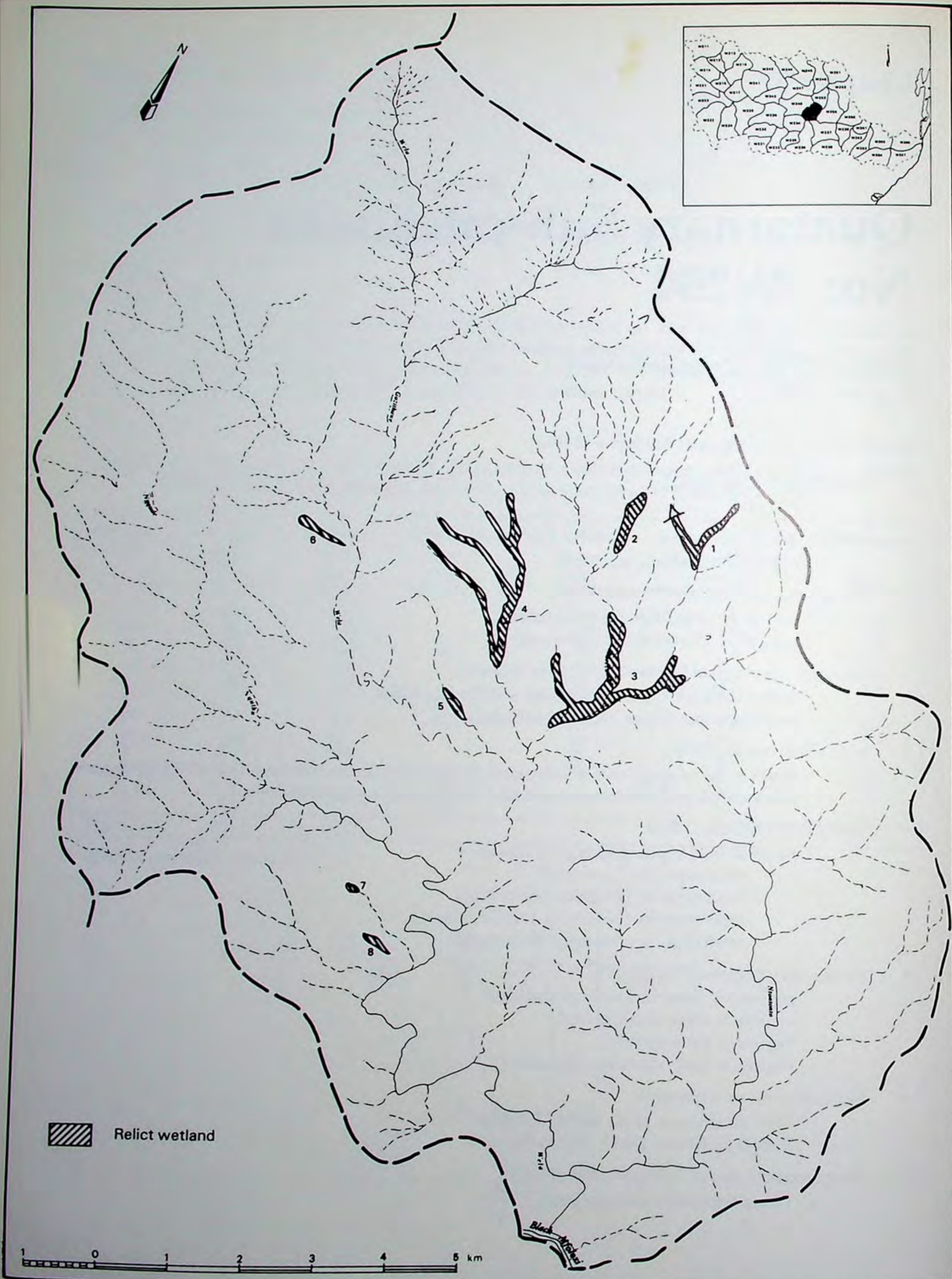
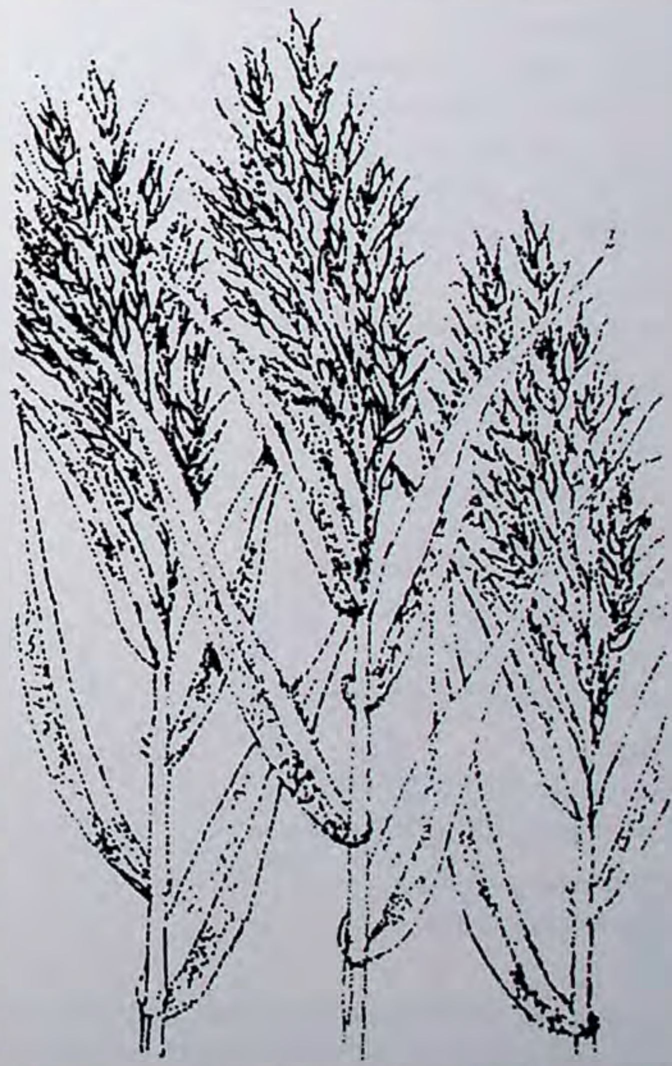


Fig. 73: The distribution of wetlands in quaternary sub-catchment W254. These data were derived from Job 608 of 1970.

- Land use (Nanni, 1982).
  The whole of sub-catchment W254 lies in KwaZulu, and is within the jurisdiction of Chief Zungu (NTRPC, pers. comm.).

Wetland inventory

- Wetland distribution (Pre Iron Age).
  No. of wetlands: 8
  Size range : 2 to 43 (ha)
  Area of sub-catchment under wetland: 111 ha (0,8%)
- Wetland status (at present).
  Area of sub-catchment under wetland: NIL ha (0,0%)
- Wetland losses: 111 ha (100%)
- Further details:
  Quaternary sub-catchment W254 is the only sub-catchment in the Mfolozi catchment to have experienced wetland losses of 100% (Table 53). Most of the systems involved lay in an upland area dominated by Dwyka tillite. For inventory purposes, no further description of these relict wetlands is warranted.



Chapter 38

Quaternary Sub-catchment No: W255

Name: Mngeni (principal river)
Fig. No: 74

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  305 km^2
- Range in altitude.
  780 to 120 m above sea level
- Physiographic regions (Turner, 1967).
  region 31 (Middleveld of Zululand)
  region 37 (Lowveld of Zululand)
- Geology (Geological Survey Dept., pers. comm.).
  major bedrock type: Sandstone (Vryheid formation)
  less dominant type: Karoo dolerite
- Soils (Fitzpatrick, 1978).
  Most of sub-catchment W255 is characterized by black clays, red structured clays and duplex soils. However, the south-west portion of the sub-catchment is covered by weakly developed soils (lithocutanic B).
- Veld types (Acocks, 1953).
  veld type 6 (Zululand Thornveld)
  veld type 10 (Lowveld)
  veld type 64 (Northern Tall Grassveld)
- Bioclimatic regions (Phillips, 1973).
  region 9 (lowland-upland)
  region 10 (riverine-interior lowland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 774 mm
  Range (Schulze, 1982): 700 to 900 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  24 million cubic metres/year.
- Land use (Nanni, 1982).
  Most of sub-catchment W255 lies in KwaZulu, and falls under the jurisdiction of Chiefs Matheni, Zungu and Mandlakazi (NTRPC, pers. comm.). In the south-east a part of the UGR becomes incorporated, which is State Land under the control of the Natal Parks Board.

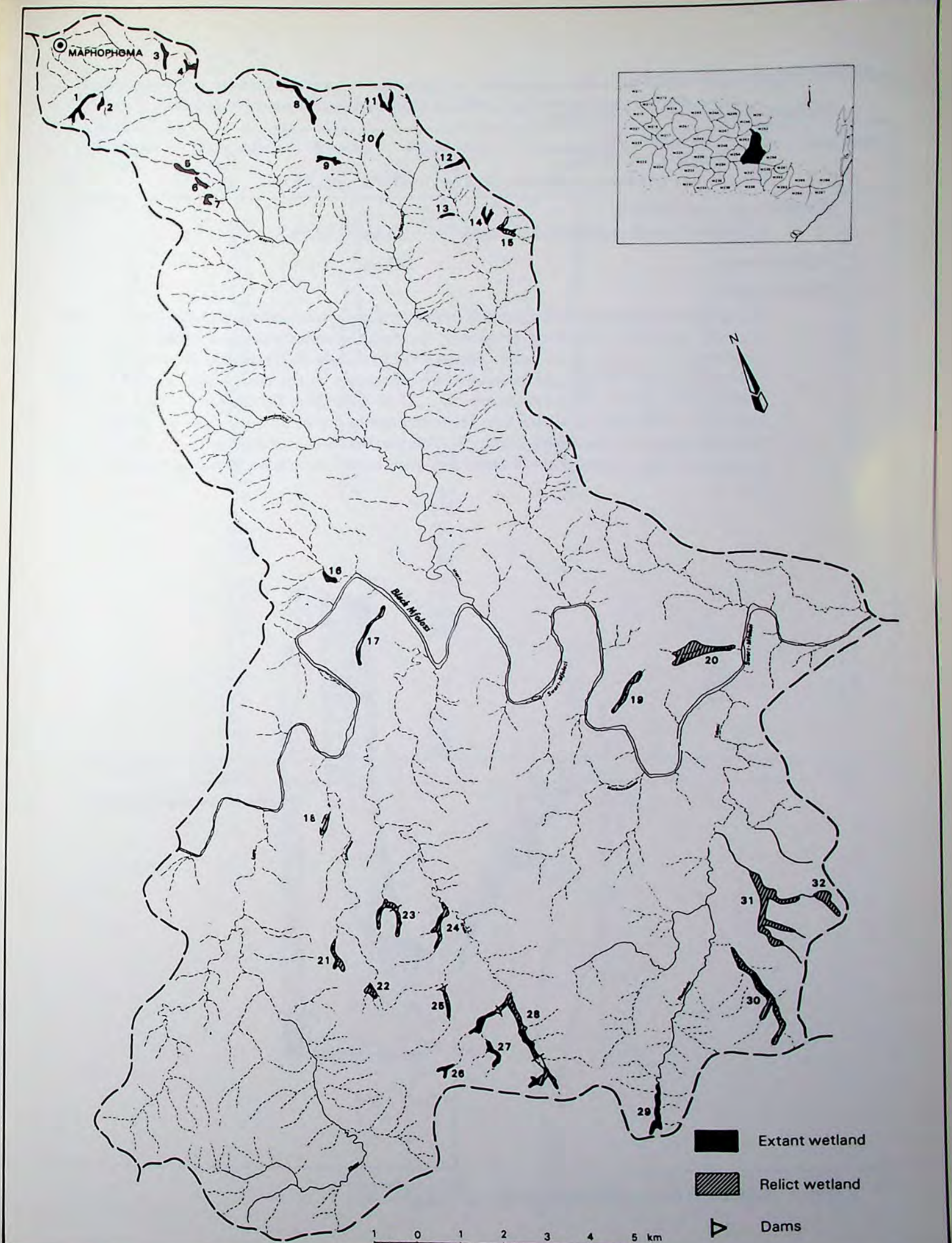
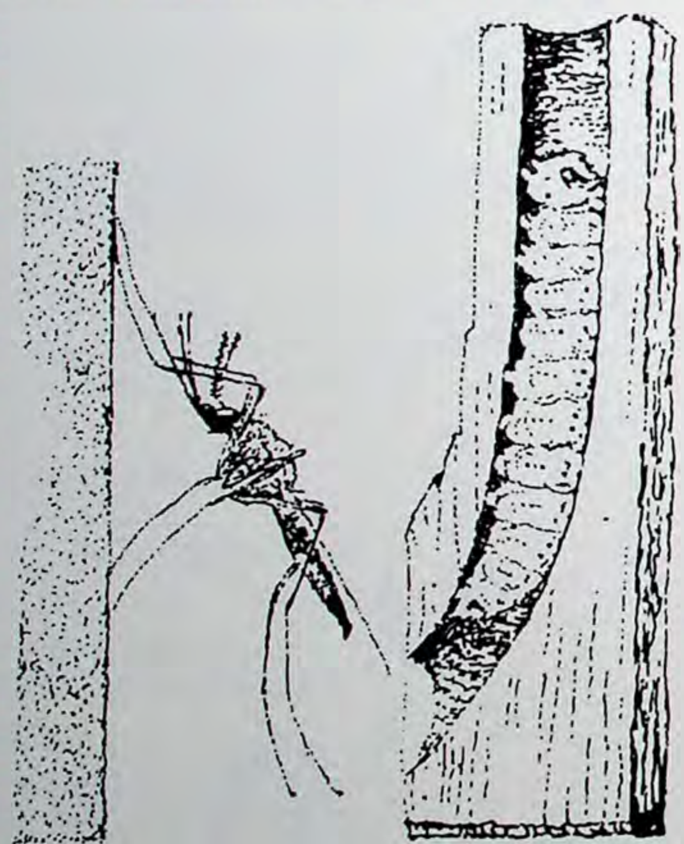


Fig. 74: The distribution of wetlands in quaternary sub-catchment W255. These data were derived from Job 608 of 1970.

Wetland inventory (Table 40)

- Wetland distribution (Pre Iron Age).
  No. of wetlands: 32
  Size range : 1,5 to 30 (ha)
  Area of sub-catchment under wetland: 223 ha (0,7%)
- Wetland status (at present).
  Area of sub-catchment under wetland: 76 ha (0,2%)
- Wetland losses: 147 ha (66%)
- Further details:
  The small size and degraded condition of the remaining wetlands in sub-catchment W255 suggests that, for inventory purposes, no further description of these systems is warranted. However, as in sub-catchment W253 (Chap. 36) it should be noted that the remaining extant systems are in headwater situations on the rim of the catchment, and in high-lying terrain. Relict wetlands Nos. 30, 31 & 32 (Fig. 74) lie within the UGR, and in an area of the reserve which was bush-cleared in the early 1930's for the purpose of tsetse fly control (Porter, pers. comm.*). This tract of land was also settled, and thus it is possible that the degradation of these wetlands could have been initiated over 50 years ago.



* R Porter: Natal Parks Board, Pietermaritzburg.

Table 40: The present status of wetlands in quaternary sub-catchment W255 (Fig. 74). Where wetland losses have amounted to 100%, no further data are provided.

Wetland No:	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	6,0	6,0	-	77	7,8	2,1
2	1,5	1,5	-	16	9,3	0,6
3	3,5	3,5	-	55	6,4	1,3
4	2,5	2,5	-	21	11,9	0,9
5	3,0	3,0	-	70	4,3	1,1
6	2,5	2,5	-	18	13,8	0,8
7	2,5	2,5	-	23	10,9	0,8
8	6,5	6,5	-	82	7,9	2,8
9	3,5	3,5	-	31	11,3	1,4
10	2,0	2,0	-	19	10,5	0,7
11	4,0	4,0	-	28	14,3	1,7
12	2,5	2,5	-	15	16,6	1,0
13	2,0	2,0	-	18	11,1	0,7
14	3,5	3,5	-	24	14,6	1,3
15	4,0	-	100	-	-	-
16	2,5	2,5	-	337	0,7	0,8
17	7,5	1,5	80	207	0,7	0,6
18	6,5	-	100	-	-	-
19	8,0	-	100	-	-	-
20	25,0	-	100	-	-	-
21	5,0	-	100	-	-	-
22	4,0	-	100	-	-	-
23	6,5	-	100	-	-	-
24	7,0	-	100.	-	-	-
25	2,5	-	100	-	-	-
26	2,5	2,5	-	37	6,7	1,0
27	3,5	3,5	-	97	3,6	1,3
28	23,5	11,0	53	722	2,4*	2,8
29	9,5	9,5	-	220	4,3	2,5
30	23,0	-	100	-	-	-
31	30,0	-	100	-	-	-
32	7,5	-	100	-	-	-
TOTAL	223,0	76,0				26,2

* includes upstream wetlands

Chapter 39

Quaternary Sub-catchment No: W256

Name: Mpelenyana (principal river)
Fig. No.: 75

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  190 km^2
- Range in altitude.
  620 to 60 m above sea level
- Physiographic region (Turner, 1967).
  But for a tiny portion in the north comprising part of region 31 (Middleveld of Zululand), the whole of sub-catchment W256 is classified as Lowveld (region 37).
- Geology (Geological Survey Dept., pers. comm.).
  major bedrock type: Sandstone (Vryheid formation)
  less dominant type: Karoo dolerite
- Soils (Fitzpatrick, 1978).
  Most of sub-catchment W256 is characterized by black clays, red structured clays and duplex soils.

  Detailed soils information for that portion lying within the UGR is available, where, from a wetland point of view the virtual absence of hydromorphic soil forms is noteworthy (Downing, 1980).
- Veld types (Acocks, 1953).
  veld type 6 (Zululand Thornveld)
  veld type 10 (Lowveld)
- Bioclimatic regions (Phillips, 1973).
  region 2 (coast hinterland)
  region 9 (lowland-upland)
  region 10 (riverine and interior lowland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 782 mm
  Range (Schulze, 1982): 700 to 900 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  17 million cubic metres/year.
- Land use (Nanni, 1982).
  North of the Black Mfolozi (Fig. 75) the land comprising sub-catchment W256 lies in KwaZulu, and is under the jurisdiction of Chief Hlabisa (NTRPC, pers. comm.). South

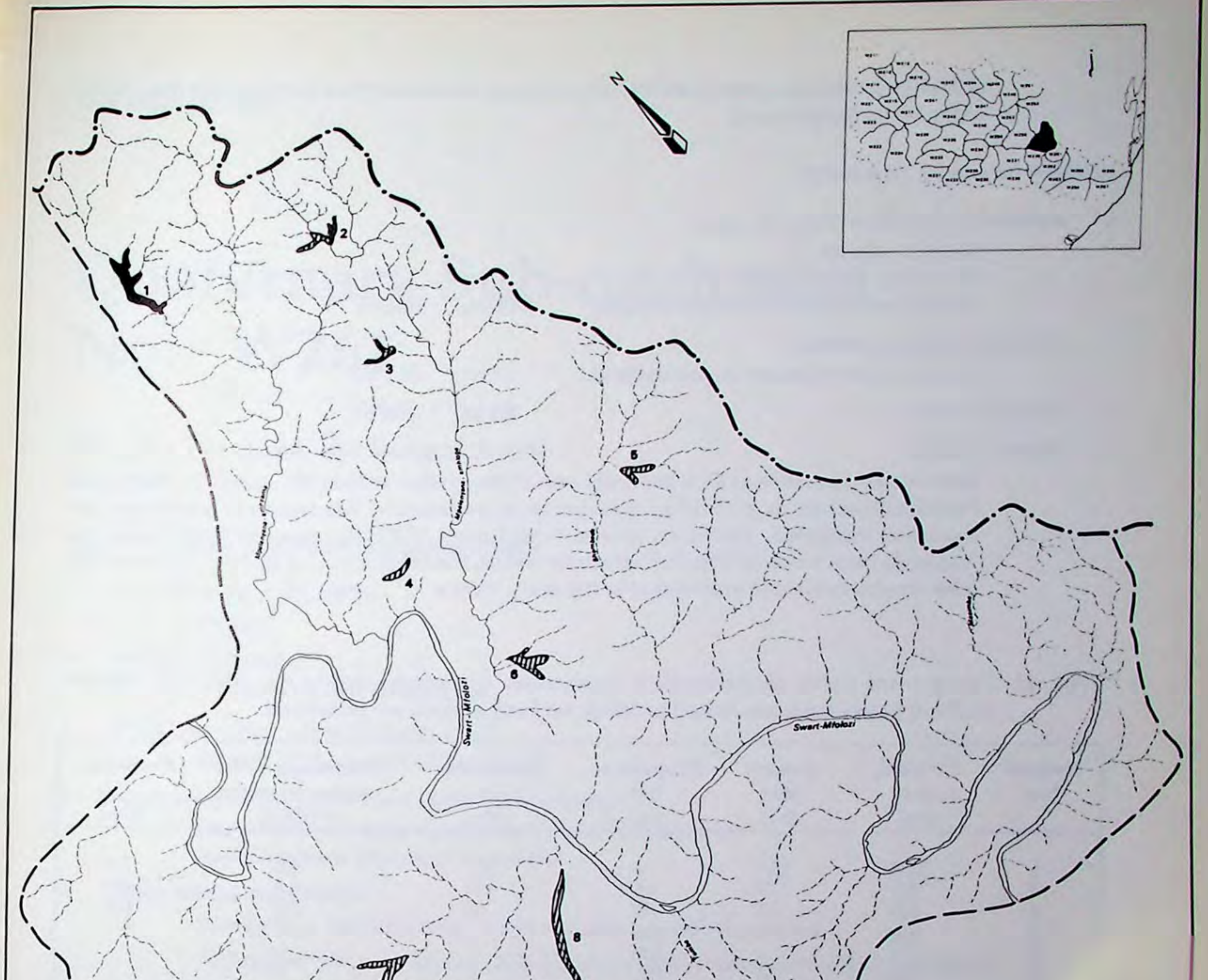


Fig. 75: The distribution of wetlands in quaternary sub-catchment W256. These data were derived from Job 608 of 1970.

of the Black Mfolozi, a part of the UGR is involved, this being State Land under the control of the Natal Parks Board.

Wetland inventory (Table 41)

- Wetland distribution (Pre Iron Age).
  No. of wetlands: 10
  Size range : 3 to 22 (ha)
  Area of sub-catchment under wetland: 106 ha (0,6%)
- Wetland status (at present).
  Area of sub-catchment under wetland: 17 ha (0,1%)
- Wetland losses: 89 ha (84%)
- Further details:
  With losses as severe as 84% and only one 15 ha system within the sub-catchment in a functional condition, no further description of wetlands in this region is warranted for inventory purposes. However, as in sub-catchment W255 the onset of degradation of wetlands Nos. 9 and 10 (Fig. 75), which lie within the UGR, could date back to when the area was bush-cleared and settled in the early 1930's.

Table 41: The present status of wetlands in quaternary sub-catchment W256 (Fig. 75). Where wetland losses have amounted to 100%, no further data are provided.

Wetland No:	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	15,0	15,0	-	337	4,4	2,9
2	4,5	1,5	66	132	1,1	0,8
3	3,0	1,0	66	50	2,0	0,4
4	4,0	-	100	-	-	-
5	3,5	-	100	-	-	-
6	8,5	-	100	-	-	-
7	13,0	-	100	-	-	-
8	13,0	-	100	-	-	-
9	20,0	-	100	-	-	-
10	22,0	-	100	-	-	-
TOTAL	106,0	17,0				4,1

Chapter 40

Quaternary Sub-catchment No: W261

Name: Mcacaza (principal river)
Fig. No.: 76

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  90 km^2
- Range in altitude.
  230 to 50 m above sea level
- Physiographic region (Turner, 1967).
  region 37 (Lowveld of Zululand)
- Geology (Geological Survey Dept., pers. comm.).
  major bedrock type: Sandstone (Vryheid formation)
  less dominant type: Karoo dolerite
- Soils (Fitzpatrick, 1978).
  Black clays, red structured clays and duplex soils throughout.

  A detailed soil map for the UGR portion of sub-catchment W261 is available.
- Veld types (Acocks, 1953).
  veld type 6 (Zululand Thornveld)
  veld type 10 (Lowveld)
- Bioclimatic region (Phillips, 1973).
  region 10 (riverine-interior lowland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 750 mm
  Range (Schulze, 1982): 700 to 800 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  3 million cubic metres/year.

  Recording station W2M02 was situated within sub-catchment W261. The installations comprised gauge plates from which run-off data were obtained over the period 1947-1962.
- Land use (Nanni, 1982).
  North of the Black Mfolozi (Fig. 76) the land comprising sub-catchment W261 lies in KwaZulu, and is under the jurisdiction of Chief Zungu (NTRPC, pers. comm.). South of the river, part of the UGR is incorporated, which is State Land under the control of the Natal Parks Board.

Fig. 76: The distribution of wetlands in quaternary sub-catchment W261. These data were derived from Job 608 of 1970.

Wetland inventory (Table 42)

- Wetland distribution (Pre Iron Age).
  No. of wetlands: 12
  Size range : 1,5 to 195 (ha)
  Area of sub-catchment under wetland: 288 ha (3,2%)
- Wetland status (at present).
  Area of sub-catchment under wetland: 26 ha (0,3%)
- Wetland losses: 262 ha (91%)
- Further details:
  No further description of the few remaining wetlands in this region is warranted for inventory purposes.

Table 42: The present status of wetlands in quaternary sub-catchment W261 (Fig. 76). Where wetland losses have amounted to 100%, no further data are provided.

Wetland No:	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	17,0	-	100	-	-	-
2	1,5	1,5	-	19	7,9	0,6
3	4,0	-	100	-	-	-
4	6,0	-	100	-	-	-
5	3,0	-	100	-	-	-
6	2,5	-	100	-	-	-
7	4,0	-	100	-	-	-
8	14,5	-	100	-	-	-
9	16,0	-	100	-	-	-
10	19,0	-	100	-	-	-
11	6,0	2,0	66	287	0,7	0,6
12	195,0	23,0	88	2 362	1,0	2,0
TOTAL	288,0	26,0				3,2

Chapter 41

Quaternary Sub-catchment No: W263

Name: Mvamanzi (principal river)
Fig. No.: 77

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  185 km^2
- Range in altitude.
  350 to 30 m above sea level
- Physiographic region (Turner, 1967).
  region 37 (Lowveld of Zululand)
- Geology (Geological Survey Dept., pers. comm., Fig. 78).
  major bedrock types: Basalt lavas (Letaba formation), and sandstone (Emakwezini formation)
  less dominant types: Mudstones (Nyoka formation), and sandstone (Ntabene formation)
- Soils (Fitzpatrick, 1978).
  Mainly red structured apedal, freely drained clays and duplex soils. In addition to these some black clays occur in the north and south-west portions of sub-catchment W263.
- Veld types (Acocks, 1953).
  veld type 6 (Zululand Thornveld)
  veld type 10 (Lowveld)
- Bioclimatic regions (Phillips, 1973).
  region 9 (lowland to upland)
  region 10 (riverine-interior lowland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 789 mm
  Range (Schulze, 1982): 700 to 900 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  6 million cubic metres/year.
- Land use (Nanni, 1982).
  The whole of sub-catchment W263 lies in KwaZulu, and mainly within the jurisdiction of Chief Mthetwa (NTRPC, pers. comm.). Sub-catchment W263 is a densely settled area, containing the townships of Makhwezini, Mfuyeni, Novunula and several other smaller settlements.

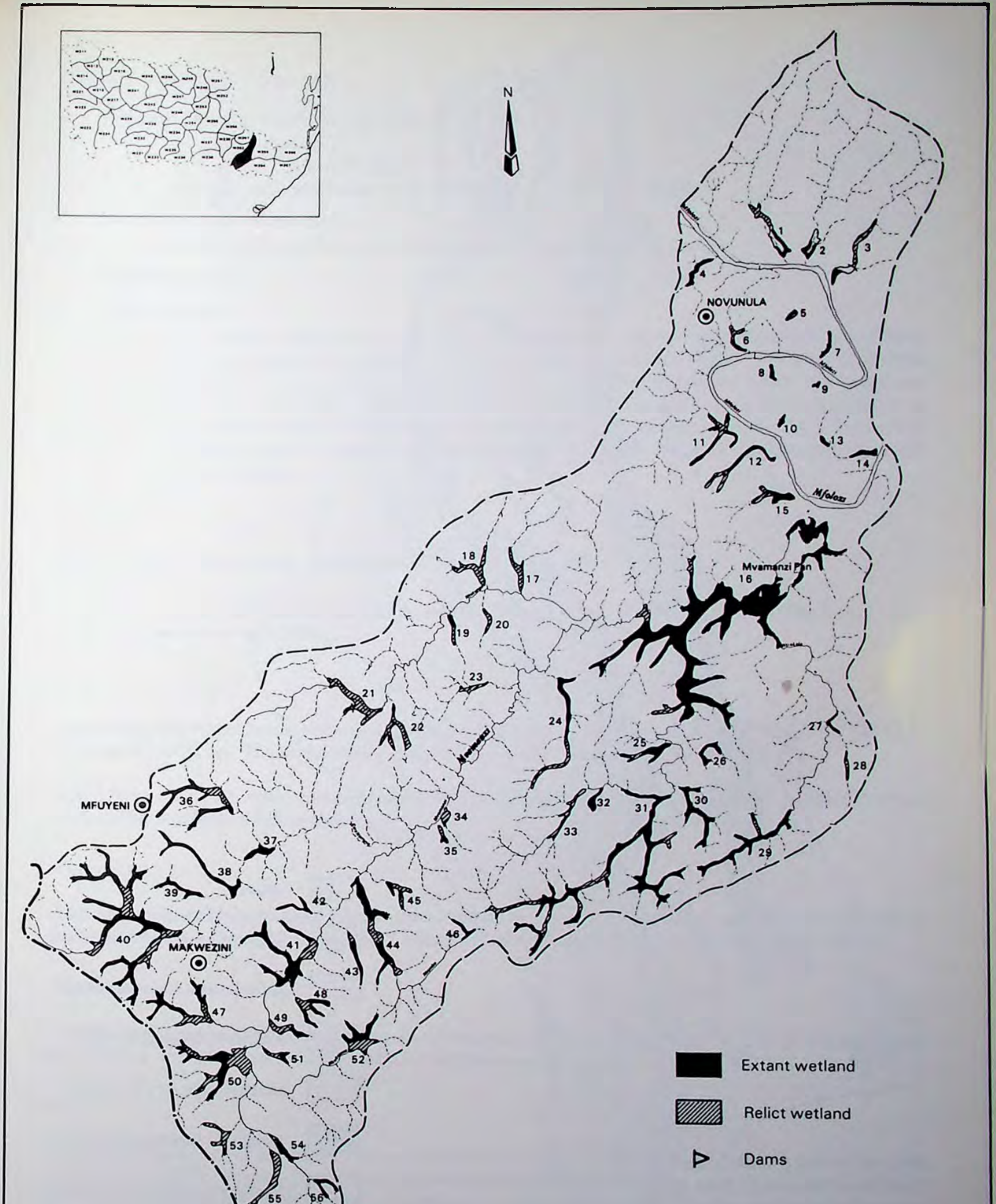
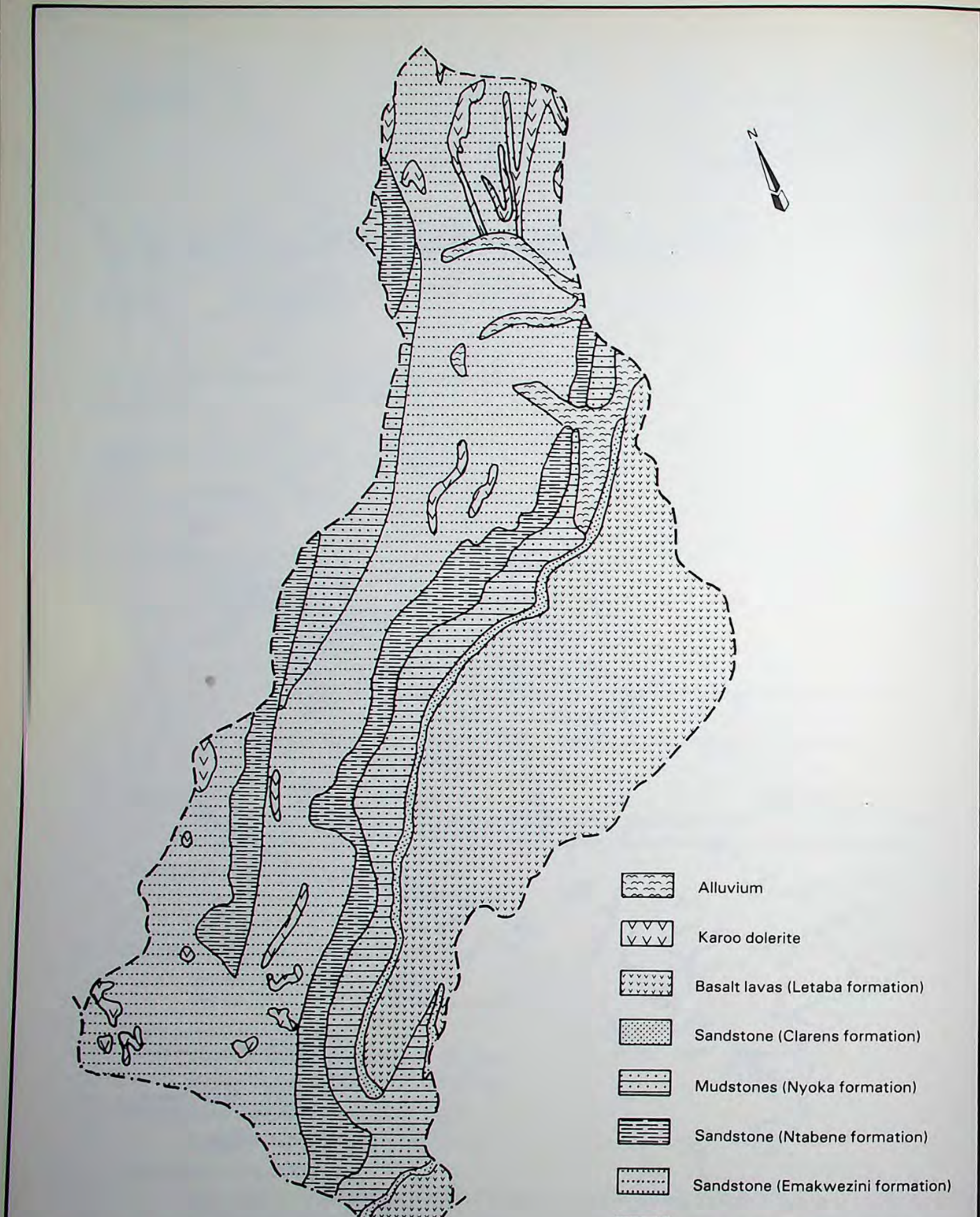


Fig. 77: The distribution of wetlands in quaternary sub-catchment W263. These data were derived from Job 608 of 1970.



Source: Dept. of Geological Survey

Fig. 78: The geology of quaternary sub-catchment W263

Wetland inventory (Table 43)

- Wetland distribution (Pre Iron Age).
  - No. of wetlands: 57
  - Size range : 1,5 to 392 (ha)
  - Area of sub-catchment under wetland: 1 101 ha (5,9%)
- Wetland status (at present).
  - Area of sub-catchment under wetland: 818 ha (4,4%)
- Wetland losses: 283 ha (26%)
- Further details:

  For a region classified as lowveld sub-catchment W263 is surprisingly rich in wetlands, and the amount of wetland lost (26%) has been relatively slight. The most important wetland in this region, Mvamanzi pan, is described below for inventory purposes. However, the large number of small wetlands in a region as densely populated as sub-catchment W263 probably bestows a high value on each system. This is because of the usage made of these resources as supplies of potable water by rural communities and their livestock.

41.1 Mvamanzi pan (Wetland No. 16, Fig. 77)

The following data are mainly drawn from the surveys of this pan conducted by Pike (1965, 1971, 1979) and Johnson *et al.*, (1979).

Form

Depending on water level, the open water surface area in Mvamanzi pan (28° 25'S; 32° 01'E) is between 42 to 55 ha. The maximum depth of the system varies from 3 to 0,7 m.

Apart from the open water component which constitutes "the pan", the Mvamanzi wetland (340 ha) extends for a further 5 km upstream.

Hydrology

Although primarily dependent upon inflow from its own catchment, marked seasonal fluctuations in water level occur. The pan is in direct contact with the Mfolozi River only during flood events.

Vegetation

The pan is surrounded by a dense fringe of tall sedges and reeds (*Phragmites*). In 1979 it was estimated that 90% of its surface area was covered by *Potamogeton pectinatus*.

Fauna

Very large numbers of waterfowl frequent Mvamanzi pan. These include pelicans (on occasions), White-faced duck, Pygmy geese, Teal, Spurwinged geese, Redknobbed coot, Spoonbill and Black egrets. Crocodiles are plentiful and occasionally migrant hippo occur. Eight species of indigenous fish are present, the most abundant being *Sarotherodon mossambicus, Mugil cephalus* (a species of marine origin) and *Clarias gariepinus*.

Table 43: The present status of wetlands in quaternary sub-catchment W263 (Fig. 77). Where wetland losses have amounted to 100%, no further data are provided.

Wetland No:	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	17,0	11,0	35	720	1,5	1,9
2	10,0	10,0	-	555	1,8	1,5
3	11,5	4,5	61	422	1,1	1,4
4	6,5	6,5	-	112	5,8	2,0
5	3,0	-	100	-	-	-
6	4,0	-	100	-	-	-
7	4,5	4,5	-	55	8,2	1,3
8	2,0	2,0	-	32	6,2	0,9
9	1,5	1,5	-	25	6,0	0,3
10	2,0	2,0	-	25	8,0	0,6
11	11,0	4,0	64	715	0,6	2,0
12	14,0	9,0	36	150	6,0	3,1
13	2,0	2,0	-	50	4,0	0,6
14	4,0	4,0	-	170	3,5*	1,2
15	8,5	5,0	41	160	3,1	1,4
16	392,0	379,0	3	13 425	5,6*	31,9
17	6,5	-	100	-	-	-
18	9,0	-	100	-	-	-
19	4,0	2,0	50	67	-	0,5
20	2,5	-	100	-	-	-
21	19,5	-	100	-	-	-
22	10,0	-	100	-	-	-
23	3,5	-	100	-	-	-
24	18,0	10,0	44	345	2,9	3,2
25	11,5	9,0	22	72	12,5	1,9
26	5,0	5,0	-	105	4,7	1,5
27	2,5	2,5	-	885	3,0*	1,1
28	3,0	1,5	50	77	1,9	0,5
29	25,0	23,0	8	350	6,6	6,2
30	14,0	14,0	-	195	7,2	4,8
31	87,0	65,0	25	1 597	4,4*	19,7
32	5,5	5,5	-	72	7,6	1,2
33	8,0	-	100	-	-	-
34	4,0	-	100	-	-	-
35	2,5	1,5	40	20	7,5	0,4
36	20,5	14,5	29	317	4,6	5,3
37	7,5	7,5	-	1 775	5,2*	1,4
38	16,0	16,0	-	1 315	5,4*	5,6
39	6,5	6,5	-	105	6,2	2,5
40	79,0	48,0	39	842	5,7	16,0
41	45,5	35,0	23	2 705	3,6*	7,7
42	4,0	4,0	-	85	4,7	2,0
43	8,5	6,5	23	82	7,9	2,0
44	33,0	24,0	27	537	5,4*	4,9
45	8,0	3,0	62	92	3,2	0,9
46	5,0	5,0	-	55	9,1	1,5
47	20,5	11,5	44	207	5,5	4,1
48	10,0	7,0	30	75	9,3	2,5
49	8,5	3,5	59	45	7,7	0,8
50	45,0	17,0	62	262	6,5	3,3
51	3,5	1,5	57	50	3,0	0,4
52	18,0	11,0	39	155	7,1	2,1
53	6,0	-	100	-	-	-
54	5,5	4,5	18	330	3,8*	1,0
55	8,5	-	100	-	-	-
56	5,0	5,0	-	50	10,0	1,8
57	3,0	3,0	-	35	8,5	1,0
TOTAL	1 101,0	818,0				158,0

* includes upstream wetlands.

Utilization

Two groups of Bantu seine netters use Mvamanzi pan for commercial fishing purposes.

Land use

The land surrounding Mvamanzi pan is used for subsistence agriculture, and the grazing of cattle. These activities are also in evidence throughout much of the Mvamanzi wetland area, but only a small proportion (13 ha) has been altered radically enough to have been designated as relict wetland (Fig. 77).

Conclusions

Indiscriminate land-use practices in the catchment of Mvamanzi pan, and the prospect of its inundation by a dam (Bales-Smith, 1987) threaten its continued existence. It is regarded as an important winter feeding ground for many species of waterfowl.

The importance of the wetland area above the pan lies in the protection it offers to the system through sediment exclusion, water quality improvement, flood attenuation and the supply of detritus. The latter function is attributable particularly to the "marginal meadows" of *Cynodon* that surround the pan.

Sources of information

Maps : 1:50 000 sheets 2831 BD Mfolozi
2832 AC Mtubatuba

Aerial photographs:

Year	Job	Scale	Strip No.	Photo Nos.
1937	117	1:25 000	No record	
1960	442	1:40 000	No record	
1970	608	1:20 000	22 23	0931 0845
1975	752	1:50 000	No record	

Literature:

See References (Chap. 46.0) under :
Pike, (1965, 1971 and 1979)
Johnson *et al.*, 1979.

Chapter 42

Quaternary Sub-catchment No: W264

Name: Msunduzi (principal river)
Fig. No: 79

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  225 km^2
- Range in altitude.
  340 to 15 m above sea level
- Physiographic regions (Turner, 1967).
  region 37 (Lowveld of Zululand)
  region 42 (Zululand Coastal Plain)
- Geology (Geological Survey Dept., pers. comm., Fig. 80).
  major bedrock type: Basalt lavas (Letaba formation)
  less dominant type: Quartz-feldspar
- Soils (Fitzpatrick, 1978).
  Most of sub-catchment W264 is characterised by grey and red (coastal) sands. However, in the south-west a tract of red structured apedal, freely drained clays and duplex soils occurs, together with some weakly developed sandy soils.
- Veld types (Acocks, 1953).
  veld type 6 (Zululand Thornveld)
  veld type 1 (Coastal Forest and Thornveld)
- Bioclimatic regions (Phillips, 1973).
  region 9 (lowland to upland)
  region 1 (coastal lowland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 887 mm
  Range (Schulze, 1982): 800 to 1 200 mm (increasing from west to east)
- Mean annual run-off (Pitman *et al.*, 1981).
  11 million cubic metres/year.
- Land use (Nanni, 1982).
  Most of sub-catchment W264 lies in KwaZulu, and falls within the jurisdiction of Chief Mthetwa (NTRPC, pers. comm). However, white owned farms are encountered in the eastern portion of sub-catchment W264, and principally used for the cultivation of sugar cane.

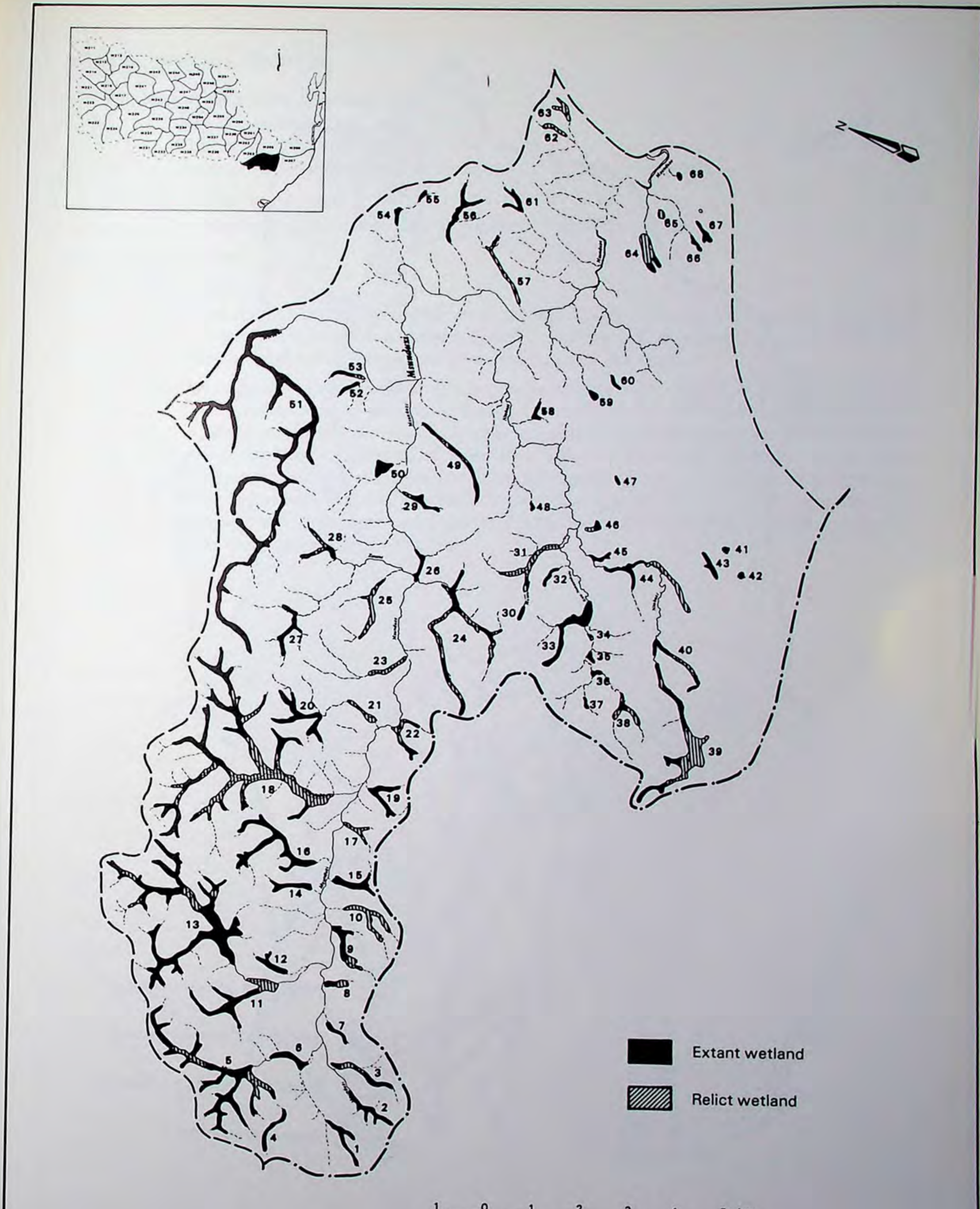
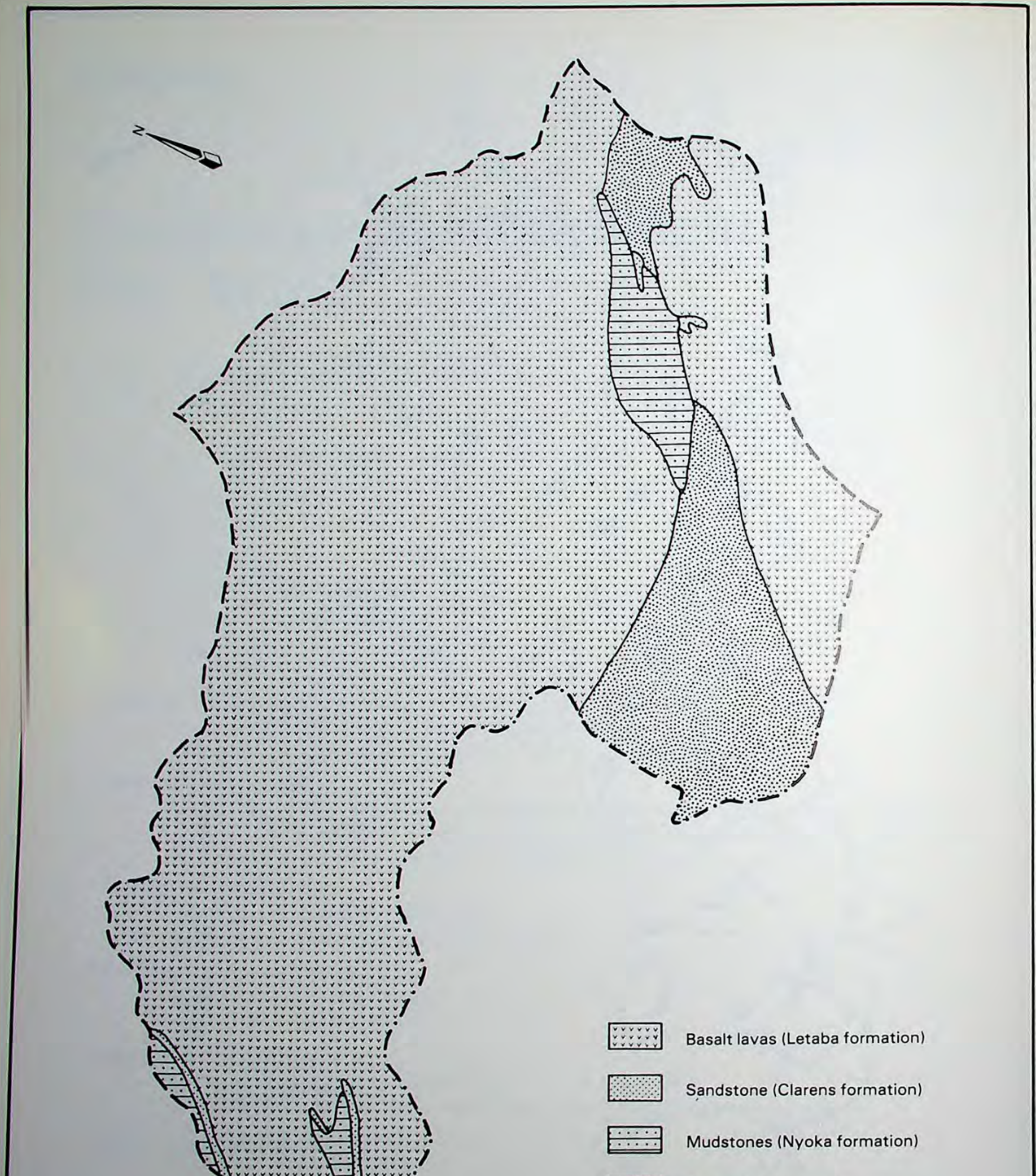


Fig. 79: The distribution of wetlands in quaternary sub-cathcment W264. These data were derived from Job 608 of 1970.



Source: Dept. of Geological Survey

Fig. 80: The geology of quaternary sub-catchment W264

Wetland inventory (Table 44)

- Wetland distribution (Pre Iron Age).
  - No. of wetlands: 68
  - Size range : 1 to 118 (ha)
  - Area of sub-catchment under wetland: 820 ha (3,6%)
- Wetland status (at present).
  - Area of sub-catchment under wetland: 563 ha (2,5%)
- Wetland losses: 257 ha (31%)
- Further details:

Considering that most of the area is classified as lowveld, the western portion of sub-catchment W264 is surprisingly rich in wetlands. This is probably due to the higher mean annual rainfall as a result of its proximity to the coast.

The largest intact wetland in this region (wetland No.51 , Fig. 79) is 98 ha in extent and lies on either side of the Hlezane River, a tributary of the Msunduzi. Although no particular wetland warrants detailed description for inventory purposes, all the wetlands in this region, irrespective of their size, serve as important resources for the rural communities living in this portion of the catchment. The upper reaches of the Msunduzi River is particularly rich in wetlands, and thus it is recommended that any plans for development in this area take this into account, and that an effort is made to impress these views upon Chief Mthetwa.

Table 44: The present status of wetlands in quaternary sub-catchment W264 (Fig. 79). Where wetland losses have amounted to 100%, no further data are provided.

Wetland No:	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	6,0	6,0	-	80	7,5	2,9
2	9,0	9,0	-	110	8,2	2,8
3	7,5	4,5	40	112	4,0	1,4
4	4,5	4,5	-	62	7,2	2,0
5	48,0	36,0	25	512	7,7*	12,3
6	10,5	10,5	-	650	7,8*	1,8
7	3,5	3,5	-	35	10,0	1,0
8	4,0	2,0	50	47	4,2	0,5
9	11,0	7,0	36	82	8,5	1,8
10	8,5	-	100	-	-	-
11	26,0	19,0	27	257	7,4	4,2
12	5,0	5,0	-	47	10,6	1,6
13	86,0	76,0	12	737	10,3	17,7
14	6,5	6,5	-	92	7,1	1,8
15	9,0	9,0	-	67	13,4	2,1
16	29,0	29,0	-	210	13,8	7,1
17	3,5	-	100	-	-	-
18	118,0	54,0	54	1 080	5,0	16,5
19	7,0	7,0	-	70	10,0	2,2
20	16,5	16,5	-	137	12,0	4,1
21	5,5	-	100	-	-	-
22	7,0	3,0	57	72	4,2	1,0
23	7,0	-	100	-	-	-
24	28,5	12,5	56	457	2,7	3,9
25	9,0	1,0	89	132	0,7	0,3
26	4,5	4,5	-	7 100	5,4*	1,4
27	7,5	7,5	-	170	4,4	2,7
28	6,5	3,0	54	95	3,1	1,1
29	5,0	4,0	20	77	5,2	1,0
30	1,5	1,5	-	30	5,0	0,6
31	12,0	-	100	-	-	-
32	2,5	2,5	-	32	7,8	1,0
33	15,0	15,0	-	687	3,3*	3,9
34	1,5	1,5	-	30	5,0	0,3
35	2,0	2,0	-	25	8,0	0,5
36	1,5	1,5	-	82	3,6*	0,4
37	1,5	1,5	-	32	4,7	0,4
38	5,0	1,5	70	125	1,2	0,3
39	42,0	12,0	71	415	2,9	4,5
40	8,5	4,5	47	570	2,9*	1,8
41	1,0	1,0	-	50	2,0	0,3
42	1,5	1,5	-	57	2,6	0,3
43	5,5	5,5	-	110	5,0	1,1
44	16,0	7,0	56	1 092	2,1*	2,8
45	3,0	3,0	-	47	6,4	1,0
46	3,5	2,0	43	42	4,7	0,4
47	1,0	1,0	-	47	2,1	0,4
48	1,0	1,0	-	35	2,8	0,3
49	11,0	8,5	23	110	7,7	3,0
50	8,0	8,0	-	37	21,6	0,9
51	99,0	98,0	1	1 320	7,4	33,0
52	2,5	2,0	20	25	8,0	0,7
53	3,5	2,5	28	45	5,5	0,9
54	2,5	2,5	-	67	6,7*	0,8
55	2,0	2,0	-	17	11,7	0,5
56	9,5	9,5	-	125	7,6	3,5
57	10,0	1,0	90	107	0,9	0,3
58	3,0	3,0	-	42	7,1	0,8
59	2,5	2,5	-	45	5,5	0,6
60	2,5	2,5	-	57	4,4	0,9
61	5,0	5,0	-	47	10,6	2,0
62	3,0	-	100	-	-	-
63	4,0	-	100	-	-	-
64	15,5	3,5	77	137	2,5	0,8
65	2,5	-	100	-	-	-
66	2,5	2,5	-	62	4,0	0,8
67	4,5	4,5	-	45	10,0	1,2
68	2,0	-	100	-	-	-
TOTAL	820,0	563,0				166,0

* includes upstream wetlands.

Chapter 43

Quaternary Sub-catchment No: W265

Name: Nkata (principal river)
Fig. No: 81

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  240 km^2
- Range in altitude.
  270 to 18 m above sea level
- Physiographic regions (Turner, 1967).
  region 37 (Lowveld of Zululand)
  region 42 (Zululand Coastal Plain)
- Geology (Geological Survey Dept., pers. comm., Fig. 82).
  major bedrock type: Basalt lavas (Letaba formation)
  less dominant types: Sandstone (Emakwezini and Vryheid formations)
- Soils (Fitzpatrick. 1978).
  Mainly red structured apedal, freely drained clays and duplex soils. Grey and red coastal sands cover the eastern portion of the catchment.
- Veld types (Acocks, 1953).
  veld type 10 (Lowveld)
  veld type 1 (Coastal Forest and Thornveld)
- Bioclimatic regions (Phillips, 1973).
  region 10 (riverine-interior lowland)
  region 1 (coastal lowland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 835 mm
  Range (Schulze, 1982): 700 to 900 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  9 million cubic metres/year.
- Land use (Nanni, 1982).
  Most of sub-catchment W265 lies in KwaZulu, and falls mainly within the jurisdiction of Chief Mpukunyoni (NTRPC, pers. comm.). Some privately owned sugarcane and timber farms occur in the south-eastern corner of the sub-catchment.

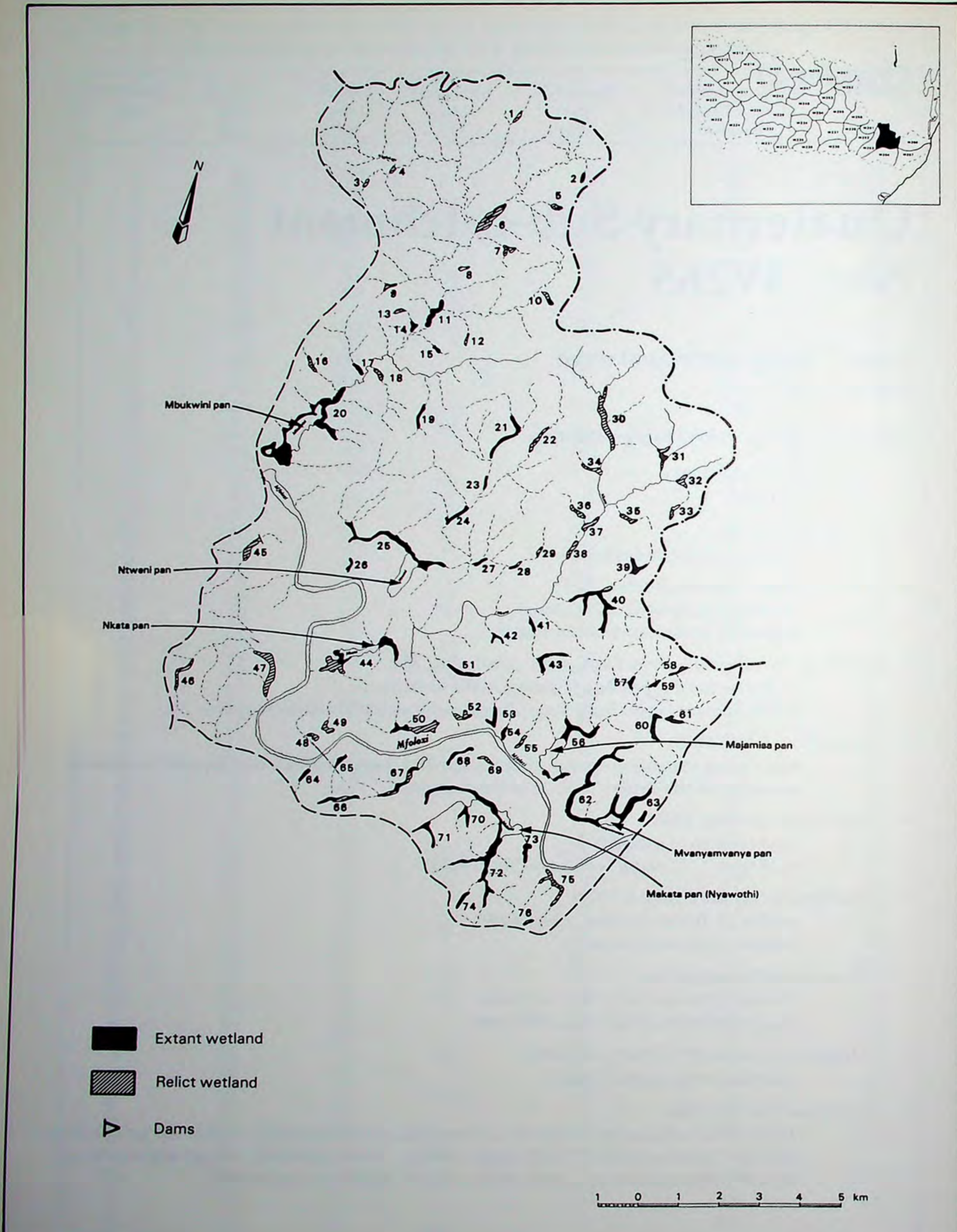
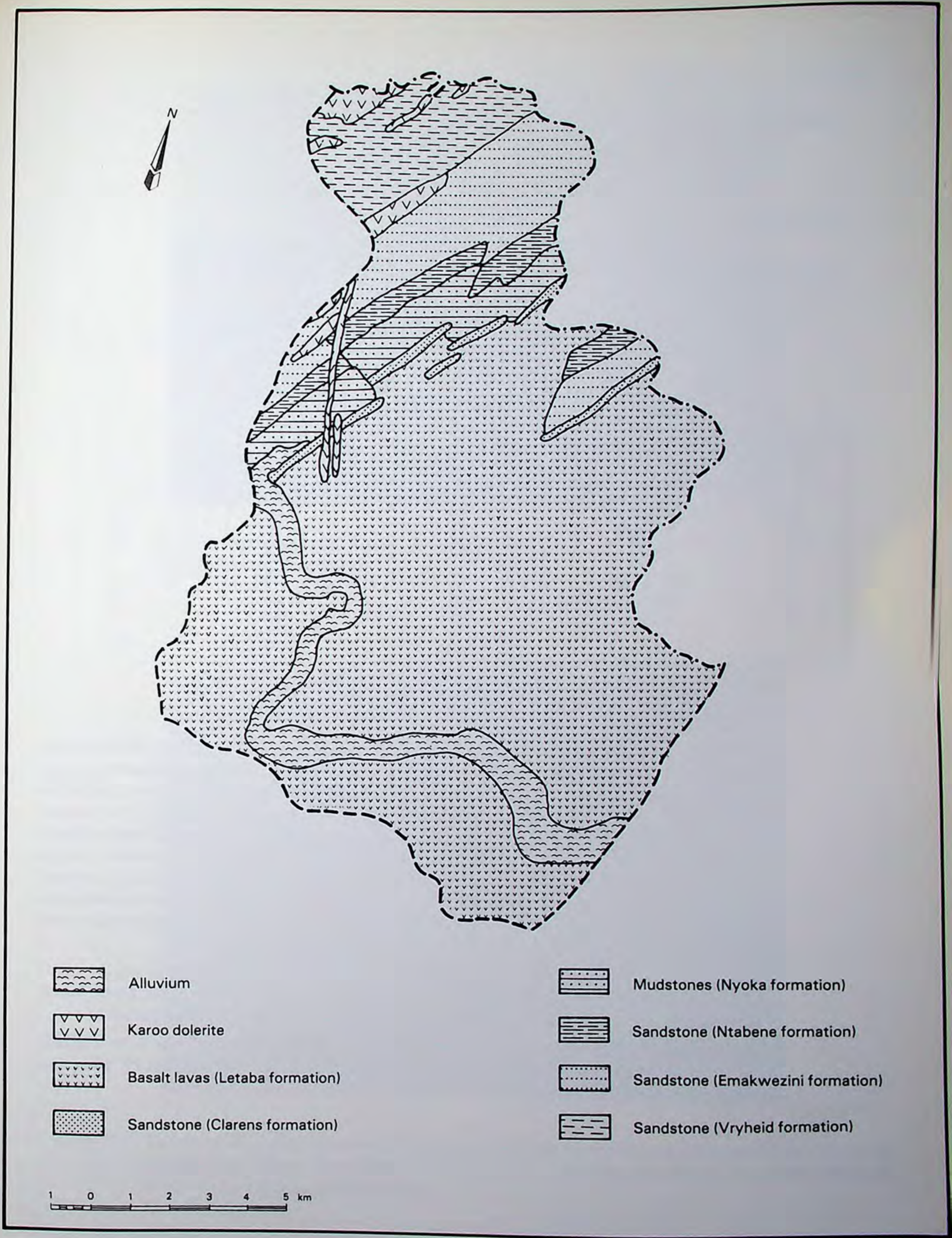


Fig. 81: The distribution of wetlands in quaternary sub-catchment W265. These data were derived from Job 608 of 1970.



Source: Dept. of Geological Survey

Fig. 82: The geology of quaternary sub-catchment W265

Wetland inventory (Table 45)

- Wetland distribution (Pre Iron Age).
  No. of wetlands: 76
  Size range : 1 to 98 (ha)
  Area of sub-catchment under wetland: 664 ha (2,7%)
- Wetland status (at present).
  Area of sub-catchment under wetland: 470 ha (1,9%)
- Wetland losses: 194 ha (29%)
- Further details:
  The main feature of sub-catchment W265 is the high incidence of pans. The 6 pan systems listed below, account for 350 ha (75%) of the existing wetlands in this sub-catchment.

Wetland No. (Fig. 81)	Name	Approximate open water surface area (ha)	Approximate extent of surrounding wetland (ha)	TOTAL (ha)
20	Mbukwini	45	53	98
25	Ntweni	32	26	58
44	Nkata	15	25	40
56	Majamisa	31	15	46
62	Mvanyamvanya	10	36	46
72	Makata	20	43	63
		153	198	351

The basic limnology of these systems has been investigated by Pike (1975, 1979) and by Johnson *et al.*, (1979). Although turbid systems, they are regarded as productive water bodies, that are under-utilised at present. Generally speaking, they are very similar to one another. The conductivity and phosphorus levels of the water is high. Maximum depths are between 2 - 3 m, and water levels are fairly stable. Submerged macrophytes (*Potamogeton* spp.) are dominant, the fish fauna is dominated by barbel (*Clarias gariepinus*) and bream (*Sarotherodon mossambicus*). Species of marine origin (e.g. tarpon) also occur, which confirms that periodically the Mfolozi river and these pan systems are in direct contact. From an ornithological point of view, the numbers of Pygmy geese are noteworthy, and Mbukwini pan (Plate 20) supports a large heronry.

Each pan has its own catchment (Table 45) and has been formed by the deposition of levees on the banks of the Mfolozi River (Plate 21). They are described as lateral lakes, which have become in-filled by sediments emanating from soil erosion upstream.

The pans are an important source of water and protein to the Zulu people settled in this area. They are used for drinking, fishing, laundering, bathing and stock watering purposes.

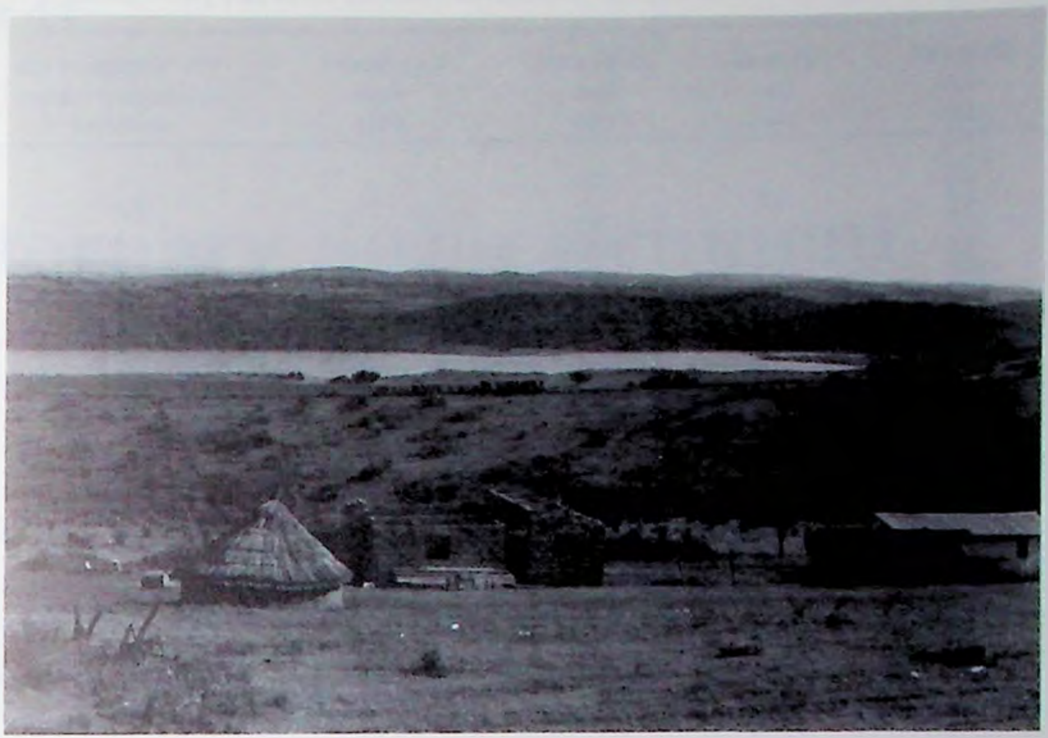


Plate 20: A view of Mbukwini pan as an example of one of the six pans in quaternary sub-catchment No. W265.

Plate 21: The sand deposits which seal the outlet of Mbukwini pan, partly account for its stable water level. These deposits prevent direct contact between the pan and the Mfolozi River, except during flood events.

Table 45: The present status of wetlands in quaternary sub-catchment W265 (Fig. 81). Where wetland losses have amounted to 100%, no further data are provided.

Wetland No:	Original size (ha)	Present size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	2,0	-	100	-	-	-
2	2,5	2,5	-	10	25,0	0,6
3	2,0	-	100	-	-	-
4	1,5	-	100	-	-	-
5	2,0	-	100	-	-	-
6	13,0	-	100	-	-	-
7	3,0	-	100	-	-	-
8	1,5	-	100	-	-	-
9	2,0	-	100	-	-	-
10	2,5	1,0	60	22	4,5	0,2
11	8,0	8,0	-	3 712	0,3*	1,8
12	1,5	-	100	-	-	-
13	1,5	-	100	-	-	-
14	2,0	2,0	-	12	-	0,5
15	1,0	1,0	-	17	-	0,5
16	3,5	-	100	-	-	-
17	2,0	2,0	-	197	-	0,7
18	3,0	-	100	-	-	-
19	3,0	3,0	-	67	-	1,3
20	98,0	98,0	-	5 600	2,1*	8,0
21	9,5	9,5	-	255	3,7	3,0
22	5,0	-	100	-	-	-
23	2,0	2,0	-	512	2,2*	0,7
24	4,5	4,5	-	1 217	1,3*	1,4
25	58,0	58,0	-	2 587	2,9*	8,5
26	2,5	2,5	-	32	7,8	0,8
27	2,5	2,5	-	222	1,1	0,8
28	2,0	-	100	-	-	-
29	1,5	-	100	-	-	-
30	18,0	-	100	-	-	-
31	5,0	2,0	60	80	2,5	0,3
32	4,0	-	100	-	-	-
33	2,5	-	100	-	-	-
34	3,5	-	100	-	-	-
35	3,0	-	100	-	-	-
36	3,0	-	100	-	-	-
37	5,0	-	100	-	-	-
38	5,0	-	100	-	-	-
39	4,5	4,5	-	62	7,2	1,0
40	15,0	14,0	7	122	15,1*	4,8
41	3,0	3,0	-	140	5,0*	0,7
42	2,5	2,5	-	35	7,1	0,9
43	4,0	4,0	-	57	7,0	1,5
44	40,0	27,0	32	3 812	1,6*	4,3
45	6,5	-	100	-	-	-
46	7,0	-	100	-	-	-
47	22,0	-	100	-	-	-
48	3,0	-	100	-	-	-
49	5,0	-	100	-	-	-
50	16,0	4,0	75	250	1,6	0,9
51	4,5	4,5	-	57	7,9	1,7
52	4,5	-	100	-	-	-
53	5,5	5,5	-	155	3,5	1,2
54	2,0	2,0	-	25	8,0	0,6
55	3,5	-	100	-	-	-
56	46,0	40,0	13	1 180	4,4	4,0
57	1,5	1,5	-	127	1,2	0,5
58	2,5	2,5	-	70	3,6	1,0
59	2,0	2,0	-	160	2,8*	0,6
60	3,5	3,5	-	57	6,1	1,4
61	2,5	2,5	-	175	1,4	0,9
62	46,0	46,0	-	495	9,3	11,6
63	4,0	4,0	-	25	16,0	0,8
64	2,5	2,5	-	30	8,3	0,8
65	3,0	3,0	-	57	5,2	0,9
66	5,0	3,5	30	57	6,1	1,3
67	11,0	9,0	18	260	4,8*	1,4
68	4,0	4,0	-	62	6,4	1,6
69	3,5	-	100	-	-	-
70	3,0	3,0	-	55	5,4	1,1
71	5,0	5,0	-	60	8,3	2,0
72	63,0	63,0	-	930	8,3*	13,0
73	3,5	3,5	-	37	9,4	1,1
74	2,5	2,5	-	22	11,4	0,8
75	8,0	-	100	-	-	-
76	1,5	-	100	-	-	-
TOTAL	664,0	470,0				91,0

* includes upstream wetlands.

Chapter 44

Quaternary Sub-catchment Nos: W266 & W267

Name: Mfolozi (principal river)
Fig. No: 83

Quaternary sub-catchment background data

- Size (Pitman *et al.*, 1981).
  505 km^2
- Range in altitude.
  80 to O m above sea level
- Physiographic region (Turner, 1967).
  region 42 (Zululand Coastal Plain)
- Geology (Geological Survey Dept., pers. comm.).
  Unconsolidated superficial deposits mainly comprising alluvium, yellowish sand and the occasional outcrop of glauconitic siltstone.
- Soils (Fitzpatrick, 1978).
  grey and red (coastal) sands.
- Veld type (Acocks, 1953).
  veld type 1 (Coastal Forest and Thornveld)
- Bioclimatic region (Phillips, 1973).
  region 1 (coastal lowland)
- Mean annual precipitation.
  Overall (Pitman *et al.*, 1981): 1 147 mm
  Range (Schulze, 1982): 800 to 1 400 mm
- Mean annual run-off (Pitman *et al.*, 1981).
  69 million cubic metres/year.
- Land use (Nanni, 1982).
  Nearly all economic activity in this region of the catchment revolves around the sugar industry established on the Mfolozi Flats. These flats comprise one of the most fertile cane producing areas in South Africa, yielding on average well over 1 million tons of cane annually (Dewey, 1986). In addition to this, a large amount of timber is grown in the region.

  Several significant natural areas managed by the Dept. of Environment Affairs (Directorate of Forestry) occur with sub-catchments W266 & W267. These are the semi-unaltered portions of the Mfolozi swamps, the dune forests of Maphelana, and parts of the Dududuku Coastal Lowlands Forest (Cooper, 1985).

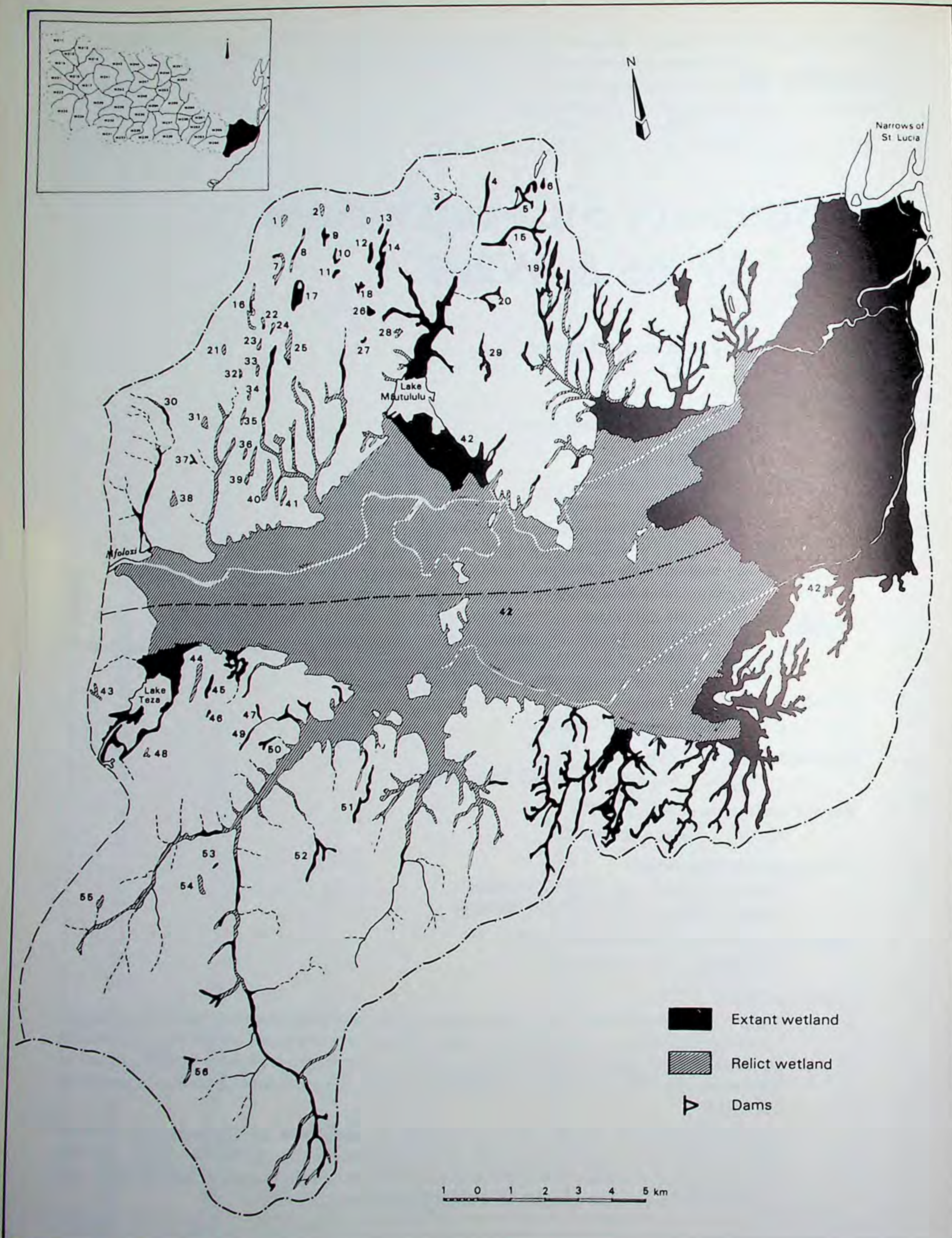


Fig. 83: The distribution of wetlands in quaternary sub-catchments W266 and W267. These data were derived from Job 608 of 1970.

Wetland inventory (Table 46)

- Wetland distribution (Pre Iron Age).
  - No. of wetlands: 56
  - Size range : 1,5 to 21 322 (ha)
  - Area of sub-catchment under wetland: 21 670 ha (43%)
- Wetland status (at present).
  - Area of sub-catchment under wetland: 9 279 ha (18,4%)
- Wetland losses: 12 391 ha (57%)
- Further details:

  Quaternary sub-catchment W266 (drained by the lowermost reaches of the Mfolozi River) and sub-catchment W267 (drained by the lowermost reaches of the Msunduzi) are treated together, because the former contains the northern portion of the "Mfolozi swamps", and the latter contains the southern portion. These swamps (Wetland No. 42, Fig. 83) constitute the second largest wetland system in Natal, and for inventory purposes, warrants particular attention. Having recently been the subject of an investigation by the National Research Institute for Oceanology, the data presented below are therefore largely drawn from the work of van Heerden (1984, 1985) and Looser (1985).

44.1 The Mfolozi swamps (Wetland No. 42, Fig. 83)

Form

The Mfolozi swamps comprise an alluvial plain centred upon co-ordinates 28°29'S and 32°18'E, which prior to any man-induced modification or alteration extended over approximately 21 322 ha, thus making the Mfolozi swamps the largest fluvial coastal plain in South Africa. The perimeter of the swamp was formerly 528 km in length, but this has now been reduced through agricultural encroachment to 312 km. The average width of the swamp is c. 6,8 km, and the maximum width is 11 km. Over its length of 28 km the land falls 20 m in height, which suggests that the average slope is 0,07%. However, it is most important to realise that the swamps lie tilted in a north-south direction with the lowest portion therefore, being the channel of the Msunduzi River. This accounts for the tendency for water and sediment to spread in this direction whenever the Mfolozi River overflows its banks.

Most of the swamp system lies within the meander belt of the Lower Mfolozi River, which is a complex of active, abandoned and near-channel environments. Shifts in position of the meander belt are common and are a reflection of the hydrological processes operative in this type of environment.

These processes (see glossary) include

- river meandering
- levee formation
- avulsion, and
- subsidence.

Table 46: The present status of wetlands in quaternary sub-catchments W266 and W267 (Fig. 83). Where wetland losses have amounted to 100%, no further data are provided.

Wetland No:	Present size (ha)	Original size (ha)	Proportion lost (%)	Catchment size (ha)	Percentage of the catchment under wetland	Perimeter (km)
1	4,5	-	100	-	-	-
2	3,0	-	100	-	-	-
3	3,5	3,5	-	65	5,4	1,1
4	13,0	13,0	-	910	3,7*	3,5
5	14,0	14,0	-	240	5,8	4,3
6	3,5	3,5	-	42	8,3	0,8
7	7,0	1,0	86	57	1,7	0,3
8	7,0	4,0	43	87	4,6	1,4
9	6,0	6,0	-	37	16,2	1,0
10	3,0	3,0	-	37	8,1	0,8
11	2,0	2,0	-	42	4,7	0,5
12	4,5	4,5	-	50	9,0	1,3
13	3,0	3,0	-	45	6,6	0,7
14	21,0	21,0	-	292	9,7*	3,9
15	20,0	20,0	-	280	7,1	7,6
16	9,5	2,0	79	120	1,6	0,5
17	20,0	20,0	-	107	18,7	2,0
18	4,5	4,5	-	42	10,7	0,9
19	6,0	4,5	25	55	8,2	2,0
20	10,0	10,0	-	132	7,6	2,2
21	2,5	-	100	-	-	-
22	2,0	1,0	50	42	2,4	0,2
23	2,5	-	100	-	-	-
24	2,5	1,0	60	35	2,8	0,2
25	12,5	1,5	88	102	1,5	0,3
26	5,0	5,0	-	45	11,1	0,8
27	1,5	1,5	-	35	4,3	0,5
28	3,0	-	100	-	-	-
29	12,0	12,0	-	170	7,0	3,6
30	5,5	3,0	45	137	2,2	1,1
31	4,5	-	100	-	-	-
32	2,0	-	100	-	-	-
33	3,0	-	100	-	-	-
34	1,5	-	100	-	-	-
35	3,0	-	100	-	-	-
36	3,0	-	100	-	-	-
37	3,0	3,0	-	50	6,0	0,6
38	6,5	-	100	-	-	-
39	8,0	-	100	-	-	-
40	14,0	-	100	-	-	-
41	4,5	-	100	-	-	-
42	21 322,0	9 059,0	57	50 500	18,4*	312,0
43	4,0	-	100	-	-	-
44	9,5	-	100	-	-	-
45	6,0	6,0	-	50	12,0	1,5
46	1,5	1,5	-	25	6,0	0,5
47	3,5	3,5	-	42	8,3	1,1
48	2,0	-	100	-	-	-
49	3,5	3,5	-	80	4,4	1,6
50	4,5	4,5	-	27	16,6	1,3
51	14,0	14,0	-	112	12,5	4,0
52	13,5	13,5	-	390	3,5	4,8
53	1,5	1,5	-	37	4,0	0,6
54	6,5	-	100	-	-	-
55	4,5	-	100	-	-	-
56	7,0	4,5	36	192	2,3	1,0
TOTAL	21 670,0	9 279,0				370,0

* includes upstream wetlands.

The Mfolozi swamps are underlain by more than 30 m of relatively fine grained sediments consisting of silts and clays (Fig. 84). However, as sea level has risen over the last 18 000 years, so has the level of the floodplain, and under the influence of continual loading, sediments in the deeper positions have dewatered and compacted. These events, together with periodic floods, therefore accounts for the channel switching which commonly occurs on the Mfolozi flats. The pattern of channels, each representing a former course of the river, is evident from aerial photography of the Mfolozi swamps, and the chronological order of these switches is shown in Fig. 85.

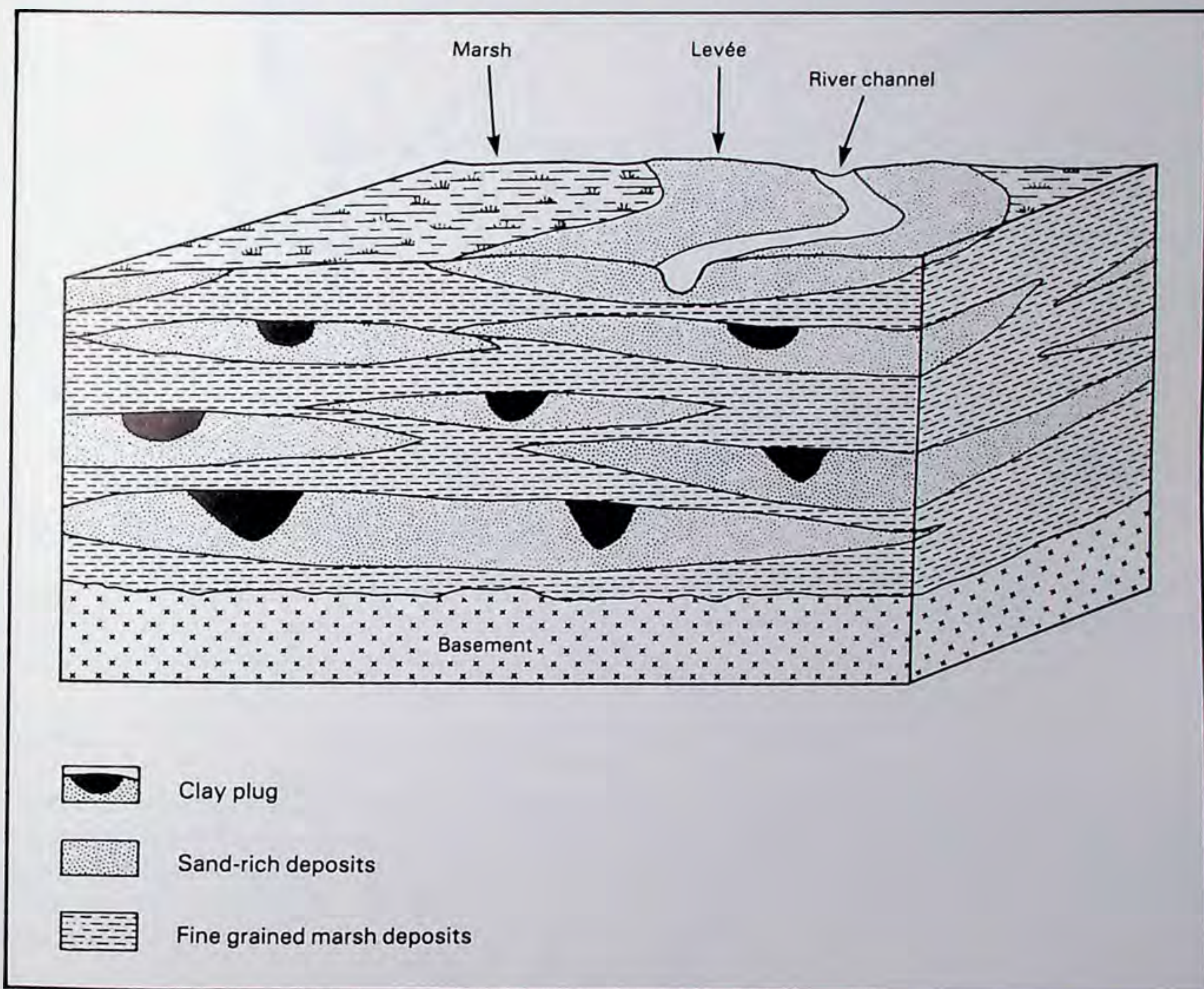


Fig. 84: Conceptual section through the Mfolozi Flats, showing the layering of the fluvial plain sediments (after van Heerden, 1985).

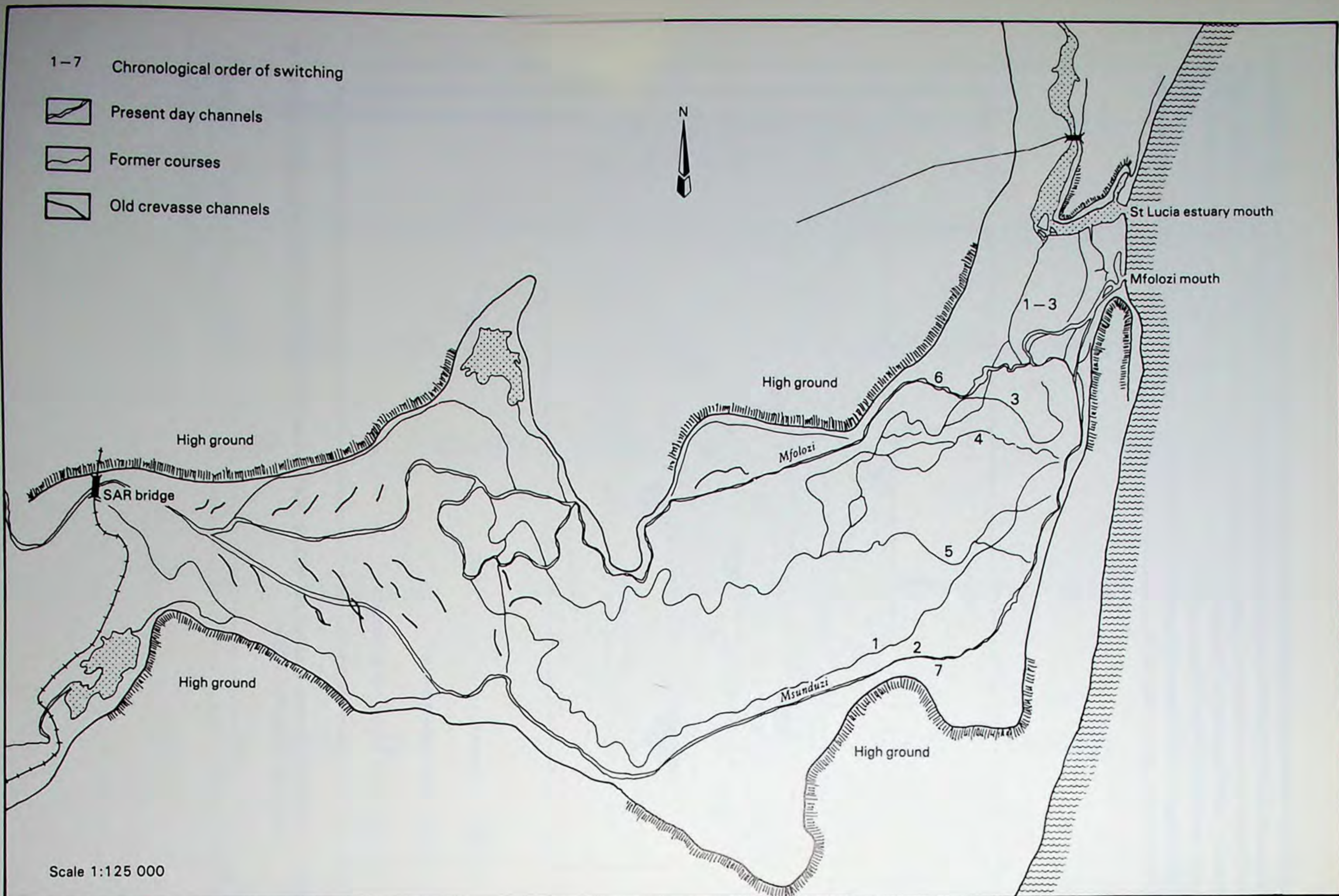


Fig. 85: Channel traces, apparent from aerial photographs of the Mfolozi Flats, showing the suggested chronological order of channel switching (after van Heerden, 1985)

Over and above such natural processes, man's activities have greatly influenced the swamps (Anon. (1966); Cooper (1984)) through the construction of artificial levees, canals, drains and flood protection works (Fig. 86). These activities have been designed to lower the water table and to impede the spread of sediment to areas adjacent to the river, but they have also increased the local subsidence rates, and caused numerous problems associated with sedimentation further downstream. Other interferences have included:

- in 1952, diversion of the mouth of the Mfolozi away from the mouth of the St. Lucia estuary (Orme (1974); Begg (1978)),

- in 1978, construction of a "link canal" designed to provide the St. Lucia system with freshwater at times when the salinity of the lake becomes unacceptably high,

- maintenance dredging and spoil disposal along the banks of the Msunduzi River.

Macroclimate

With reference to the data provided by Phillips (1973) the macroclimate of this region is indicated in the table below:

• mean annual precipitation	=	1 300 mm	
• relative humidity	=	75-80 %	
• temperature			
mean annual	=	21 °C	
		Maximum (°C)	Minimum (°C)
mean daily	=	25	16,5
extreme daily	=	46	2,0
• mean annual potential evaporation	=	1 000 mm	

There are at least four weather stations in the area. These are River View (Station 339/357), Dududuku (Station 339/441), Uloa (Station 339/538) and Cape St. Lucia (Station 339/720). Between them, these stations have records extending back to 1918.

Hydrology

Lying at the receiving end of a 10 000 km^2 catchment, it is understandable that large volumes of water pass through the Mfolozi swamps at different times of the year. Estimates of the mean annual run-off from the Mfolozi catchment vary from 1 060 x 10 m^3 (Chew and Bowen, 1971) to 746 x 10 m^3 (Hutchison, 1976). The mean annual run-off from the Msunduzi catchment is stated to be 89 x 10 m^3 (Chew and Bowen, 1971).

Both the Black and the White Mfolozi have erratic flow characteristics. Occasionally they cease flowing altogether in the dry season, and in the wet season flood violently. The mean annual flow is in the order of 45 m^3/sec, and the "bank full" capacity estimated to be 500 m^3/sec (Weiss and Midgley (1976) in Begg (1978), p. 71).

Periodically devastating floods occur, the magnitude and frequency of which are given below (Comrie-Greig and Cooper, 1984). The most recent, and unforgettable, of these flood events was that associated with Cyclone "Domoina" which struck Northern Natal in January 1984. "Domoina" generated an unprecedented amount of rainfall (e.g. 415 mm in one day at Matubatuba) and, since the catchment was unable to absorb or store such excessive volumes of water, devastating floods resulted downstream.

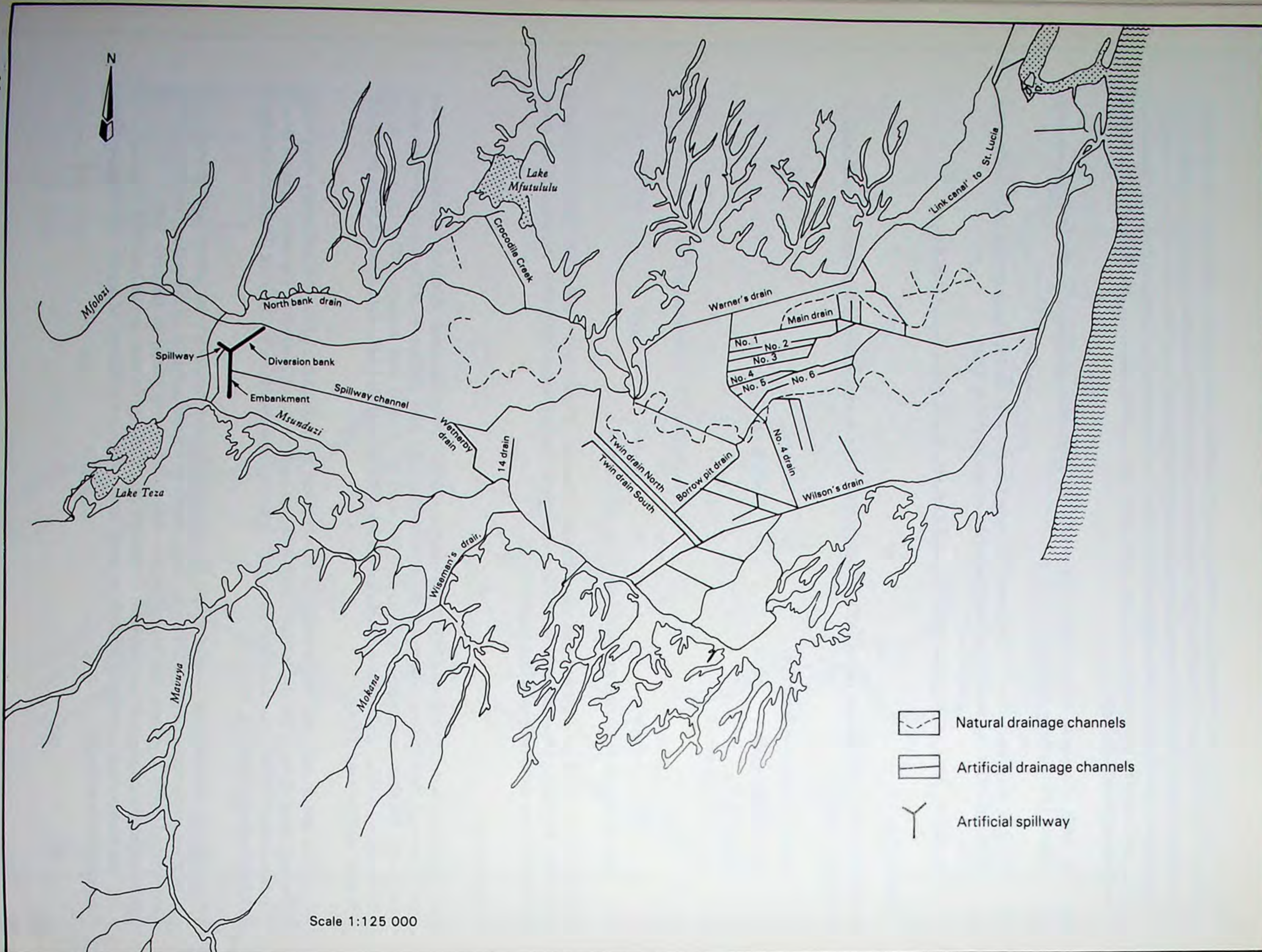


Fig. 86: Drainage of the Mfolozi Swamps.

Source: Umfolozi Co-operative Sugar Planters Ltd.

Year	Flow (in m^3/sec)
1880	4000
1905	3000
1918	3700
1925	3000
1937	1500
1953	2000
1956	1600
1957	5650
1963	8500
1973	2300
1975	2300
1977	7650
1984	c 15000

Siltation

The average sediment load carried by the Mfolozi River is 2,5 million tons (Rooseboom, 1975). However, during Cyclone "Domoina", six times this amount of sediment was deposited on the Mfolozi Flats in one storm event. In this case the extremely high flood levels forced the Mfolozi River to switch channels and occupy a course which possessed a better gradient to the sea (i.e. along the lower lying, southern edge of the swamp system), and over 15 million tons of sediment were deposited in a wedge-shaped zone now referred to as "the trap area" (Fig. 87). The coarsest fraction of the suspended load (sand) occupied the upper reaches of the wedge, and the finest fraction (silt and clay) occupied the lower reaches. This difference resulted from the drop in water velocity that occurred as the floodwaters, once unconfined by the river valley, spread over the swamp (Plates 22 & 23).

Albeit entirely natural for sedimentation to occur in an area such as the Mfolozi swamps, sediment deposition remains as the greatest problem that managers of the area presently have to face. Furthermore, the matter is exacerbated by the poor condition of the catchment upstream.

Plate 22: An impression of the "sand trap area" in the upper portion of the Mfolozi flats, one year after these deposits were laid down during Cyclone Domoina. (Date of photo: 1985.01.24).

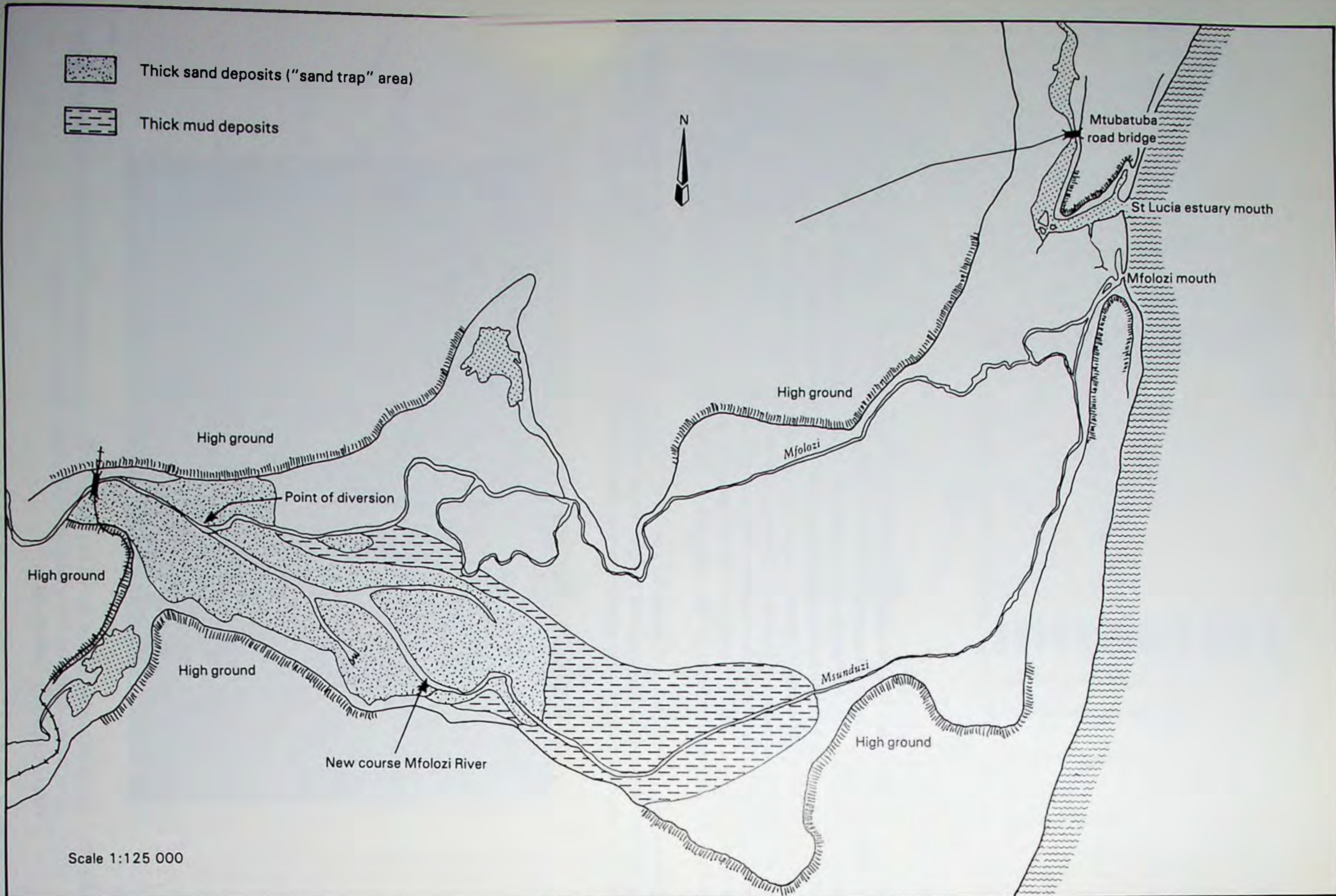


Fig. 87: Fluvial deltaic deposits laid down over the Mfolozi Flats after floods associated with Cyclone Domoina (after van Heerden, 1985)

Plate 23: A considerable amount of sedimentation took place in the Mfolozi flats during "Domoina". These post-flood photos suggest that 38% of the cultivated areas on the Mfolozi flats were buried in sand and silt (Kovacs *et al.*, 1985).
(Photo source: Sugar Industry Central Board).

Fauna and flora

Although approximately 9 000 ha of the Mfolozi swamps have not been reclaimed for sugarcane or timber production, the undeveloped areas have nevertheless been altered by the construction of drains and artificial levees on both banks of the Mfolozi and Msunduzi Rivers (Fig. 86).

The precise nature of the plant communities which comprise the Mfolozi swamps is unclear. According to Croft (1905) (in Begg, 1978 : p 76) reedswamp (*Phragmites*) and mangroves (*Avicennia* and *Bruguiera*) dominate the lowermost portion of the swamps near the sea; Beater (1962) and Weisser (1978) describe the vegetation in the vicinity of Lake Teza, and west of the Mapelane dunes to be dominated by papyrus (*Cyperus papyrus*); Cooper (1985) considers that the Mfolozi swamps are "succeeding rapidly from a Papyrus Swamp to a Swamp Forest", and that there has been a dramatic increase in the patches of swamp forest (*Ficus trichopoda*) during the past 20 years. Weisser (1978) found extensive beds of *Phragmites* and *Typha capensis* (bullrushes) in parts of the swamp, and maintains that elsewhere the swamp is dominated by *Echinochloa pyramidalis* (antelope grass). This has been confirmed by Taylor (pers. comm.*), who suggests that the area is not as wet as people imagine, and that various forms of alien vegetation (including bugweed, napier fodder, *Syringa*, and Paraffin weed (*Eupatorium odorata*) have also become established in the swamps. Apart from the clumps of *Ficus trichopoda* already mentioned, large tracts of *Barringtonia racemosa* (freshwater mangrove) also occur. Clearly, the swamps comprise a mosaic of different plant communities, a more thorough understanding of which is highly necessary.

Very little is known about the fauna associated with the Mfolozi swamps, although the fauna of Lake Teza have been partially documented by the Natal Parks Board (Anon, 1986). It is clear that both Lake Teza (188 ha) and Lake Mfuthululu (155 ha) are important refuge areas for wildlife, and waterfowl in particular. For example, Lake Teza is ranked amongst the best ten coastal wetlands in Natal, with bird densities of 186/km of shoreline having been recorded (Ryan *et al.*, 1986.). Pygmy geese, which is a species considered to be rare in Southern Africa, are particularly numerous, with populations in excess of 600 birds having been recorded.

Land tenure

Land ownership of the Mfolozi swamp is complicated , not only because of the size of the swamp and the different uses to which it has been subjected, but also because of the recent change in landownership brought about by Cyclone "Domoina" (Fig. 88). The damage caused by "Domoina" has prompted the State to buy the land back from the land owners (rather than continuing to compensate them for flood damage) and to place this land (the "sand trap area", Fig. 87) under the jurisdiction of the Directorate of Forestry.

The Mfolozi swamps are owned by three parties :

- The State
  Controlling the eastern edge of the swamp adjacent to the forested dunes of Mapelane; the "sand trap area", Lake Teza, Lake Mfuthululu, the northern extremities of the swamp which extend into the Dukuduku State Forest; the mouth of the Mfolozi River and its connections to St. Lucia.

- The Umfolozi Co-operative of Sugar Planters (UCOSP)
  Comprising over 150 separate sugar cane farms occupying the upper and middle reaches of the swamps.

- Timber companies
  The farms owned by timber companies lie mainly in an area south of the Mfolozi Flats, and are particularly evident in that part of the swamp known as the Mavuya River. Of the 6 different parties involved the majority of the plantations in sub-catchments W266

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* R Taylor: Research Officer, Natal Parks Board, St. Lucia.

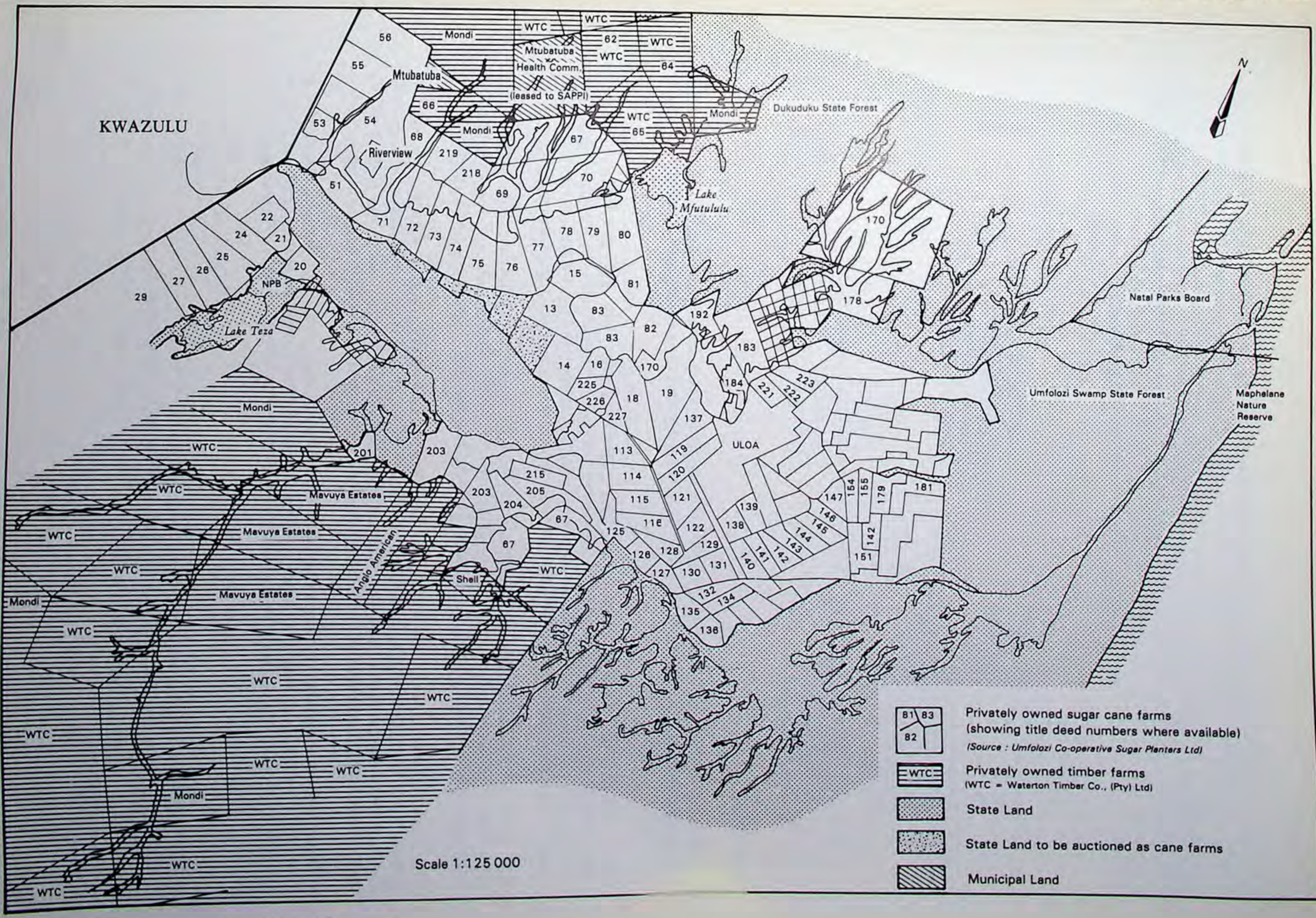

Fig. 88: Landownership of the Mfolozi Swamps.

& W267 are owned by the Waterton Timber Co., (i.e. the timber division of SAICCOR, van der Walt, pers. comm.*).

Exploitation of the Mfolozi swamps in the manner described above has brought about varying degrees of disruption. The most important of these are those associated with physical alteration of the system :

	Perceived severity of problem*
• crop production	2
• afforestation	2
• water abstraction	1
• channelling & ditching	3
• flood diversion structures	2
• dam construction	1
• levee construction	2
• waste disposal (bagasse, dunder)	1
• road construction	1
• rail construction	1
• siltation	2

* 1 = moderately serious
2 = serious
3 = very serious

Conclusion

Despite the fact that so little is known about the Mfolozi swamp, there is no doubt that even in its highly modified condition, the Mfolozi swamp constitutes one of the most important wetland systems in Natal.

The economic and ecological importance of the swamp results from the area being a natural depositional sedimentary environment. However, man's interference with the swamp (associated mainly with agricultural development) began over sixty years ago, and since that date has intensified steadily, to the extent that at present only 43% of the system remains in a semi-natural condition.

The most recent aerial photography (Plate 23) and local sources of information indicate that agricultural encroachment is continuing. Thus, if what remains of the Mfolozi swamps is to be protected, a limitation to further expansion of agriculture into the swamp must be specified.

The Mfolozi swamp is a classical example of how wetlands can be used, and cannot be used to advantage. The downstream consequences of such mismanagement for St. Lucia, the economic consequences for the sugar industry, the upstream consequences for planned works such as dams, and the ecological consequences as far as the swamp is concerned, are closely inter-related factors.

Therefore, if management and conservation of the Mfolozi swamp is to be effective (i.e. to ensure long term stability and sustained resource availability) it is essential that an integrated land use plan be prepared. This plan must incorporate the entire swamp system (Fig. 83), and be adhered to by all the parties concerned (Fig. 88).

* Mr J L van der Walt: Managing Director, Waterton Timber Co., KwaMbonambi.

Finally, the ability of the developed and undeveloped parts of the Mfolozi swamp to retain river borne sediment, is a characteristic of the area that must be allowed for in any future management plan. It is recognised that misuse of the catchment has done much to aggravate this problem, and that a dam upstream would alleviate the situation, but the recommendation to permanently set aside the "sand trap area" as a sediment sink (van Heerden, pers. comm.*) is fully supported. However, when another flood occurs it should be anticipated that the deposits that are presently in the sand trap area could be reactivated, and could migrate downstream. Therefore, the farms on the edge of the sand trap area are somewhat hazardly situated.

Sources of information

Maps : 1:50 000 sheets 2832 AC Matubatuba
2832 AD & BC St. Lucia Estuary
2832 CB Cape St. Lucia
2832 CA KwaMbonambi

Aerial photographs :

Year	Job	Scale	Strip No.	Photo Nos.
1937	117	1:24 000		
1960	442	1:40 000	no record	no record
1965	449/4	no record		
1970	608	1:20 000	22	0912 - 0923
			23	0854 - 0866
			24	0759 - 0771
			25	0742 - 0754
			26	4780 - 4791
			27	6477 - 6485
			28	6397 - 6398
			29	6378 - 6379
1975	752	1:50 000	no record	no record

Literature:

See References (Chap. 46.0) under:

Anon, 1966
Beater, 1962
Begg, 1978
Chew & Bowen, 1971
Comrie-Greig, 1984
Comrie-Greig and Cooper, 1975
Cooper, 1984 (a&b)
Cooper, 1985
Dewey, 1986
Looser, 1985
Orme, 1974
Perry, 1986
Porter, 1977
Ryan *et al.*, 1986
van Heerden, 1984, 1985
Weisser, 1978

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* Dr I van Heerden: National Research Institute for Oceanology, Stellenbosch.

Chapter 45

Conclusions

"By the construction of open drains, waterlogged areas were dried out and rendered fit for cultivation, and by protecting river banks, flooding was diminished .. .."

Department of Irrigation (1948).

This study was undertaken to establish

- the distribution of wetlands in the Mfolozi catchment
- the extent of wetlands in the Mfolozi catchment
- the status of wetlands in the Mfolozi catchment, and
- to assemble information relevant to the management of wetlands in the Mfolozi catchment (Chap. 1.4 refers).

45.1 The distribution of wetlands

45.1.1 Actual distribution

By plotting the location of every wetland presently or formerly larger than 1 ha in size on 1:50 000 maps, the distribution of wetlands in the Mfolozi catchment has been established for the first time in the history of this region. Excluding seepage areas (see glossary) 1 485 wetlands were located (Table 47), 751 (51%) of which were in the catchment of the White Mfolozi River (see Frontispiece). A further 477 (32%) occurred in the catchment of the Black Mfolozi, and 257 (17%) in the lower Mfolozi region.

Of the wetlands located in the catchment, 641 (43%) comprised unfragmented extant wetlands, whereas 355 (24%) comprised extant, but fragmented wetlands. The location of only 33 wetlands had already been shown on the 1:50 000 maps. Thus, the decision to re-interpret aerial photography as a means of identifying wetlands in a catchment study of this nature is fully justified (Chap. 1.2).

Table 47: The number of wetlands in the Mfolozi catchment according to their present status and the sub-catchment in which they occur (see Frontispiece).

Status	White Mfolozi	Black Mfolozi	Lower Mfolozi	Whole catchment
Extant wetlands	309	216	116	641
Extant, but fragmented wetlands	192	96	67	355
Relict wetlands	250	165	74	489
Original number of wetlands	751	477	257	1485

A total of 489 relict wetlands were located, many of which had already been mapped by the Surveyor General as dongas or eroded water courses. Thus, 33% of the wetlands in the catchment were in a condition whereby they were assumed to have lost their normal wetland functions and values.

45.1.2 *Factors determining the distribution of wetlands*

Several physiographic, bioclimatic and geomorphological factors determine the occurrence of wetlands in the landscape. Due to the ready availability of maps containing such information for the Mfolozi catchment (Figs. 4, 6, 7, 8, 9, 10 and 12 refer) an attempt was made to examine provisionally, some of these inter-relationships in more detail.

a. The distribution of wetlands according to physiographic region (Table 48).

Taking the historical areal cover of wetlands into account (Chap. 45.2.1), the data contained in Table 48 indicate that 221 km^2 (44%) of the wetland in the Mfolozi catchment occurs in the Zululand coastal plain (physiographic region 42). In this region 32,7% of the landscape is occupied by wetland, due to the large catchment upstream, the change in river gradient in the lower reaches of the catchment, and the high local rainfall. These features give rise to the extensive floodplains, pans and swamps which characterise this region, the largest of which is the Mfolozi swamp, which occupies 31% (213 km^2) of this relatively small (675 km^2) physiographic region.

The plainland regions and the upland regions, occupying a total of 1 249 km^2 (12%) and 1 895 km^2 (19%) of the Mfolozi catchment respectively, were more or less equally rich in wetlands. The three plainland regions contained c. 85 km^2 (17%) of the wetland in the catchment, and the three upland regions contained 101 km^2 (20%). The wetland cover in these two types of terrain was 6,4% and 5,3% respectively.

The high-lying plateau region contained very little wetland, but only because 0,6% of the catchment is involved, and individual wetlands in the plateau region are seldom larger than 3 ha (e.g. Nsonto wetlands, Chap. 3.1.1).

Although occupying the greatest proportion of the catchment, i.e. 5 864 km^2 (58%), the lowveld and middleveld regions of Zululand contained the least amount of wetland (1,4% and 1,6% respectively). Only 88 km^2 of wetland were located in these areas, the low incidence of which is probably attributable to the arid nature of these regions (Chap. 45.1.2d).

b. The distribution of wetlands according to bioclimatic region (Table 49).

In defining the bioclimatic regions of Natal and KwaZulu, land form played a very important part (Phillips, 1973), therefore it is not surprising that a marked similarity between the data contained in Table 48, and that contained in Table 49 is apparent.

These data confirm that within the Mfolozi catchment the majority of the wetland located occurred within the coastal lowland area (bioclimatic region 1). This area, which occupies only 917 km^2 (9%) of the catchment, contained 225 km^2 of wetland, i.e. 45% of the wetland in the Mfolozi catchment. In the coastal lowland region of the Mfolozi catchment 24,5% of the landscape is occupied by wetland, whereas it has been estimated by Scotney & Wilby (1983) that on average only 5% of coastal lowland area of Natal is covered by wetland.

The two upland regions of the catchment (bioclimatic regions 6 and 8) also contained extensive amounts of wetland. These regions were found to contain 190 km^2 (38%) of the wetland in the Mfolozi catchment. However, the proportion of wetland cover in these areas, being 7,1% and 4,3% respectively, was considerably lower than that elsewhere in Natal where estimates of 10% and 12% for these particular bioclimatic regions have been quoted (Scotney & Wilby, 1983). The higher

Table 48: The distribution of wetlands in the Mfolozi catchment in relation to physiographic region (Fig. 4), (- denotes the occurrence is less than 1%).

Physiographic Region					Areal distribution of wetland		Wetland Cover	
Name	Catgegory	Area (km^2)	Percent	km^2	Percent	Total percent per category	Percent per region	Percent per category
Skurweberg Plateau	A	60	0,6	1	-	-	0,3	0,3
Nqutu Divide		484	4,8	40	8		8,3	
Babanango Block	B	494	4,9	11	2	20	2,2	5,3
Hlobane-Manyini-Ceza Block		917	9,1	50	10		5,4	
Buffalo Plain		10	0,1	1	-		5,0	
Utrecht-Vryheid Plain	C	383	3,8	31	6	17	8,1	6,4
Nondweni-White Mfolozi Plain		856	8,5	53	11		6,2	
Melmoth-Nkandhla Block	D	332	3,3	7	1	9	2,1	
Middleveld of Zululand		2 418	24,0	39	8		1,6	1,8
Lowveld of Zululand	E	3 446	34,2	49	10	10	1,4	1,4
Zululand Coastal Plain	F	675	6,7	221	44	44	32,7	32,7
TOTAL	10 075	100,0	502	100	100			

* Key: A = Plateau region
B = Upland region
C = Plainland region
D = Intermediate region
E = Low-lying region
F = Coastal region

Table 49: The distribution of wetlands in the Mfolozi catchment in relation to bioclimatic region (Fig. 10).

Bioclimatic Region					Areal distribution of wetland		Wetland percentage cover	
Name	No.	Area km^2	Percent a	Percent b	km^2	Percent	in Mfolozi catchment	in Natal* generally
Coast lowland	1	917	4	9	225	45	24,5	5
Coast hinterland	2	181	2	2	1	-	0,5	3
Mistbelt	3	403	6	4	5	1	1,2	3
Highland-submontane	4	614	6	6	15	3	2,4	8
Moist upland	6	1 270	10	13	90	18	7,1	10
Dry upland	8	2 307	30	23	100	20	4,3	12
Lowland-upland	9	1 260	11	12	36	7	2,8	N/R
Riverine-interior lowland	10	3 123	31	31	30	6	0,9	N/R
TOTAL		10 075	100	100	502	100		

Column a = contains estimates by NTRPC (1984)
Column b = contains revised estimates (this study)
N/R = no record.

* according to Scotney & Wilby (1983)

incidence of wetlands (7,1%) in the moist upland areas (bioclimatic region 6) is to be expected, due to the higher rainfall.

In contrast to this situation, the dry lowveld region (bioclimatic region 10) was sparsely covered in wetland. Here, only 30 km^2 of wetland occurred in a region 3 123 km^2 in extent. Other wetland poor regions were bioclimatic region 2 (coastal hinterland) and bioclimatic region 3 (mistbelt). The Mistbelt is a well watered area and so it is possible that the low incidence of wetland (1.2%) in this region, is attributable to the steep terrain.

c. The distribution of wetlands according to bedrock characteristics(Table 50).

Without knowing the exact proportion of the Mfolozi catchment occupied by each of the 18 different geological formations listed in Table 50, the true relationship between these data and the distribution of wetlands cannot be revealed. Furthermore, these data are biased by the large proportion of wetland (43%) occurring near the coast, where alluvium is stated to be the underlying material.

If alluvium is excluded the data indicate that 78% of the wetland occurring in the rest of the Mfolozi catchment was underlain by three different types of bedrock :

- Sandstone (of the Vryheid formation) underlay 40% of the wetland in the catchment,
- Dwyka tillite underlay 27% of the wetland in the catchment, and
- Karoo dolerite underlay 11% of the wetland in the catchment.

Table 50: The distribution of wetlands in the Mfolozi catchment according to bedrock characteristics (Fig. 15). (- denotes an occurrence of less than 1%).

Underlying geology	Areal distribution of wetland		
	km^2	Percent	Percent (if alluvium is excluded)
Younger rocks			
Alluvium	213	43	excluded
Yellowish (aeolian) sand	4	-	1
Karoo sequence			
Karoo dolerite	32	6	11
Sandstone			
Vryheid formation	117	23	40
Emakwezini formation	4	1	1
Clarens	1	-	-
Ntabeni	1	-	-
Shale			
Pietermaritzburg formation	11	2	4
Volksrust formation	1	-	-
Basalt lavas	15	3	5
Dwyka tillite	78	16	27
Mudstone	6	1	2
Natal Group Sandstone	2	-	-
Pongola sequence (volcanic rocks)			
Mozaan group	1	-	-
Nsuzi group	1	-	-
Basement complex			
Granite	15	3	5
Quartz feldspar	1	-	-
Basal quartzite	1	-	-
TOTAL	502	98	96

An 89% prevalence for wetlands to be distributed on granitic rocks in Zimbabwe has been demonstrated by Whitlow (1985), but no such relationship is evident in the Mfolozi catchment.

Elsewhere in Natal wetlands often occur in areas in which the geology is characterised by alternating strata of erosion resistant and non-erosion resistant rock types (Maud, pers. comm.)*, and generally, wetland rich areas are prevalent where thick sheets of dolerite occur. This tendency was apparent in the headwater regions of the Mfolozi catchment.

d. The distribution of wetlands according to mean annual precipitation (Table 51).

A very general picture of wetland distribution according to the known variation in mean annual precipitation within the Mfolozi catchment is summarised in Table 51. These data indicate that 44%

* Dr R Maud: Consulting Geologist, Drennan, Maud and Partners, Durban.

Table 51: The distribution of wetlands in the Mfolozi catchment in relation to mean annual precipitation (Fig. 12).

Mean annual precipitation			Areal distribution of wetlands		Wetland cover
Range (mm)	Area of catchment (km^2)	Percent	km^2	Percent	Percent
600 - 700	322	3	0	0	0,0
701 - 800	3 808	38	105	21	2,7
801 - 900	3 556	35	88	17	2,5
901 - 1 000	1 542	15	89	18	5,8
1 001 - 1 200	675	7	120	24	17,7
1 201 - 1 400	172	2	100	20	58,1
TOTAL	10 075	100	502	100	

of the wetlands in the catchment occur in areas that experience more than 1000 mm of rainfall per annum.

Only a small amount of the catchment (172 km^2) experiences more than 1 200 mm of rainfall per annum, and within this region (Fig. 12) the proportion of wetland cover is as high as 58%. Wetland cover diminishes from this exceptionally high amount of 58% in the 1 200 to 1 400 mm zone, to 18% in the 1 000 to 1 200 mm zone, to 6% in the 900 to 1 000 mm zone, to less than 3% in the 700 to 900 mm zone, to 0% in areas experiencing less than 700 mm of rainfall per annum.

In conclusion therefore, there seems to be a strong association between the incidence of wetlands and the amount of rainfall in a particular region. The distribution of wetlands in the Mfolozi catchment illustrates that the amount of wetland increases directly in relation to the mean annual precipitation.

45.2 The extent of wetlands in the Mfolozi catchment

45.2.1 Historical areal cover

The data presented in Table 52 illustrate that originally 5% (50 244 ha) of the Mfolozi catchment was occupied by wetlands. This is probably a highly conservative estimate, because the results of a survey conducted in the Tugela catchment (van der Eyk *et al.*, 1969) indicate that originally at least 13% of the Tugela catchment was covered by hydromorphic soils (i.e. wetland). The difference between these estimates of wetland cover in two adjacent ecologically similar catchments, is attributed to differences in interpretation of the aerial photography used.

Of the 50 244 ha of wetland mapped, 48% (24 255 ha) lay in the Lower Mfolozi region (Frontispiece). This region was richer in wetlands than any other portion of the catchment for reasons that have already been stated (Chap. 45.1.2a). The White Mfolozi catchment contained 41% (20 392 ha) of the wetland demarcated, whereas the catchment of the Black Mfolozi River contained 11% (5 587 ha).

The original extent of wetland in each quaternary sub- catchment (Fig. 13) varied from 43% in sub-catchments W266 and W267, to 0,02% in sub-catchment W235. The average amount of wetland cover within each of the 43 quaternary sub-catchments of the Mfolozi catchment was 3,8%.

Table 52: Quantification of wetland cover in the Mfolozi catchment.

Quaternary sub-catchment No.	Size (km²)	Original amount of wetland cover (ha)	Original amount of wetland cover (%)	Present amount of wetland cover (ha)	Present amount of wetland cover (%)
White Mfolozi					
W211	275	3 052	11,0	2 864	10,4
212	120	422	3,5	126	1,0
213	235	1 650	7,0	334	1,4
214	270	1 850	6,8	275	1,0
215	130	594	4,6	102	0,8
216	255	1 822	7,1	938	3,6
217	190	1 469	7,7	287	1,5
221	220	1 102	5,0	301	1,4
222	400	1 625	4,1	475	1,2
223	320	2 485	7,7	268	0,8
224	300	353	1,2	117	0,4
225	355	572	1,6	85	0,2
226	340	565	1,6	193	0,6
231	165	883	5,4	327	2,0
232	230	809	3,5	725	3,2
233	170	127	0,7	29	0,2
234	185	138	0,7	62	0,3
235	110	2	0,0	2	0,0
236	245	39	0,1	33	0,1
237	275	167	0,6	39	0,1
238	185	170	0,9	44	0,2
239	140	250	1,8	6	0,0
262	170	246	1,4	117	0,7
Sub-total for White Mfolozi	5 285	20 392		7 749	
Black Mfolozi					
W241	340	606	1,8	125	0,4
242	415	911	2,2	426	1,0
243	210	19	0,1	9	0,0
244	205	233	1,1	157	0,8
245	285	595	2,1	291	1,0
246	260	130	0,5	53	0,2
247	280	160	0,6	77	0,3
248	285	265	0,9	228	0,8
251	255	1 466	5,7	367	1,4
252	265	399	1,5	286	1,1
253	125	85	0,7	28	0,2
254	135	111	0,8	0	0,0
255	305	223	0,7	76	0,2
256	190	106	0,6	17	0,0
261	90	288	3,2	26	0,3
Sub-total for Black Mfolozi	3 635	5 597		2 166	
Lower Mfolozi					
W263	185	1 101	5,9	818	4,4
264	225	820	3,6	563	2,5
265	240	664	2,7	470	1,9
266 & 267	505	21 670	43,0	9 279	18,4
Sub-total for Lower Mfolozi	1 155	24 255		11 130	
GRAND TOTAL	10 075	50 244		21 045	

45.2.2 *Recent areal cover*

The present extent of wetland in the Mfolozi catchment is approximately 21 045 ha (Table 52). This suggests that only 2,1% of the Mfolozi catchment is covered by wetland. However, this estimate is based on the interpretation of aerial photography which in some cases was 15 years old (Fig. 3), and thus, it is probable that wetlands presently occupy less than the 2,1% currently estimated in the Mfolozi catchment.

Of the 21 045 ha of wetland mapped, 53% (11 130 ha) occur in the Lower Mfolozi region. The White Mfolozi catchment contained 37% (7 749 ha) of the extant wetland located in the catchment, and the Black Mfolozi catchment contained 10% (2 166 ha).

The present extent of wetland varies considerably from one quaternary sub-catchment to another (Fig. 89), but the regions with the highest cover (18,4%) are quaternary sub- catchments W266 and W267. In contrast, sub-catchment W254 is totally devoid of wetland.

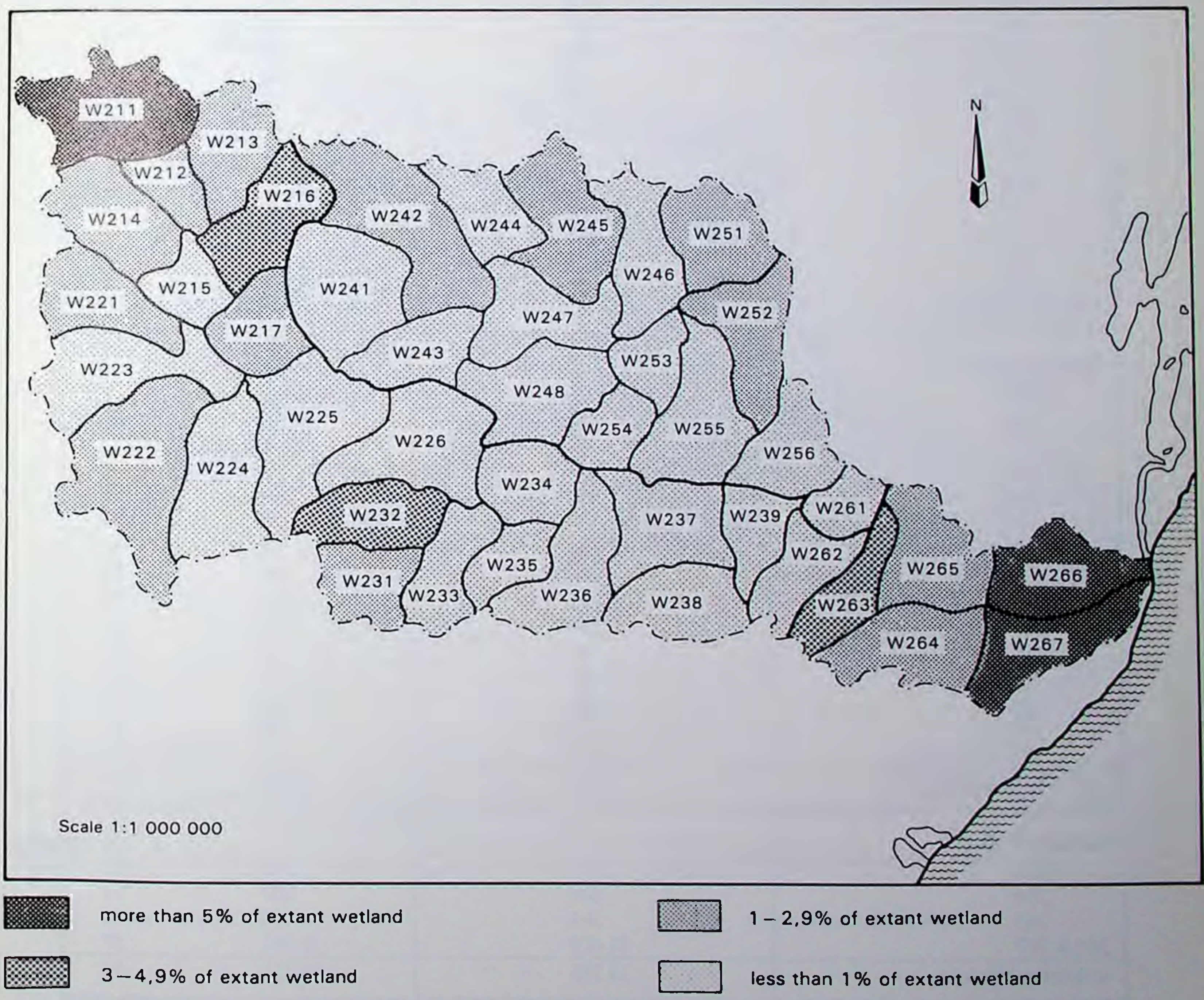


Fig. 89: The relative percentage of extant wetland in the Mfolozi catchment *(source of data is Table 52)*

Table 53: Quantification of wetland losses in the Mfolozi catchment.

Quaternary sub-catchment No.	Original amount of wetland cover (ha)	Amount of wetland cover lost (ha)	(%)
White Mfolozi			
W211	3 052	188	6
212	422	296	70
213	1 650	1 316	80
214	1 850	1 575	85
215	594	492	83
216	1 822	884	48
217	1 469	1 182	80
221	1 102	801	73
222	1 625	1 150	71
223	2 485	2 217	88
224	353	236	67
225	572	487	85
226	565	372	66
231	883	556	63
232	809	84	10
233	127	98	77
234	138	76	55
235	2	0	0
236	39	6	15
237	167	128	76
238	170	126	74
239	250	244	97
262	246	129	52
in White Mfolozi	20 392	12 643	62
Black Mfolozi			
W241	606	481	79
242	911	485	53
243	19	10	53
244	233	76	32
245	595	304	51
246	130	77	59
247	160	83	52
248	265	37	14
251	1 466	1 099	75
252	399	113	28
253	85	57	67
254	111	111	100
255	223	147	66
256	106	89	84
261	288	262	91
in Black Mfolozi	5 597	3 431	61
Lower Mfolozi			
W263	1 101	283	26
264	820	257	31
265	664	194	29
266 & 267	21 670	12 391	57
in Lower Mfolozi	24 255	13 125	54
IN WHOLE CATCHMENT	50 244	29 199	58

The data contained in Table 52 suggest that the average amount of wetland cover in the Lower Mfolozi region has been reduced from 21 to 9,6%; in the catchment of the White Mfolozi from 3,8 to 1,5%; and in the catchment of the Black Mfolozi from 1,5% to 0,6%.

The extent of these losses in each quaternary sub-catchment varies from 0 - 100% (Table 53), but overall 29 199 ha (58%) of the Mfolozi catchment's former wetland resources have been lost since the advent of the Iron Age (see Preface).

Of these losses 45% (13 125 ha) was in the Lower Mfolozi region, 43% (12 643 ha) was in the White Mfolozi catchment, and 12% (3 431 ha) was in the catchment of the Black Mfolozi River. More specific details of the losses of wetland within each quaternary sub-catchment are given in Fig. 90.

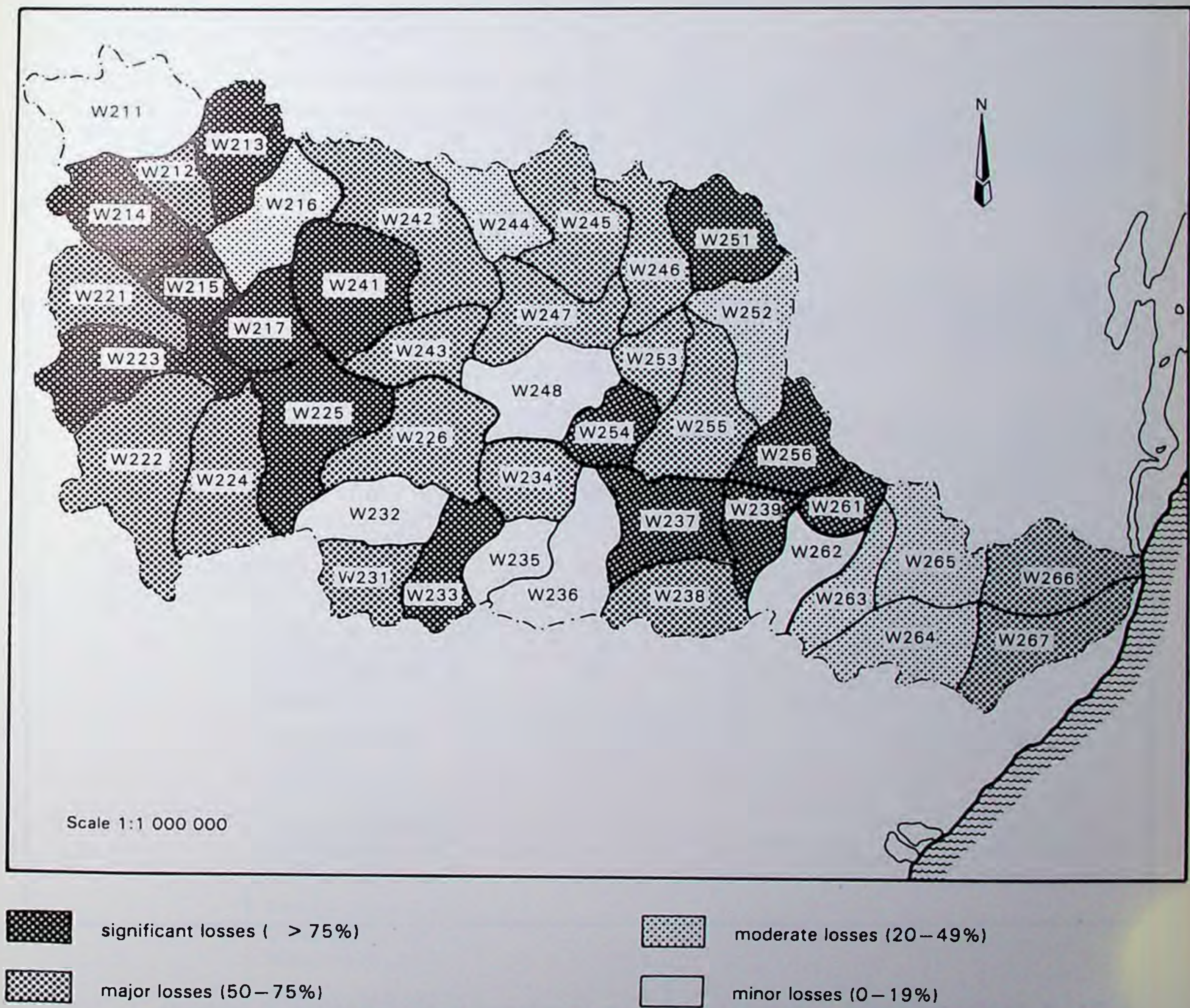


Fig. 90: Net losses of wetland in the Mfolozi catchment *(source of data is Table 53)*

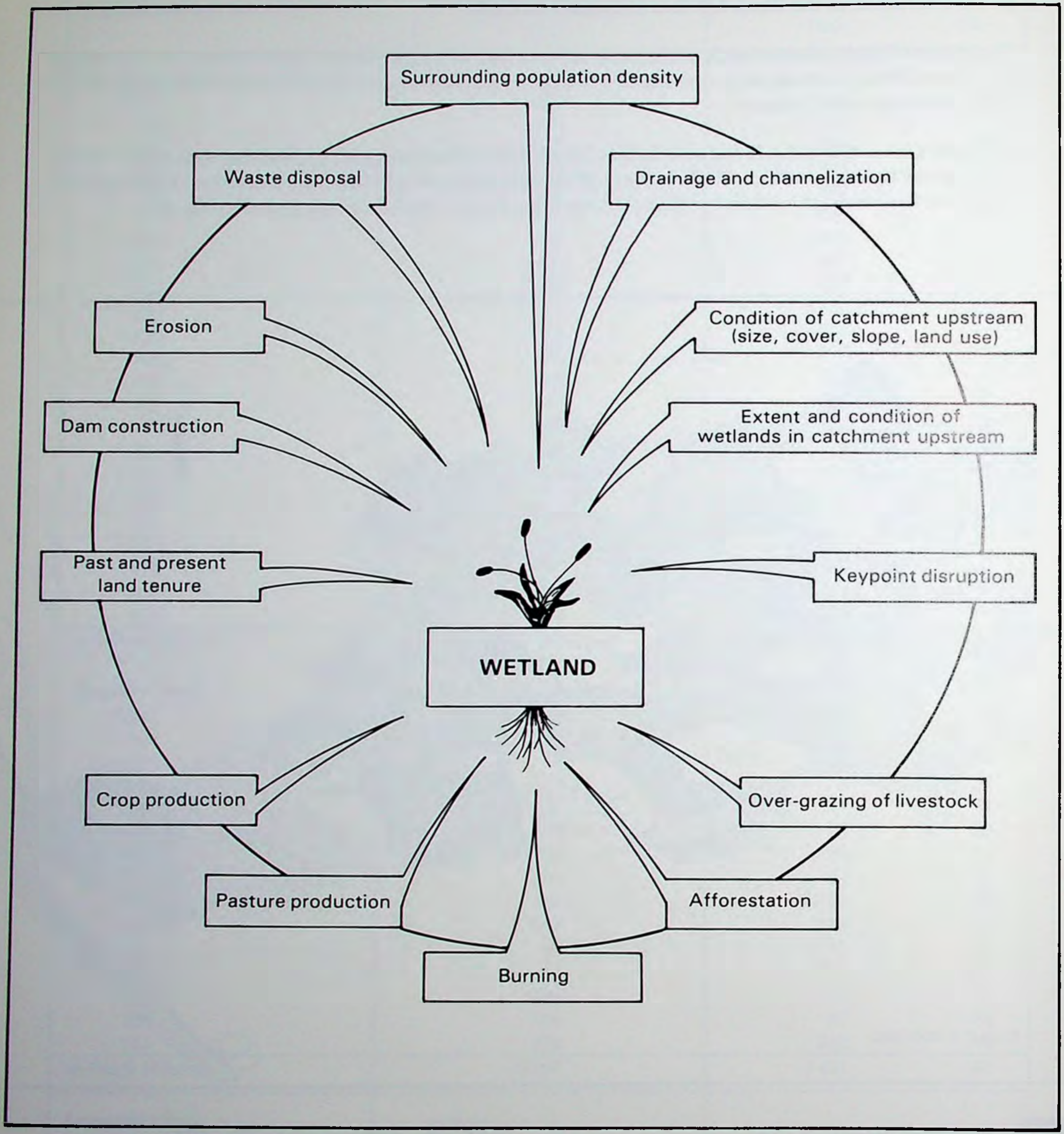


Fig. 91: A diagrammatic representation of the factors contributing to the destruction of wetlands

45.3 The status of wetlands in the Mfolozi catchment

45.3.1 Factors contributing to the destruction of wetlands

Many factors have accounted for the loss of over 29 000 ha of wetland in the Mfolozi catchment. These range from factors such as excessive population pressures and inappropriate forms of land use in the catchment area surrounding wetlands, to destabilising factors associated with direct interference with the wetland (Fig. 91). Because of time constraints, it was not possible to establish precisely which of these factors played the most important role in accounting for the losses of wetland incurred in the Mfolozi catchment.

The views expressed below are based on an analysis of the aerial photography of 662 sites (Table 54), and field observations made whilst travelling around the catchment.

a. Burning (prevalent in 69% of the wetlands examined)

It was assumed that virtually every wetland in the Mfolozi catchment had been burnt, either accidentally or deliberately, at some time or another. Generally, wetlands are burnt in order to provide grazing at a time when other sources of forage are not readily available, but the timing and frequency of burning are important factors if a deterioration of soil structure, and a reduction in soil moisture is to be prevented.

b. Erosion (prevalent in 57% of the wetlands examined)

Although erosion is really the product of mismanagement in the form of overgrazing, for example, there is little doubt that this factor has been the most important in contributing to the destruction of

Table 54: An assessment of the land usage of wetlands in the Mfolozi catchment, based on the examination of 662 extant or partially extant sites. The perturbations listed have been ranked according to their frequency of occurrence.

Perturbation	Frequency of occurrence (n = 662)	
	No.	Percent
Burning	429	69
Grazing	425	68
Erosion	355	57
Stock watering	340	55
Crops	318	51
Roads and tracks	300	48
Dam construction	80	13
Afforestation	76	12
Infilling/siltation	43	7
Pasture development	33	5
Channels and ditches	29	5
Water abstraction	26	4
Railway construction	16	3
Waste disposal	5	< 1
Excavation	4	< 1
Reed cutting	4	< 1

wetlands in the Mfolozi catchment. Soil erosion in certain wetland sites commenced well over 1000 years ago, but aerial photography dating back to 1944, indicates that the extent of erosion in wetlands has been exacerbated in relatively recent times by expanding populations, economic pressures for agricultural production, and the overgrazing of cattle.

The most damaging form of erosion in the catchment has been gully erosion. When occurring in areas comprised of hydromorphic soil, this form of erosion rapidly leads to lowering of the water table, drying out of the wetland, the encroachment of woody vegetation (such as thorn trees), and the loss of the functions and values normally associated with extant wetlands.

The extent of the gully erosion in the Mfolozi catchment appears to be closely linked to three major factors. These are

- over population
- over grazing, and
- exploitation.

In many parts of Africa the ever-growing population pressure and declining productivity of arable land, has led to the extension of cultivated areas at the expense of grazing lands (Whitlow, 1985). This trend is evident in KwaZulu as well, but is exacerbated by the growing numbers of livestock that have been restricted to wetland areas. This tendency has led to overgrazing, to the development of paths converging upon watering points, and to the initiation of gully erosion.

Elsewhere in the catchment, economic incentives such as the need of private landowners to maximise financial returns from their land has tended to stress natural resources such as wetlands in a similar way.

c. Crop production (prevalent in 51% of the wetlands examined)

Crop production features as another important factor accounting for the wetland losses incurred in the Mfolozi catchment (Table 54). However, it is necessary to distinguish between the cultivation of wetlands in the context of a peasant farming community (as in many parts of KwaZulu for example), and the cultivation of wetlands in the context of a commercial farming operation (as in the many parts of white-owned Natal).

The former is generally associated with the tillage of vegetable gardens using hoes, is a well established tradition amongst peasant farmers, and inflicts little permanent damage to wetlands (Whitlow, 1985). However, in commercial farming operations mechanical means of ploughing are used to cultivate wetlands, and drains are dug in order to provide for improved soil aeration and root development. The drying out process is often associated with increased erosion, and extensive losses of wetland.

d. Dam construction (prevalent in 13% of the wetlands examined)

A fairly large number of farm dams in the Mfolozi catchment have inundated areas which were previously wetland. In some cases this has resulted in losses of valuable habitat, but in the majority of cases dam construction has led to the stabilisation of water courses, particularly when constructed within dongas, or relict wetlands.

e. Afforestation (prevalent in 12% of the wetlands examined)

Relatively few wetlands in the Mfolozi catchment have been used directly for the planting of trees. The areas most severely affected are quaternary sub-catchments W266 & W267, where wetlands have been planted with gum trees and pine trees in the interests of increasing timber production.

In the Babanango area (quaternary sub-catchments W231 & W232) large tracts of steeply sloping land are presently being planted with trees, and in many cases in areas too close to existing wetlands. Part of the problem is the fact that until recently, maps of wetland distribution have never been available to provide the guidance necessary to lessen the chances of this happening.

In other parts of the catchment, such as quaternary sub-catchment W211, wattle plantations have been established in the proximity of wetlands. This has necessitated the burning of wetlands in winter, because of the so called "fire hazard" that they represent to the commercial timber.

45.3.2 *Land tenure*

The use of wetlands is often determined by who owns them, and in the Mfolozi catchment wetlands were found to fall within the jurisdiction of one or other of the four groups specified in Table 55.

At present 46% of the extant wetland in the Mfolozi catchment is owned by the State, 32% is privately owned, and 21% is under the jurisdiction of KwaZulu.

It is generally thought that more damage to wetlands has arisen in tribal areas than in white owned areas. However, it should be noted that 53% of the relict wetland in the Mfolozi catchment occurs on privately owned land, and only 25% occurs in KwaZulu.

The relatively high amount of relict wetland in State ownership (22%) is partly due to the Government having recently expropriated c. 2 500 ha of sand damaged farmland on the Mfolozi Flats (see Chap. 44.1).

Table 55: The distribution of wetlands in the Mfolozi catchment in relation to land tenure.

	Area of wetland involved					
	Total		Extant		Relict	
	km	%	km	%	km	%
Private individuals or companies	221	44	67	32	154	53
Tribal authorities	115	23	43	21	72	25
State Departments	162	32	97	46	65	22
Municipal authorities	4	1	3	1	1	0
TOTAL	502	100	210	100	292	100

45.3.3 *The probable consequences of wetland degradation*

The importance of wetlands in Natal and KwaZulu has already been addressed (Begg, 1986) but, in brief, the value of these ecosystems includes well established functions and values such as

- water storage
- stream flow regulation
- drought relief
- flood damage protection
- soil erosion protection
- water purification
- wildlife protection
- recreational opportunities
- raw materials.

In the Mfolozi catchment, wetlands would have had the same functions and values as those listed above, and thus the losses incurred (Table 53, Fig. 90), are viewed in a particularly serious light. This is because it is highly probable that the following consequences have materialised:

a. the increased incidence of and severity of downstream flooding

Although the consequences of the Mfolozi floods in 1984 are still fresh in our minds, and have been documented by Kovacs *et al.*, (1985), Comrie-Grieg (1984), Cooper (1984) and others, it is not possible to quantify this statement. However, overseas it has been estimated that if 5% of a catchment is occupied by wetland, flood peaks associated with 1 : 50 year storms may be attenuated by as much as 54% (Verry and Boelter, 1978).

This inventory has suggested that at least 5% of the Mfolozi catchment was originally occupied by wetland (Table 52), and that wetlands have been reduced in extent to 2,1%. According to Verry and Boelter (1978), this could mean that the potential of wetlands to reduce the flood peaks associated with 1 : 50 year storms would have been reduced from 54 to 38%. If wetland destruction in the Mfolozi catchment continues therefore, the severity of flooding downstream can be expected to increase.

b. the increased incidence of and severity of river flow cessation, and reduced winter flows

It is not possible to quantify this statement because of the paucity of data on river flow in the Mfolozi catchment. However, the recollections of many farmers that have had a long association with the catchment substantiate this view, and elsewhere in Natal studies have shown that the stream flow from catchments that are endowed with wetland is markedly prolonged (Schulze, 1979).

c. lowering of the water table

There is a great deal of evidence to suggest that the water table in many parts of the Mfolozi catchment has been lowered, through the erosion of wetland sites (Plate 12). An outward reflection of this is reduced river flows mentioned in b above, and the encroachment of woody plants such as various *Acacia* spp., *Dichrostachys cinerea*, wattles (*Acacia mearnsii*) and various other forms of dryland vegetation (MacDonald, 1979).

d. increased sediment loads

Although quantitative data to support this viewpoint are unavailable, from studies conducted in other parts of the world, it has been shown that there is a logarithmic relationship between the sediment yield of a catchment and the percentage of the catchment occupied by wetlands (Novitski, 1978). The data presented (summarised in Fig. 8, Begg (1986)) suggest that there is a significant increase in sediment yield from a catchment once the extent of wetlands falls below 5%.

Thus, if one accepts that the present sediment yield from the Mfolozi catchment, which is in the order of 2,5 million tons/year (Rooseboom, 1975), is an expression of the diminished extent of wetlands in the catchment, it can be assumed that significantly less sediment would have been carried downstream, had the extent of wetland loss in the catchment not been as severe (Table 53).

e. a deterioration in water quality

It is well known that the water quality of an entire catchment can become markedly altered by the water purifying processes operative in wetlands (van der Valk *et al.*, 1978). Providing water has the opportunity to pass through the soil of a wetland these ecosystems can show remarkably efficiency in removing pollutants from water, and in destroying water-borne pathogens. However, eroded wetlands cannot perform this function.

Insufficient information on water quality in the Mfolozi catchment exists to show that a deterioration in water quality has occurred over the period that the extent of wetlands in the catchment has diminished. However,it is predicted that the present 58% loss of wetland reported here, will be felt as development in different parts of the catchment progresses, and pollution stemming therefrom results. The "good water suitable for drinking and almost any other use" (Archibald *et al.*, 1969) which characterised much of the catchment in the late 1960's, may now no longer be generally applicable, and in certain areas, such as below the coal mines at the head of catchment, the extent of pollution could have worsened (Plate 9).

If the water quality of the Mfolozi River is to be prevented from unnecessary deterioration, it would be foolhardy to allow the present rate of wetland destruction in the catchment to continue.

f. a deterioration in the health of people not having access to purified water

If the assumption underlying the above paragraph is acceptable, it would seem reasonable to predict that the health of people which do not have ready access to purified water will deteriorate, if wetland destruction in the Mfolozi catchment is allowed to continue. Wetlands naturally cleanse and purify water at no cost to society, and therefore government agencies responsible for managing water resources of the catchment should capitalise upon their presence, and their capabilities.

g. increased bank erosion

Although periodic floods will undermine even the best established riparian vegetation (as when "Domoina" uprooted the riverine forests alongside the banks of the Mfolozi River in 1984), the reinforcement of river banks by the roots of wetland associated plants is a valuable aid in preventing soil erosion (Begg, 1986). It is probable therefore, that the destruction of 58% of the wetlands in the Mfolozi catchment has led to increased bank erosion (Plate 24), and without the resistance that wetland plants offer to flowing water, the velocity and erosive power of floodwaters would have increased. The flooding that results from general catchment degradation, and the lesser amount of wetlands available to attenuate these floods aggravates the situation further.

Plate 24: Bank erosion of the Sandspruit River in quaternary sub-catchment No. W214 has probably been exacerbated by wetland destruction upstream.

h. habitat deterioration, local species extinction and threatened wildlife resources

The ecological significance of wetlands have been well established throughout the world, since it is known that the wetness of these habitats has a major influence on the biological productivity and diversity of the fauna and flora associated with them (Begg, 1986).

The effects of erosion in former wetlands of the Mfolozi catchment, as manifested by scrub invasion, has already been mentioned (under c above), and the consequences of this insidious alteration of the habitat have been documented by various persons working in the Umfolozi Game Reserve (Deane (1966), Watson and MacDonald (1973), MacDonald and Birkenstock (1979)).

In essence, the diminished grassland and reedbed habitat associated with wetlands is considered to be one of the prime causes for the local decline in various mammal species (such as reedbuck) and various birds species (such as African marsh harrier, Grass owl and Marsh owl). On these grounds, it seems reasonable to assume therefore, that although unmonitored, similar species losses would have resulted amongst other forms of life, such as reptiles and amphibians, that are equally dependant on wetlands.

Further losses of wetland in the Mfolozi catchment simply mean further losses of animal life, and a greater tendency for rare species to become vulnerable, for vulnerable species to become endangered, and for endangered species to become extinct (Thomson, 1986).

i. lower agricultural productivity

The agricultural value of wetlands in the Mfolozi catchment is evident from the large extent to which wetlands are used for crop production and as grazing for livestock (Table 54). However, degraded wetlands, which have been over-utilised and eroded, not only fail to fulfil a useful agricultural purpose, but also cease to perform invaluable regional functions.

In the Mfolozi catchment there is an abundance of evidence to show that local assets in the form of wetlands have now been reduced to national liabilities in the form of dongas.

j. lower quality of life for rural communities

Field observations suggest that there is a high degree of dependence upon wetlands amongst rural communities in the Mfolozi catchment. Even the smallest of wetlands can serve as a water supply, and be used each day as a source of water for domestic purposes such as cooking, washing and drinking. Added to this, the use of wetlands as vegetable gardens and other crops which are grown for home consumption is important in the every day lives of rural people (Whitlow, 1985), and especially during drought years, when dryland crops have failed.

Wetlands lost through erosion offer no such advantages to rural communities (Plate 16), and wetland loss in the catchment generally, simply lessens the prospect of assured yields of potable water being available for society at large. Longer distances then have to be travelled to obtain water, which being scarce, rapidly becomes contaminated and infected by water-borne diseases.

45.4 Recommendations

45.4.1 Wetland Conservation

Wetlands provide a resource of great economic and social value to people throughout the Mfolozi catchment. However, only 42% of the resource remains, and these remnants face continued destruction.

Wetland conservation means the rational utilisation of this resource, and towards achieving this, the following recommendations are offered:

a. Far more public funds must be spent on extension services, because at present the number of persons engaged in extension work is hopelessly inadequate. Testimony to this is the fact that the offices of the nearest soil extension officer lie 50 km beyond the borders of the Mfolozi catchment. With one member of staff attempting to serve such a vast area it is not surprising that his influence is not felt.

b. Responsibility for enforcement of wetland protection laws at all levels of government needs to be clearly defined.

c. Land management systems are needed that demonstrate and encourage wetland conservation, and economic incentives, such as tax relief, must be found to create an interest amongst farmers in wetland conservation.

d. Wetland conservation programmes should be directed to farmers, foresters, tribal authorities, and other land managers, with view to ensuring that the conservation of these resources is based on co-operation, and an understanding of wetland functions and values.

e. Government agencies must work <u>together</u> to protect the remaining wetlands of the Mfolozi catchment and their resource values.

f. That until such time, wetland regulations can be tailored to suit wetland functions, a moratorium on wetland development should be adopted. This will prevent worsening the consequences of wetland destruction (Chap. 45.3.3), and will force wetland managers to think holistically, in a catchment context (Cunningham, 1986).

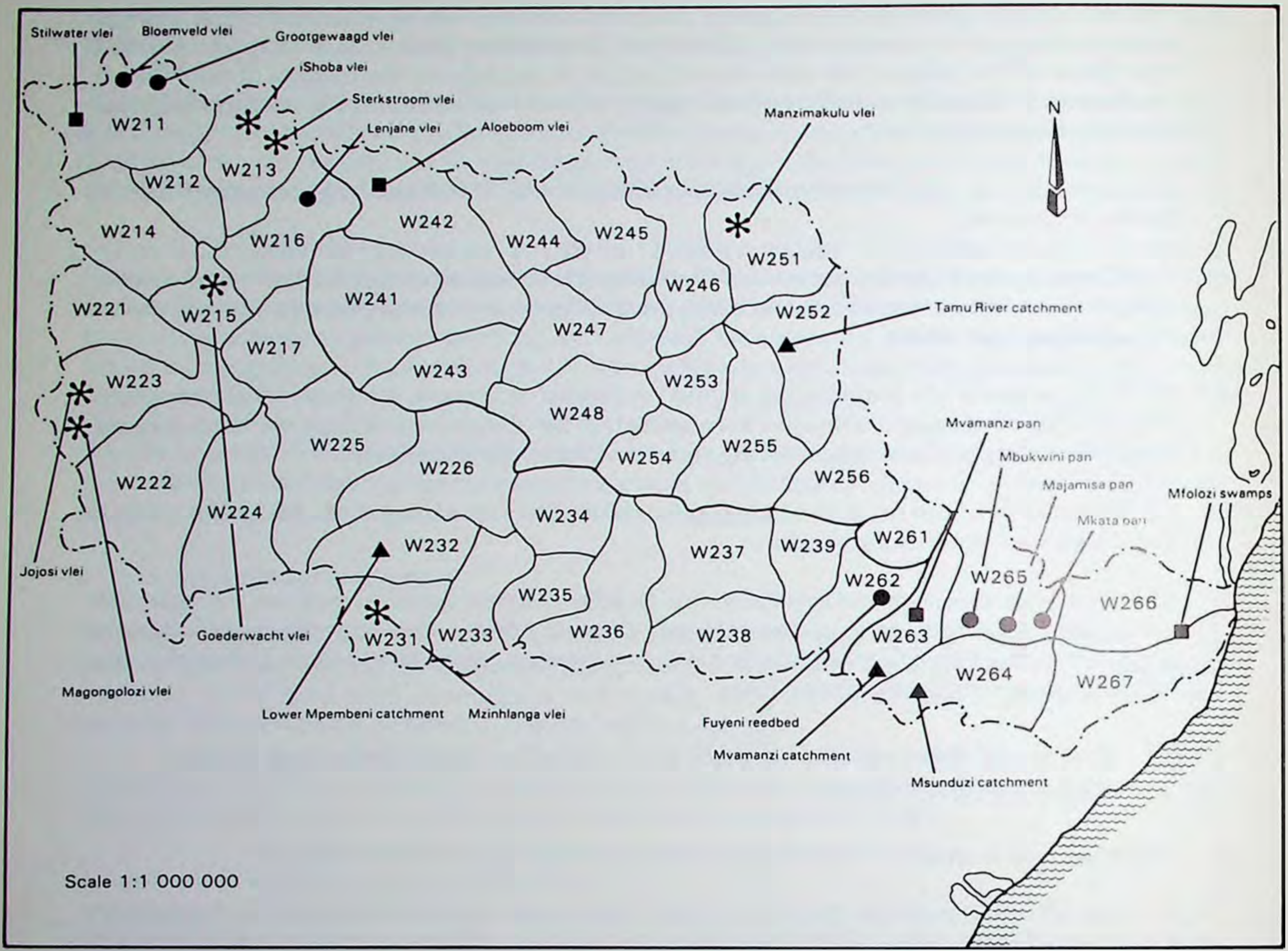
45.4.2 *The most important individual wetlands or wetland areas in the Mfolozi catchment*

a. There are four wetlands of critical importance in the Mfolozi catchment (Fig. 92)

- The Mfolozi swamps (including Lake Teza and Lake Mfuthululu) in quaternary sub-catchments W266 & W267 (Chap. 44).
- Stilwater vlei, near the source of the White Mfolozi, in quaternary sub-catchment W211 (Chap. 3).
- Aloeboom vlei, near the source of the Black Mfolozi, in quaternary sub-catchment W242 (Chap. 26).
- Mvamanzi pan in quaternary sub-catchment W263 (Chap. 41).

b. There are another seven <u>important</u> wetlands (Fig. 92)

- Bloemveld vlei and Grootgewaagd vlei in quaternary sub-catchment W211 (Chap. 3).
- Lenjane vlei in quaternary sub-catchment W216 (Chap. 8).
- The Fuyeni reedbed in quaternary sub-catchment W262.
- The pan systems of quaternary sub-catchment W265, notably Mbukwini pan, Majamisa pan and Makata pan (Chap. 43).



■ wetlands of critical importance

● important wetlands

▲ important wetland rich areas

✱ wetlands that warrant rehabilitation

Fig. 92: The location of individual wetlands of critical importance (■), wetlands of importance (●), wetland rich areas (▲), and wetlands that warrant rehabilitation (✱) in the Mfolozi catchment.

c. There are four important wetland rich areas (Fig. 92)

- The Tamu River catchment in quaternary sub-catchment W252 (Chap. 35).
- The Lower Mpembeni catchment in quaternary sub-catchment W232 (Chap. 17). The Upper Mvamanzi catchment in quaternary sub-catchment W263 (Chap. 41).
- The Upper Msunduzi catchment in quaternary sub-catchment W264 (Chap. 42).

45.4.3 *Wetlands with rehabilitation potential in the Mfolozi catchment*

There are seven fragmented or relict wetlands in the Mfolozi catchment that warrant further investigation, with a view to determining their suitability as reclamation sites (Fig. 92).

- iShoba vlei and Sterkstroom vlei in quaternary sub-catchment W213 (Chap. 5).
- Goederwacht vlei in quaternary sub-catchment W215 (Chap. 9).
- Jojosi vlei and Magongolozi vlei in quaternary sub-catchment W223 (Chap. 11).
- Mzinhlanja vlei in quaternary sub-catchment W231 (Chap. 16).
- Manzimakulu vlei in quaternary sub-catchment W251 (Chap. 34).

45.4.4 *Information needs*

A wetland inventory is a starting point for the development of knowledge about wetlands and wetland conservation. Hence, it is strongly recommended that:

a. a study aimed at a classification of wetlands in the Mfolozi catchment is conducted as soon as possible, because without this, the correct management advice cannot be offered.

   The inventory of wetlands in the Mfolozi catchment has provided the framework necessary to initiate a classification study, and as such should be seen as an opportunity to enhance the scientific base upon which the long term conservation of wetlands in Natal and KwaZulu, ultimately depends.

b. A functional assessment of wetlands in the Mfolozi catchment should be attempted incorporating the individual contribution of wetlands to water quality, water storage, flood control, sediment control, recreation and wildlife. This assessment will help to reinforce the recommendations made in Chap. 45.4.1.

45.4.5 *Funding needs*

Thus far, funding has been woefully short to meet and develop the wetland research programme defined in Chap. 8 of the report "The Wetlands of Natal" (Part 1) (Begg, 1986), and even the real costs of undertaking the Mfolozi inventory were underestimated and underfunded.

Therefore, it is strongly recommended that:

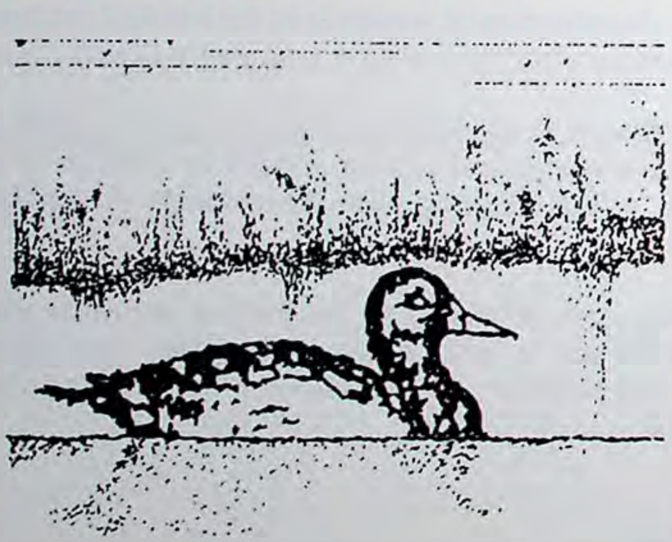
- additional funds should be made available by the State to facilitate the completion of wetland inventories for other catchments.

- the requirement to find such funds is placed upon the shoulders of those organisations most closely linked to wetland management and wetland regulation. These are, for example:
    - The Department of Agricultural Economics & Marketing
    - The Department of Agriculture & Water Supply
    - The KwaZulu Department of Agriculture & Forestry
    - The Natal Agricultural Union
    - The S.A. Sugar Association

45.4.6 Co-ordination

Without a spirit of co-operation, common goals designed to conserve wetlands, and a firm commitment to do so, wetland resources throughout Natal & KwaZulu face continued destruction. The deeply entrenched attitudes that have given rise to wetland losses can only be counteracted or changed through a co-ordinated effort to minimise any further destruction, loss or degradation of wetlands.

It is therefore recommended that multi-disciplinary co-ordinating committees are formed to evaluate the implications of any development application that impinges on wetland resources.



Chapter 46

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Chapter 47

GLOSSARY OF TERMS

ALLUVIUM

Silt or fine sedimentary materials from which floodplains are formed.

AVULSION

The breaching of levees during floods causing a sudden shifting of the river channel (Fig. 85).

BASE FLOW

Stream discharge comprised of sub-surface run-off.

BIOCLIMATIC REGION

Broad areas characterised by distinctive ecological responses to climate and landform as expressed by vegetation and reflected in soils, fauna and water. A map of the bioclimatic regions of Natal has been prepared by the late Prof. J. Phillips (1973).

CATCHMENT AREA

A basin-shaped area from which rainfall is collected and concentrated into stream flow.

CHAMPAGNE SOIL

A hydromorphic soil form characterised by a deep, black topsoil with over 10% organic carbon, underlain by a strongly gleyed subsoil with permanent water table.

COENOCLINE

A gradient in community composition, or distinctive species assemblages.

COMPACTION

A process by which the porosity of the soil is decreased, and major factor influencing infiltration.

DETRITUS

An "aquatic compost" comprised of organic debris from decomposing plants and animals.

DOMOINA

The name of a tropical cyclone that swept over Southern Mozambique, the Eastern Transvaal, Swaziland and Northern Natal on 27 January 1984. For five days thereafter torrential rains fell over these areas, and extraordinarily damaging floods occurred downstream.

DYSTROPHIC SOILS

Soil that has suffered marked leaching, and is said to have a low base status.

ECOLOGY

The science which deals with the relationship between plants and animals, and their environment.

ENDORHEIC

A form of wetland characterised by having no outlet (closed drainage).

ECOSYSTEM

A system which includes the organisms of a natural community functioning together with their environment.

EVAPORATION

The process by which water is withdrawn by radiation from a moist land area, or water surface, and passes into the atmosphere as vapour.

EXTANT WETLANDS

Existing wetlands, which in their present condition perform functions such as stream flow regulation, flood damage protection, water purification, wildlife and soil erosion protection.

FAUNA

The animal life characteristic of a particular region or environment.

FLORA

A collective term of the plant life characteristic of a particular region or environment.

GEOMORPHOLOGY

The study of landform or topography.

GLEYED SOILS

Soil that has been or is subject to intense reduction as a result of prolonged saturation with water.

HYDROLOGY

The science that underlies the development and control of water resources. Hydrology is a very broad science, involving the study of water and especially the factors governing its movement on land.

HYDROMORPHIC SOIL

Soils in which water logging becomes the dominant factor determining its physico-chemical characteristics (such as gleying and mottling).

HYGROPHILOUS PLANTS

Moisture loving plants which can live where there is an abundant supply of available water.

INTERCEPTION

Precipitation which does not reach the soil, being retained for some period, however, short, amongst the plant/ organic material above the soil surface.

INTERSPERSION

A measure of the regularity in distribution of vegetation/habitat types in a wetland.

KATSPRUIT SOIL

A hydromorphic soil form characterised by a normal (orthic) topsoil underlain by a strongly gleyed subsoil with permanent water table.

KEYPOINT

A natural obstruction that resists downward erosion of the river channel. Frequently these are a hard stratum of rock (such as a dolerite dyke or sill), but can also occur laterally in the form of alluvial ridges.

LEVEE FORMATION

A ridge building process occurring as a result of sediment deposition along the banks of rivers. The formation of unstable "alluvial ridges" on either side of the channel above the level of the floodplain results (Fig. 84).

MACROCLIMATE

The local climate within a relatively short distance of the wetland specified.

MARSH

A particularly moist form of wetland dominated by herbaceous plants (such as reeds (*Phragmites*), rushes (*Typha*) and various *Juncaceae*) which often develop in shallow depressions or along river margins.

MEANDERING

A wandering process occurring in that part of river systems where channel slopes are low.

MESOTROPHIC SOIL

Soil that has suffered moderate leaching and is said to have a medium base status.

PAN

A semi-permanent lake that is fringed by wetland associated plants. The outlet is generally blocked by sediment.

PHYSIOGRAPHIC REGION

The regions of any terrain unit characterised by physical features such as mountains, escarpments, plains, valleys and other land forms.

QUATERNARY SUB-CATCHMENT

The smallest unit of differentiation used in a system adopted by the Directorate of Water Affairs as a means of subdividing South Africa into hydrologically discrete drainage basins.

RELICT WETLAND

The remains of previous wetlands, which in their present condition have lost the functions normally associated with extant wetlands.

RENSBURG SOIL

A hydromorphic soil form characterised by a black, strongly structured and expansive topsoil, underlain by a strongly gleyed subsoil with permanent water table.

RIPARIAN

Occurring on the banks of rivers or streams.

SEEPAGE AREA

An area commonly found at a change of slope and at the head of drainage lines (often in association with dolerite and shales) in which there is a high incidence of springs.

SOIL MOISTURE

The amount of water stored in the soil. Of tremendous benefit to man, since soil-water supplies the largest fraction of fresh water that benefits man, through the production of non-irrigated crops.

STREAM ORDERING

A means of comparing rivers of different sizes in a catchment. The smallest streams, which have no tributaries are called first order streams. When two of these coalesce they form second order streams, and when two second order streams join they form third order streams, and so on.

STREAM FREQUENCY

A measure of the total number of natural drainage channels per unit area of the catchment.

SUBSIDENCE

A sinking of the land caused by the dewatering and compaction of the sediments from which alluvial plains are formed. This process creates topographic lows (or backswamps) in inactive parts of the plain. During floods when the river may breach its levees, such areas automatically serve as focal points to which floodwaters gravitate. Thus subsidence is an important mechanism that forces channel switching to occur.

SUSTAINED YIELD

The principle of managing a plant or animal population in which there is a balance between those individuals removed and those replaced by natural growth, so that the population is not depleted.

SWAMP

Wooded wetlands with standing, or gently flowing water. Typical species include *Barringtonia racemosa*, *Syzygium cordatum* and *Ficus hippopotami*.

VLEI

Wetlands of a slightly drier form than marshes, but also occurring in depressions dominated by non-woody plants. Instead of reeds, these inlcude sedges (such as *Carex*, *Leersia* and *Cyperus* spp.) and terrestrial grasses (Gramineae) such as *Hemarthria*, *Aristida*, *Andropogon* and *Monocymbium* spp.

WATERSHED

The divide separating one drainage basin from another.

WATER TABLE

The upper surface of ground water, or that level below which the soil is saturated.

WETLAND

A collective term used to describe land where an excess of water is (or was) the dominant factor determining the nature of soil development and the types of plant and animal communities living at the soil surface.

APPENDIX

Appendix 1

NATAL WETLAND INVENTORY

Date: ..../....198..

Catchment data	
Drainage Region:	W
Catchment Name:	Mfolozi
Catchment size:	10 075 km
Quaternary sub-catchment No.	
Sub-catchment name:	
Sub-catchment size:	km²

Bioclimatic region	
Physiographic region	
Mean annual precipitation (mm)	
Mean annual run-off (x 106 m3)	

Wetland No:	

Season	
..Wet..	..Dry..

Description	
in situ?	
Not in situ?	(if so, see →

Air Photo Reference			
Date	Job No.	Strip No.	Photo No.
19			

Background data

Sheet Name		Position in landscape	Hw	Vb	Pl	Area (ha)	
Sheet No.		Slope (%)				Perimeter (km)	
Co-ordinates	° 'S ° 'E	Elevation (m a.s.l.)					

Wetland catchment size (ha)	
Catchment: wetland area ratio %	
Stream order	

Drainage/Flow pattern		Attenuation rating	
Channel		Good	
Braided		Moderate	
Diffuse		Poor	

Land-use data

Land Tenure			
Municipal/ Private/State	M	P	S
Farm No.			
Mapped?		Y	N

Land Use (in catchment)			
Agriculture		Urban	
Forestry		Grazing	
Industry		Natural veld	
Mining			

Type of alteration/disruption evident (If none — indicate here ☐)

	past	present		past	present		past	present
grazing			ridge and furrow			rail/road construction		
burning			irrigation			dam construction		
pasture			excavation			waste disposal		
crops			ditching			erosion		
afforestation			infilling			siltation		
cutting			channelling			stock watering		
trampling			abstraction					

Ecological data

Cover Type				
Aquatic/open water		grass-	hygrophilous	
Sedge			dryland	
Reeds		Trees	indigenous	
Bullrushes			alien	
Papyrus				
condition of marginal veg. →	Dense	Intermediate	Sparse	

Interspersion	
Type	Rating
High	
Mod.	
Low	

Saturation Status	
Perm. waterlogged	
Reg.	
Irreg.	

Soil Form	
Champagne (organic)	Willowbrook (melanic)
Katspruit (orthic)	Rensburg (vertic)
Alluvium	

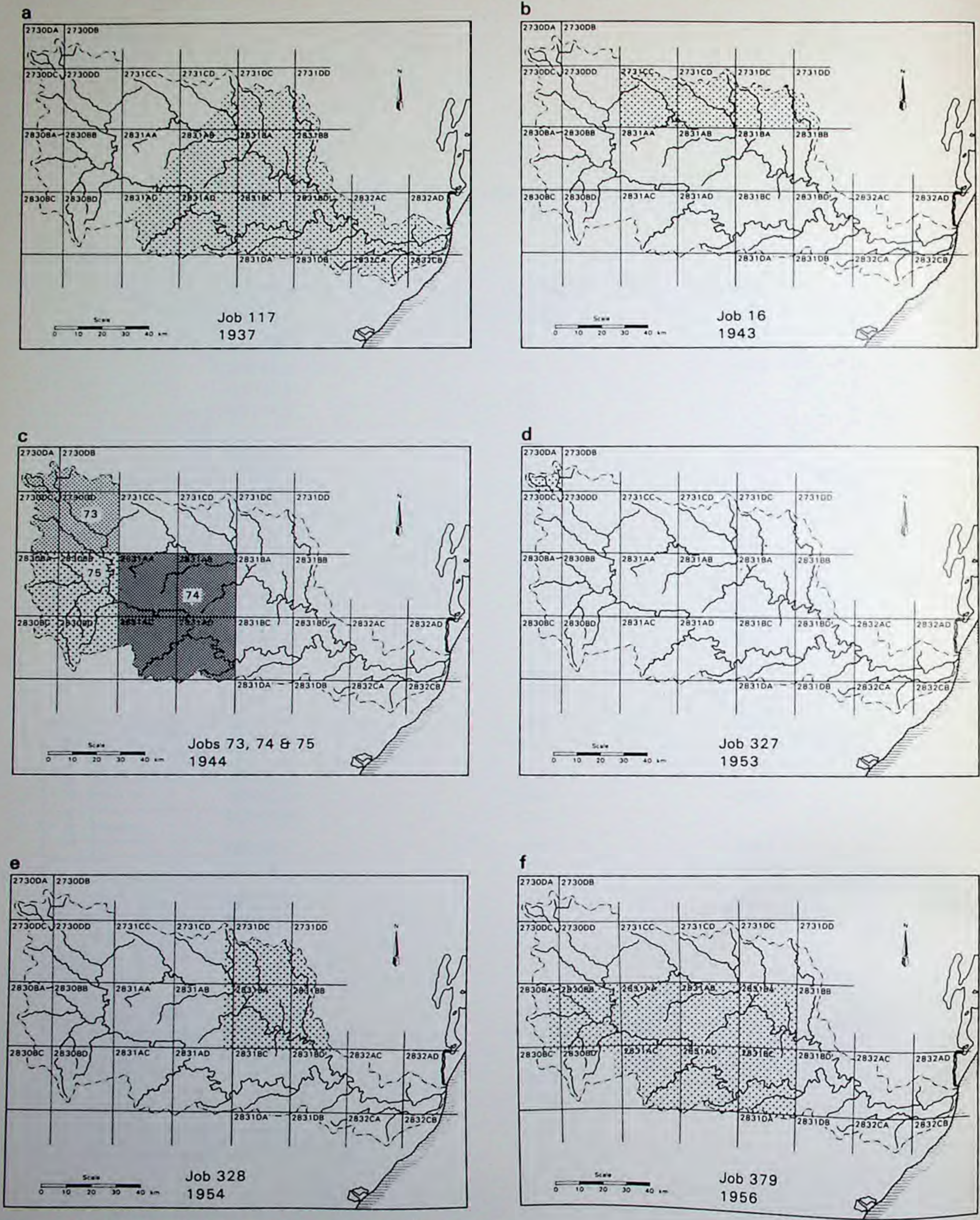
Notes ____________________

Special Values:	
wildlife?	
recreation	

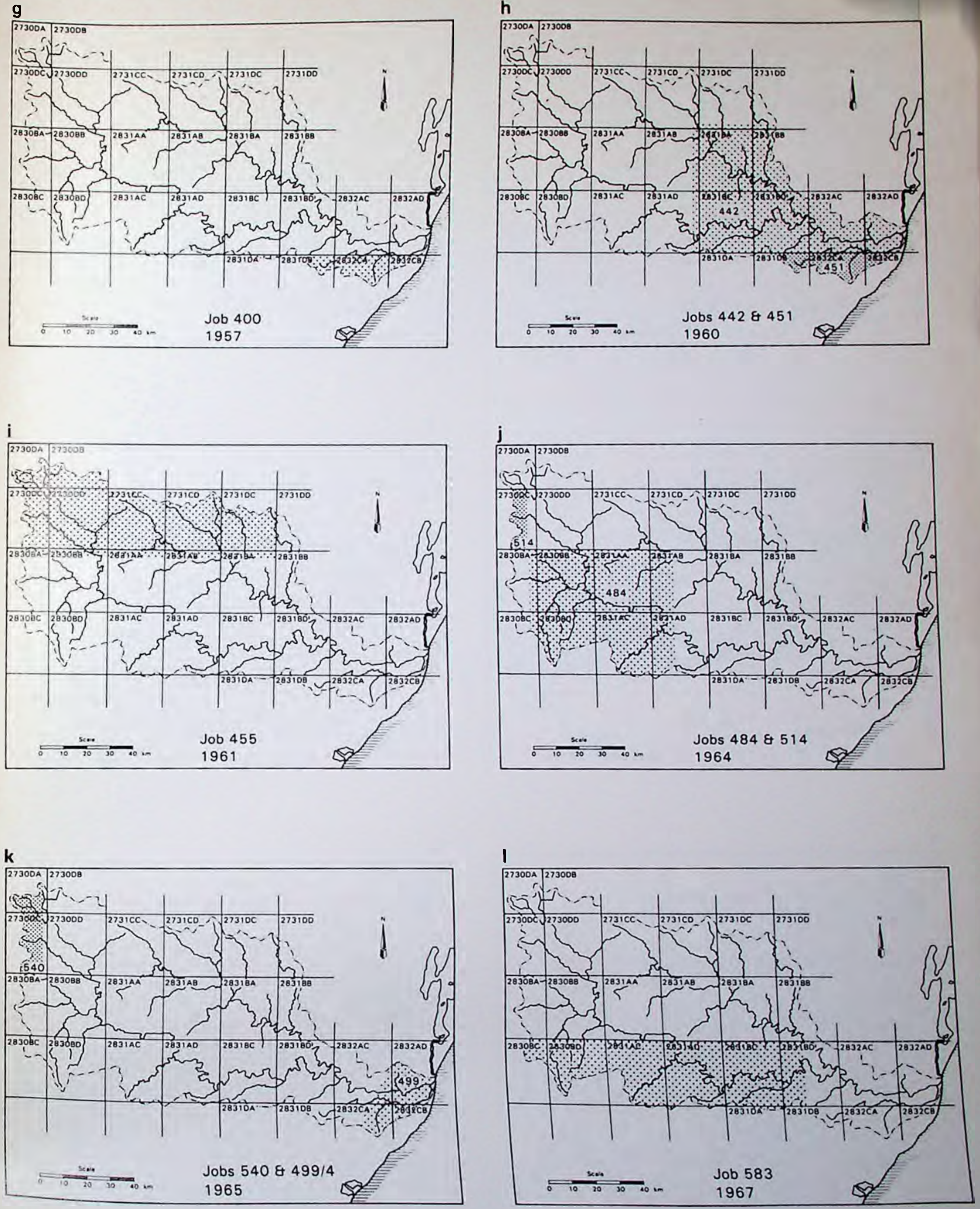
Appendix 2

INDEX OF AERIAL PHOTOGRAPHY FOR MFOLOZI CATCHMENT YEAR

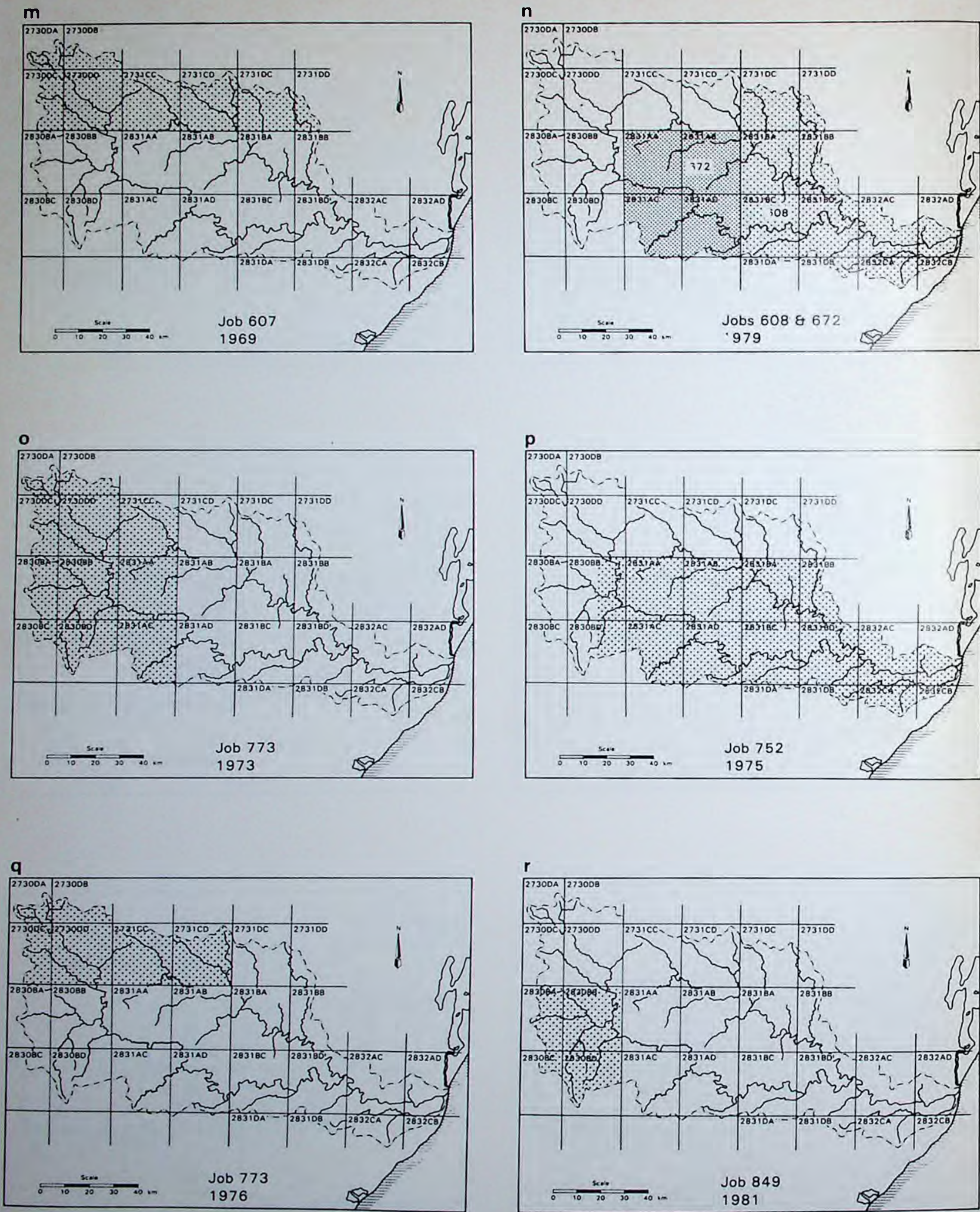
Year	Job No.	Scale
1937	117/c	1:25 000
1943	16	1:25 000
1944	73	1:18 000
	74	1:19 000
	75	1:19 000
1953	327	1:36 000
1954	328	1:30 000
1956	379	1:30 000
1957	400	1:30 000
1960	442	1:40 000
	451	1:30 000
1961	455	1:36 000
1964	484	1:36 000
	514	1:40 000
1965	540	1:40 000
	499/4	N/R
1967	583	1:30 000
1969	583	1:30 000
1969	607	1:36 000
1970	608	1:20 000
	672	1:30 000
1973	773	1:50 000
1975	752	1:50 000
1976	773	1:30 000
1981	849	1:30 000



Appendix 3: **The relationship between the 1:50 000 map coverage shown in Fig. 2 and the aerial photography for the Mfolozi catchment referred to in Appendix 2.**



Appendix 3 (continued): **The relationship between the 1:50 000 map coverage shown in Fig. 2 and the aerial photography for the Mfolozi catchment referred to in Appendix 2.**



Appendix 3 (continued): The relationship between the 1:50 000 map coverage shown in Fig. 2 and the aerial photography for the Mfolozi catchment referred to in Appendix 2.