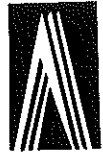
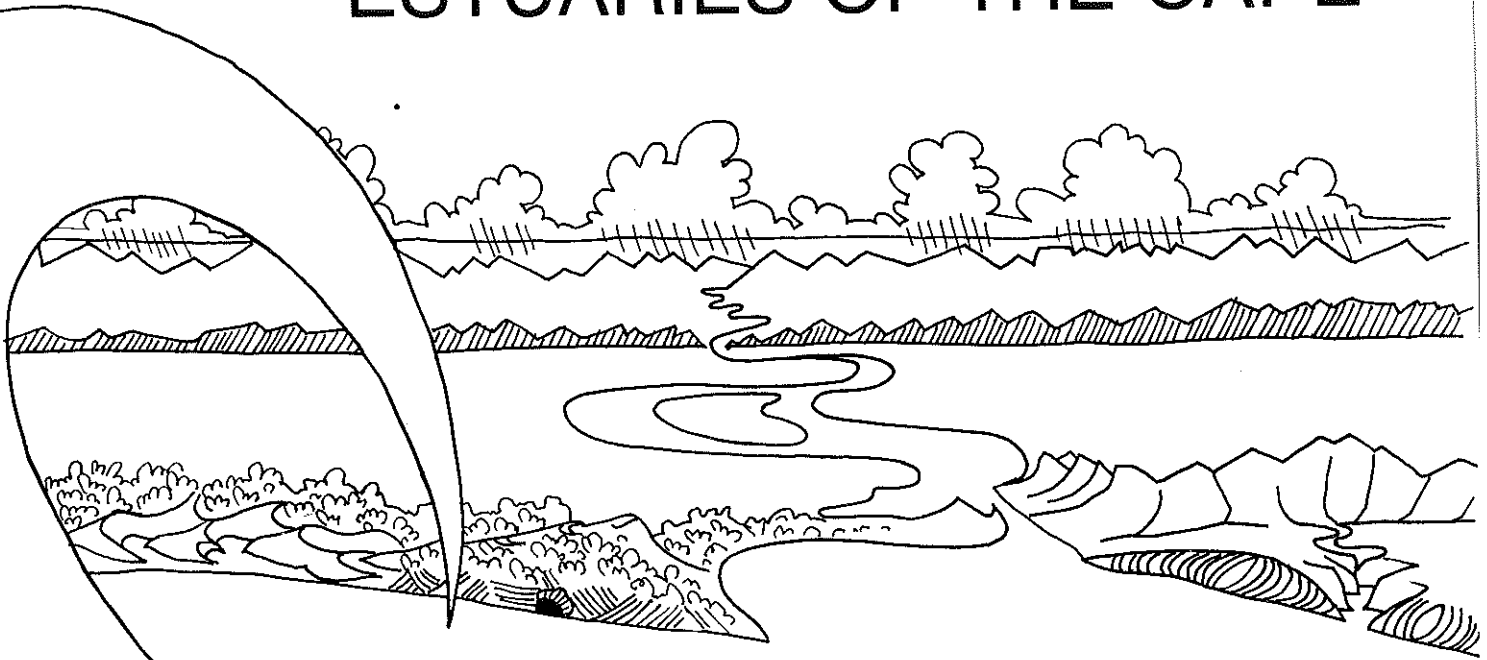


COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH
NATIONAL RESEARCH INSTITUTE FOR OCEANOLOGY
ESTUARINE AND COASTAL RESEARCH UNIT – ECRU



ESTUARIES OF THE CAPE



PART II

SYNOPSIS OF AVAILABLE INFORMATION
ON INDIVIDUAL SYSTEMS

EDITORS: A E F HEYDORN
J R GRINDLEY

REPORT NO. 8

ROOIELS (CSW 10)

ESTUARIES OF THE CAPE

PART II: SYNOPSES OF AVAILABLE INFORMATION ON INDIVIDUAL SYSTEMS

REPORT NO. 8: ROOIELS (CSW10)

(CSW10 — CSIR Estuary Index Number)



FRONTISPIECE: ROOIELS ESTUARY — ALT. 500 m, ECRU 79-08-15

COMPILED BY: T J E HEINECKEN

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PREFACE

The Estuarine and Coastal Research Unit (ECRU) was established by the National Research Institute for Oceanology of the CSIR in 1979 with the following aims :

- to contribute information relevant to the development of a cohesive management policy for the South African coastline;
- to compile syntheses of all available knowledge on the 167 estuaries of the Cape between the Kei and the Orange rivers;
- to identify gaps in information and to stimulate research at Universities, Museums and other institutions to fill these.

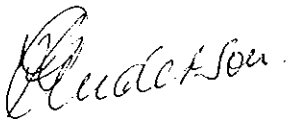
The Unit was established at the request of the Government, and the Department of Environmental Affairs contributes substantially to the running costs.

In 1980 the Unit published its first report under the title "The Estuaries of the Cape, Part I - Synopsis of the Cape Coast. Natural Features, Dynamics and Utilization" (by Heydorn and Tinley)*. As the name of the report implies, it is an overview of the Cape Coast dealing with aspects such as climate, geology, soils, catchments, run-off, vegetation, oceanography and of course, estuaries. At the specific request of the Government, the report includes preliminary management recommendations.

The present report is one of a series on Cape Estuaries being published under the general title "The Estuaries of the Cape, Part II." In these reports all available information on individual estuaries is summarized and presented in a format similar to that used in a report on Natal estuaries which was published by the Natal Town and Regional Planning Commission in 1978. It was found however, that much information is dated or inadequate and that the compilation of Part II reports is therefore not possible without brief prior surveys by the ECRU. These surveys are usually carried out in collaboration with the Botanical Research Institute and frequently with individual scientists who have special interest in the systems concerned. One of these is Prof J R Grindley of the University of Cape Town who is co-editor of the Part II series.

These surveys are however not adequate to provide complete understanding of the functioning of estuarine systems under the variable conditions prevalent along the South African coastline. The ECRU therefore liaises closely with Universities and other research institutes and encourages them to carry out longer-term research in selected estuarine systems. In this way a far greater range of expertise is involved in the programme and it is hoped that the needs of those responsible for coastal zone management at Local-, Provincial- and Central Government levels can be met within a reasonable period of time.

Finally, it has been attempted to write the Part II reports in language understandable to the layman. However it has been impossible to avoid technical terms altogether. A glossary explaining these is therefore included in each report.



F P Anderson
DIRECTOR

National Research Institute for Oceanology
CSIR

* CSIR Research Report 380

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ROOIELS

1. SYNONYMS AND DERIVATIONS

Rooiels, Rooi Els or Rooi-els.

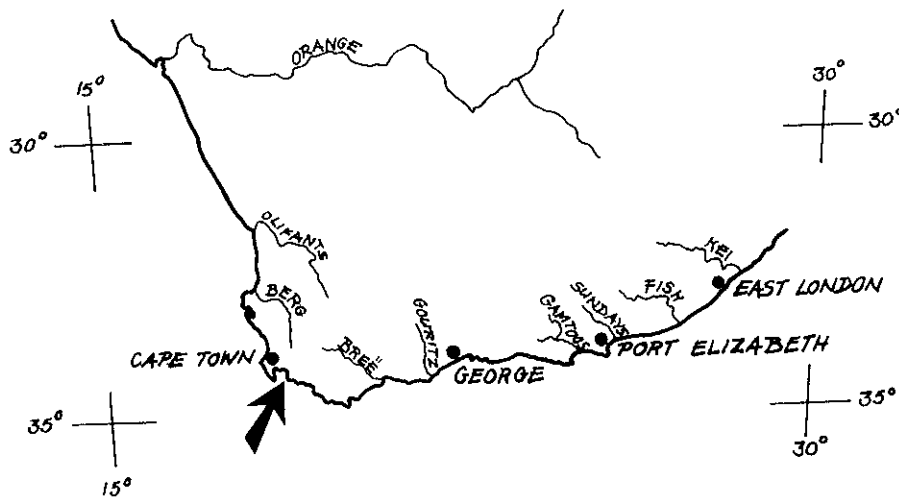
The name Els refers to the European alder tree which is similar in appearance to the indigenous Cunonia capensis, commonly known as the Rooiels. A number of these trees are found in the forest patches occurring in the catchment of the Rooiels river.

A cave situated close to the river, a short distance upstream from the mouth is an archaeological site which has been studied in detail by the Archaeology Department of the University of Cape Town and the South African Museum. Remains in the cave suggest that marine, terrestrial and estuarine resources were exploited by its inhabitants (Avery 1981 in press) and (Smith 1981 in press).

Further details regarding the excavated remains are given under the appropriate headings in the report which follows.

2. LOCATION

The Rooiels river mouth is situated at $34^{\circ} 18' S$ and $18^{\circ} 49' E$ (1:50 000 Sheet 3418 BD), and is approximately 70 km from Cape Town.



2.1 Accessibility

The coastal road from Gordons Bay to Cape Hangklip on the eastern side of False Bay crosses the Rooiels river at its mouth.

The estuary itself falls within the Hottentots Holland Mountain Catchment and the Rooiels Township areas (Fig 1).

According to the General Plan 690 LD of the Rooiels Township obtained from the Surveyor General's Office, two portions designated as public open space for the Rooiels township include sections of the estuary above and below the original road bridge which crossed the estuary. This diagram also shows that the mouth of the Rooiels river is situated on a portion of State Land which is presumably part of the Hottentots Holland Mountain Catchment Area (See Fig 1). Access to the public open spaces is via a 20 ft (6 m) lane between erven 46 and 45 and from Riverside road which according to the township plan runs alongside the upper arm of the estuary.

3. ABIOTIC CHARACTERISTICS

3.1 Catchment :

The Rooiels river catchment lies within the Blousteenberg which are situated at the southern extension of the Hottentots Holland Mountain range (1:500 00 Sheet SE 35/17½).

Area

From the 1:50 000 Topographical Sheet 3418 BD the catchment area has been calculated to be approximately 20km².

River length

The total distance from the river mouth to the end of the longest tributary is approximately 9 km. (1:50 000 Sheet 3418 BD).

Tributaries

A number of small streams, which would flow only during the rainy season, enter the main stream along its course (1:50 000 Sheet 3418 BD).

Mean annual run-off

No published data could be traced.

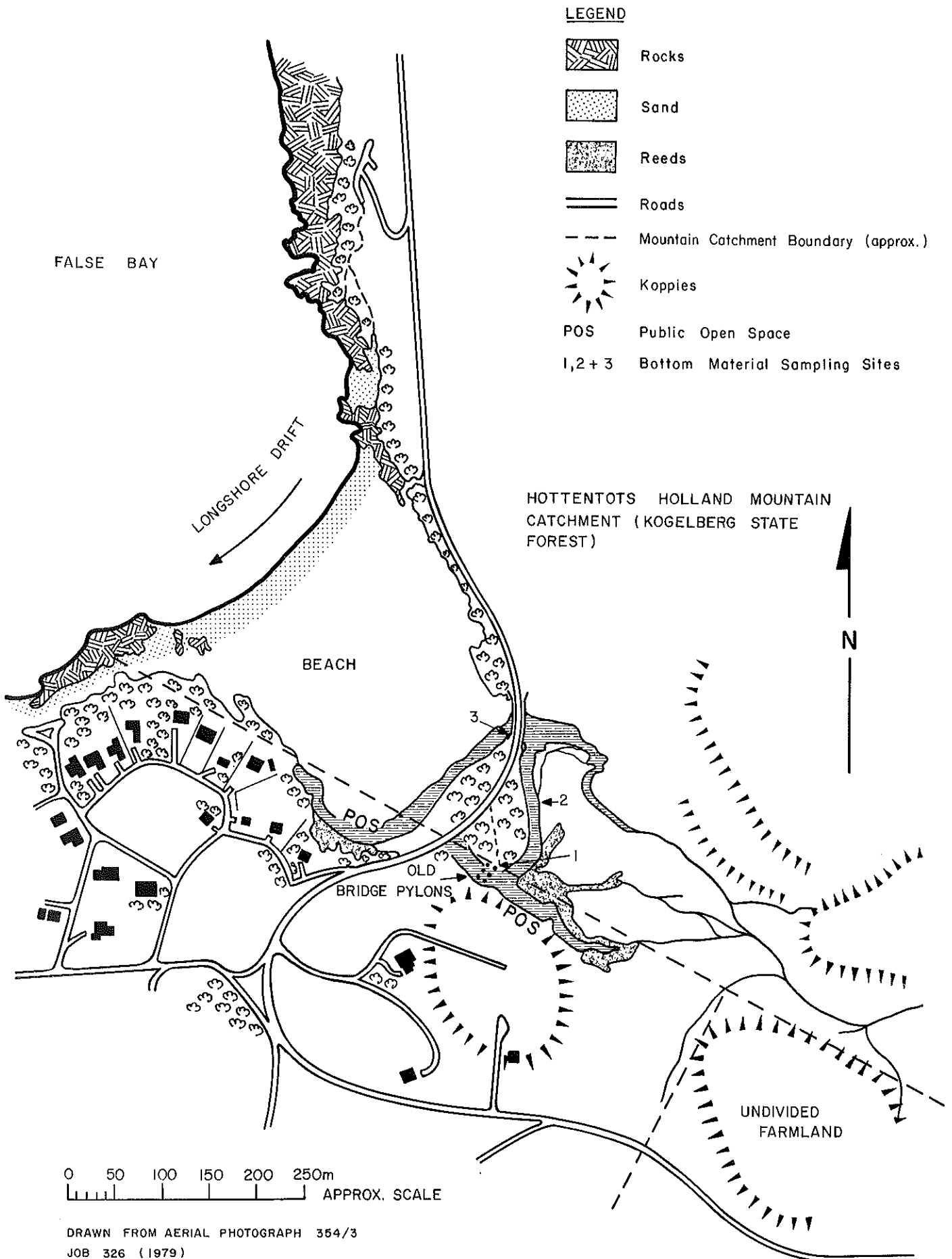
3.2 Flow :

The river has a steep gradient, is shallow and is very narrow in its upper catchment area. It is consequently fast flowing with many small rapids and waterfalls. There are no known data available for volumetric flow.

Flood history and level fluctuations

When the river is in flood during winter, the entire floodplain and beach are inundated with brown, peat-stained water to a level which can be at least 0,5 m higher than that recorded during the initial ECRU survey. This was evident from the debris drift-line in the surrounding reedbed.

FIG. 1: ROOIELS ESTUARY.



Following heavy rains during February 1981 the river came down in flood and the main channel was cut diagonally across the main beach. Similar channels are evident in past aerial photographs of the system (Job No 786 of 1977).

3.3 Obstructions :

(a) In the catchment

There are no artificial obstructions but, as mentioned above, numerous small rapids and waterfalls are present in the upper catchment area.

(b) Near the mouth

Aerial photographs taken during 1938 show that at that time the river formed an extensive meander across the lower end of its floodplain (Fig 2). It is evident that with the construction of the bridge and embankment for the coastal road in the early 1950's, the main flow channel was relocated towards the northern side of the floodplain under the present road bridge and that the river established a meander on the seaward side of the road embankment so as to enter the sea at its former position (Fig 1). Wooden pylons of an old bridge can be seen in the southern arm of the estuary above the road (Plate I). The uniform width and shape of the channel connecting the northern and southern arms of the upper estuary suggests that this channel was artificially formed when the new bridge was built.

3.4 Siltation :

Van Wyk (1958 unpublished) stated emphatically that there was no evidence of mud or silt washing down from the upper catchment, even after the winter rains when the river had been in flood.

During the ECRU survey of December 1979 there was a thin layer of decayed organic matter and fine black mud in the upper reaches of the southern arm of the estuary above the road. However, there are no signs of erosion due to run-off on the slopes above the estuary.

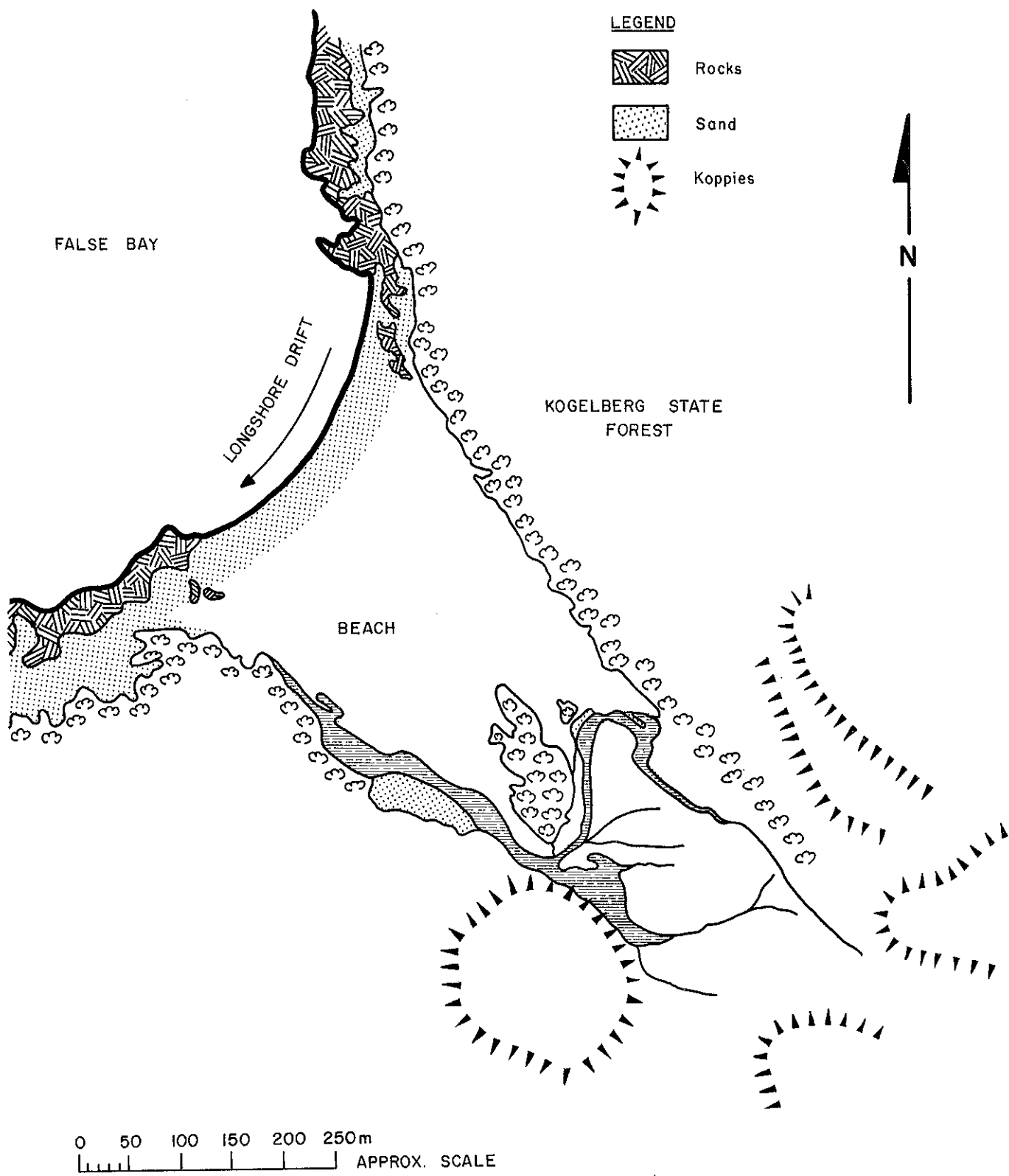
3.5 Land ownership/use :

(a) Catchment

The entire catchment of the Rooiels river lies within the declared Hottentots Holland Mountain Catchment Area (Mountain Catchment Areas Act No 63 of 1970). This is State Land administered by the Directorate of Forestry with the objective of conserving natural ecosystems on a multiple use basis while maintaining a sustained flow of high quality water.

In order to achieve these objectives it has been found necessary to carry out a programme of rotational burning of the vegetation.

FIG. 2: CONFIGURATION OF THE ROOIELS ESTUARY
IN 1938.



0 50 100 150 200 250m
APPROX. SCALE

DRAWN FROM AERIAL PHOTOGRAPH I2775
JOB 126 / 38 (1938)

As far as possible wooded kloofs, certain peaks, natural springs and estuarine areas such as the lower part of the Rooiels river are excluded from the burning programme (Directorate of Forestry pers. comm.). Public access to the Kogelberg State Forest Reserve is very restricted and rigorously controlled to protect the natural vegetation including certain rare species of fynbos within the catchment.

(b) Around the estuary

Almost the entire estuarine area falls within the Hottentots Holland Mountain Catchment Area (See Section 2.1). The Rooiels township is situated on the southern side of the estuary and was proclaimed in 1942 with 319 erven and 5 areas of public open space (Cape Provincial Administration 1973). According to the General Plan 690 LD of the Rooiels Township obtained from the Surveyor General's office, two portions of public open space include parts of the estuary. These are situated adjacent to the township above and below the coastal road (See Fig 1).

Although the township was proclaimed in 1942, by 1981 only 125 erven (39 percent) had been developed (Secretary, Ratepayers Association, pers. comm.). The majority of houses at Rooiels are used only over weekends and during the holiday season. The southern boundary of the Rooiels township borders onto two undivided portions of farmland which extend down to the upper part of the estuary (See Fig 1).

Public access and use of the estuarine areas falling within the Forestry Catchment zone are subject to the same conditions which apply to the upper Rooiels catchment (See 3.5 (a) above). Up until May 1981 the public had access to a small picnic area above the road embankment. Due to misuse this has recently been fenced off by the Directorate of Forestry so that the general public now have access to only the beach area seaward of the road embankment (See Section 2.1). During the latter part of 1980 application was made to the local authority for subdivision of one of the undivided portions of land to the south-east of the Rooiels township (PLATE II). This met with strong opposition from the ratepayers of Rooiels who feared that development of this sensitive area with its steep gradients could seriously affect the natural beauty of the Rooiels valley and that the maintenance of this portion in its natural state was essential for the conservation of the valley (Currie 1981 unpublished). The application was subsequently turned down by the local authority who also resolved not to consider any further applications for subdivision of land in this particular area at present (Caledon Div. Council, pers. comm.).

3.6 Local Authority

The Caledon Division Council is the authority controlling the development on private land and is responsible for the provision and maintenance of road and services in the area. The Directorate of Forestry administers all the State land at the estuary while the interests of the Rooiels property owners are looked after by the Rooiels Ratepayers Association.

3.7 Estuary uses :

The entire estuarine area above the road embankment and bridge except for the portion of public open space within the Rooiels township is closed to the public (See Sections 2.1 and 3.5). The estuary and beach below the road are used extensively by the public of the Cape Town metropolitan area and by residents of Rooiels for general beach-orientated recreation, mainly over weekends and during holiday periods. Recreational activities include swimming, bait-gathering, and fishing (Cape Provincial Administration 1973).

3.8 Morphometry of the estuary :

Area

The area of the estuary up to the head of tidal effect is approximately 1,22 ha as calculated from the 1:10 000 aerial photograph (Job No. 326 of 1979). However at high spring tides the entire beach area is flooded (refer to Fig 1).

Shape

The estuary which is flanked by the steep slopes of the Kogelberg mountains has a multi-channel configuration through its floodplain, with the main water body above the road being roughly H-shaped (Frontispiece). As already mentioned (See section 3.3 (b)) the river course was displaced seawards with the building of the coastal road. The river now enters the beach area under the road bridge on the northern side of the floodplain, and then swings southward running parallel to the road before turning west to enter the sea alongside a rocky point at the western extremity of the bay (Fig. 1).

Bathymetry

The estuary is generally less than 1 m deep; however, the main channel under the bridge had been scoured to a depth of 3,0 m at the time of the ECRU survey in December 1979. When the mouth is open the depth increases slightly at high tides with the seawater pushing up into the estuary.

3.9 Geomorphology :

The rocky environment of the upper catchment through which the river has cut its course, consists of material belonging to the Table Mountain Group (TMG). In the floodplain its movement is restricted by vegetation and artificial structures such as the coastal road and bridge.

Geology

As indicated above the Rooiels is situated in a typical south-western Cape TMG environment. The sandstone is folded to some extent and dips to the NNE at roughly 45° . This dipping is clearly visible in the strata of the Hangklip-Rooiels mountains. The colours of the sandstone vary from red-brown when fresh to dark brown, yellow and white. The sands are fine-grained and well-sorted (ECRU Survey December 1979).

According to Boucher (1978), the geology around the estuary

consists of a tongue of Tertiary sands¹ intruding into the Peninsula Formation² of Table Mountain Sandstone (TMS) (Fig 3).

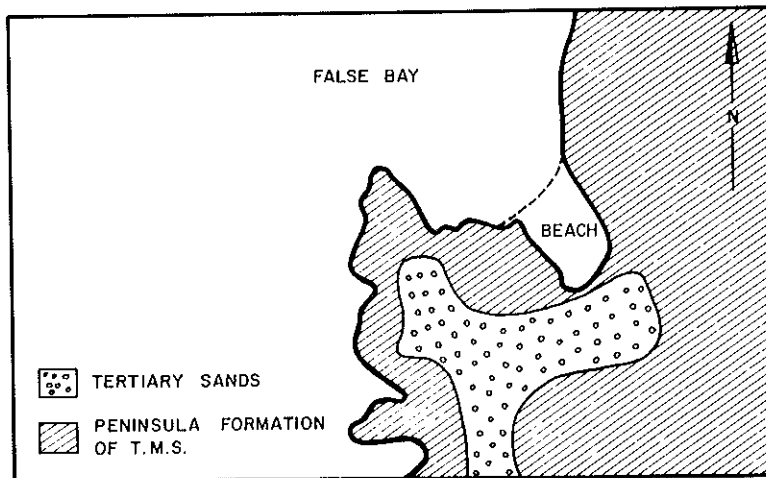


FIG 3 : Geology of the Rooiels area (after Boucher 1978).

Nature of bottom materials

Van Wyk (1958 unpublished) describes the bottom of the estuary as being very stony with sand in places upstream of the bridge. Bottom sand samples taken by the ECRU in December 1979 at three sites (See Fig 1) are described as follows:

Site 1 : Colour of sample - dark brown with darker streaks due to a high percentage of organic material. The grains are well rounded but poorly sorted. Quartz grains and small grains of a calcareous nature were also present. The only bed-forms were poorly formed ripples with organic detritus present in the depressions between the ripples.

Site 2 : Bottom materials consisted of poorly sorted unconsolidated weathered products of TMS.

Site 3 : This sample was generally of finer grain size and showed better sorting with a higher percentage of shell fragments and a lower percentage of organic material. This is probably due to more water movement and greater interaction of sea and river water (ECRU Survey December 1979).

Sandbar characteristics

A broad flat beach extending from the road to the sea acts as a sandbar for the estuary (Fig 1). According to Van Wyk (1958 unpublished), the mouth was open in September 1958 and the river flowed out to sea, more or less across the centre of the beach (Fig 4). During the ECRU survey in December 1979, no water was flowing out to sea at low tide but as the tide came up, seawater

1. *Tertiary sands : Sands originating from the Tertiary System which relates to the period of time which elapsed between the end of the Cretaceous and the present time.*
2. *Peninsula Formation : Forms part of the Table Mountain Series.*

pushed up into the estuary to cover the south-western half of the beach. On subsequent visits to the estuary by members of ECRU on 3 February 1981 and 11 March 1981 the river was open to the sea on the southern side of the beach. During floods the river cuts a direct channel out to sea on the northern side of the beach; then, under the influence of longshore drift and sediment movement in a south-westerly direction, the mouth moves across the beach to reach a position against the rocky shoreline on the southern side of the bay (PLATE III).



FIG 4 : General view of the Rooiels estuary in September 1958
(G F Van Wyk).

Configuration of adjacent shore

The coast on either side of the estuary is a rugged, rocky shoreline composed of TMS.

3.10

Oceanography :

Major currents

According to Harris (1978), four different major current patterns have been identified in False Bay. South-easterly winds form a large cyclonic circulation within the bay while the north-westerly winds cause an eastward flowing current which, "enters the bay at Hangklip and follows the coastline of the bay until being influenced by the winds within it." The other two types are slow-moving and appear to move in and out of the bay with the tides during the periods of calm weather.

Waves

The waves enter False Bay predominantly from the south-west and, according to Shipley (1964), refraction of these waves by "Rocky Bank" in the south-west corner of the bay causes them to

converge and leads to irregular freak waves which break on the eastern shores of False Bay. This has led to the drowning of a number of anglers in the vicinity of Rooiels.

From aerial photographs it appears as if waves sweep into the Rooiels bay mainly from the west.

Surf zone currents

A build up of water in the eastern corner of the Rooiels bay, caused by the westerly swells sweeping into the bay, results in a longshore drift in a southerly direction. This would explain the opening of the estuary in the south-western corner of the beach under all but flood conditions - (See Section 3.9 "Sandbar characteristics".).

Tides

The tidal range between mean low water spring and mean high water spring levels at the estuary is approximately 1,48 m (South African Tide Tables 1979). From signs on the vegetation lining the banks of the estuary above the road, it was evident that the range of tidal influence was at least 8 cm at the time of the ECRU visit to the estuary on 11 March 1981 (Plate II).

3.11 Physico-chemical characteristics :

Data on physico-chemical characteristics have been collected by G F van Wyk in 1958, S Grindley in 1978 and during various ECRU visits to the estuary. These are presented in Table 1. It can be expected that during the winter after rains the estuary becomes totally fresh when it assumes the character of a river mouth. In summer however, the water may even become hypersaline due to evaporation, low in-flow from the river and overtopping of the sandbar at high spring tide. According to Van Wyk (1958 unpublished) the tidal influence extends to approximately 450 m above the road bridge.

3.12 Pollution :

The only form of pollution evident at the estuary is litter left by picnickers or that washed up by the tides.

3.13 Public health aspects :

As mentioned before, the upper catchment and estuary fall within an uninhabited natural area and it is therefore unlikely that any public health hazards are present. The lack of public toilets at the estuary may lead to problems when the area is visited by large numbers of people, as often happens over weekends.

4. BIOTIC CHARACTERISTICS

4.1 Flora :

Phytoplankton/diatoms

Various pennate diatoms and chlorococcales associated with filamentous algae were present.

TABLE 1 : Physico-chemical data for the Rooiels estuary

Date	ECRU		81-03-11	S Grindley (1978) April 1978	G F van Wyk (1958) 58-09-10
	79-12-04	81-03-11			
Time	11h00 - 12h00	11h30 - 15h00	-	-	10h00 - 11h30
State of mouth	Closed	Open	-	-	Open (shallow)
State of tide	Low	Low	-	-	Low
Position of sampling site	At old bridge pylons in southern arm	In the southern arm	In the southern arm	In the southern arm	Top end of southern arm
Depth (m) at sampling site	0,75	1,8	-	-	-
* Width (m)	-	-	-	-	-
Diss. O ₂	Top	-	-	-	-
mg/ℓ	Bottom	-	-	-	-
Salinity	Top	26	28	24	-
(°/∞)	Bottom	-	-	-	-
Temp.	Top	20,4	20,5	18	15
(°C)	Bottom	20,2	18,8	-	-
pH	-	-	6,5	-	6,4
Secchi disc transparency (m)	> 0,75 m	1,7	-	-	1,8
Water colour	Brown, peat-stained	Brown, peat-stained	Brown, peat-stained	Brown, peat-stained	Brown, peat-stained
Substrate	Coarse sand & pebbles	Mud overlying sand	Muddy	Muddy	Rock & coarse sand

* Estuary/River width at sampling site

Aquatic vegetation

(a) Estuary

Grindley (1978 unpublished) recorded that filamentous green algae were prolific along the edges of the water in the upper part of the estuary during April 1978. Van Wyk (1958 unpublished) reports the presence of Potamogeton at the top end of the blind channel. During the ECRU surveys, Ulva sp., various filamentous algae including Chaetomorpha, Cladophoropsis and threads of the diatom Melosira sp. as well as Ruppia (not Potamogeton) were noted in the estuary above the bridge and road embankment.

(b) Adjacent shoreline

The rocky shoreline on either side of Rooiels bay was not sampled during any of the ECRU visits to the estuary but the marine algae of Rooiels were studied by Wm E Isaac in September 1944 and October 1946. He gives a zonal sequence as follows:-

"Sub-littoral	-	Poor and local development of <u>Ecklonetum</u> .
Lowest Littoral	-	Mixed algal vegetation, well developed.
About L.W.N. to	-	<u>Bifurcaria</u> association, well developed.
Mid-zonal level	-	<u>Gelidium</u> association, poorly developed.
About H.W.N.	-	<u>Porphyra</u> association, well developed."

(L.W.N. and H.W.N. - low and high water neap tide levels).

Species such as Chaetangium ornatum and Porphyra capensis were found at the mouth of the Rooiels and on the riverbank a short distance from the sea (Isaac 1949).

Semi-aquatic vegetation

A diagram from G F van Wyk's field notes of 1958 shows an area of dense Phragmites reeds occurring at the upper end of the southern channel above the road embankment. During the ECRU survey in December 1979 these reeds were still present together with another area on the seaward side of the road, i.e., in the bend in the estuary on the southern side of the beach (See Fig 1).

Grindley (1978 unpublished) reports that Juncus and Phragmites were found growing along the banks in the upper part of the estuary.

Some of the more common semi-aquatic and marginal plants occurring in the marshy areas of the floodplain are as follows:

<u>Scirpus nodosus</u>	<u>Camolus porosus</u>
<u>Senecio halimifolius</u>	<u>Sporobolus virginicus</u>
<u>Orphium frutescens</u>	<u>Plantago carnosa</u>
<u>Ficinia</u> sp.	<u>Carpobrotus</u> sp.
<u>Chenolea diffusa</u>	<u>Prionium serratum</u>

(ECRU Survey 1979)

Terrestrial vegetation

(This section is contributed by Miss R Parsons of the Botanical Research Institute).

The area falls into Acocks Veld Type 69, Macchia (Fynbos) (Acocks 1975).

The geology and associated vegetation of the Hangklip area was described in detail by Boucher (1978). He states "The vegetation is subdivided into three main categories, namely, Coastal plain vegetation, Mountain vegetation and Riparian vegetation". According to him two main vegetation types occur within these three categories, i.e. Broadleaved Scrub and Fynbos. The vegetation of the Rooiels estuary consists of both these types with Fynbos being dominant on the slopes.

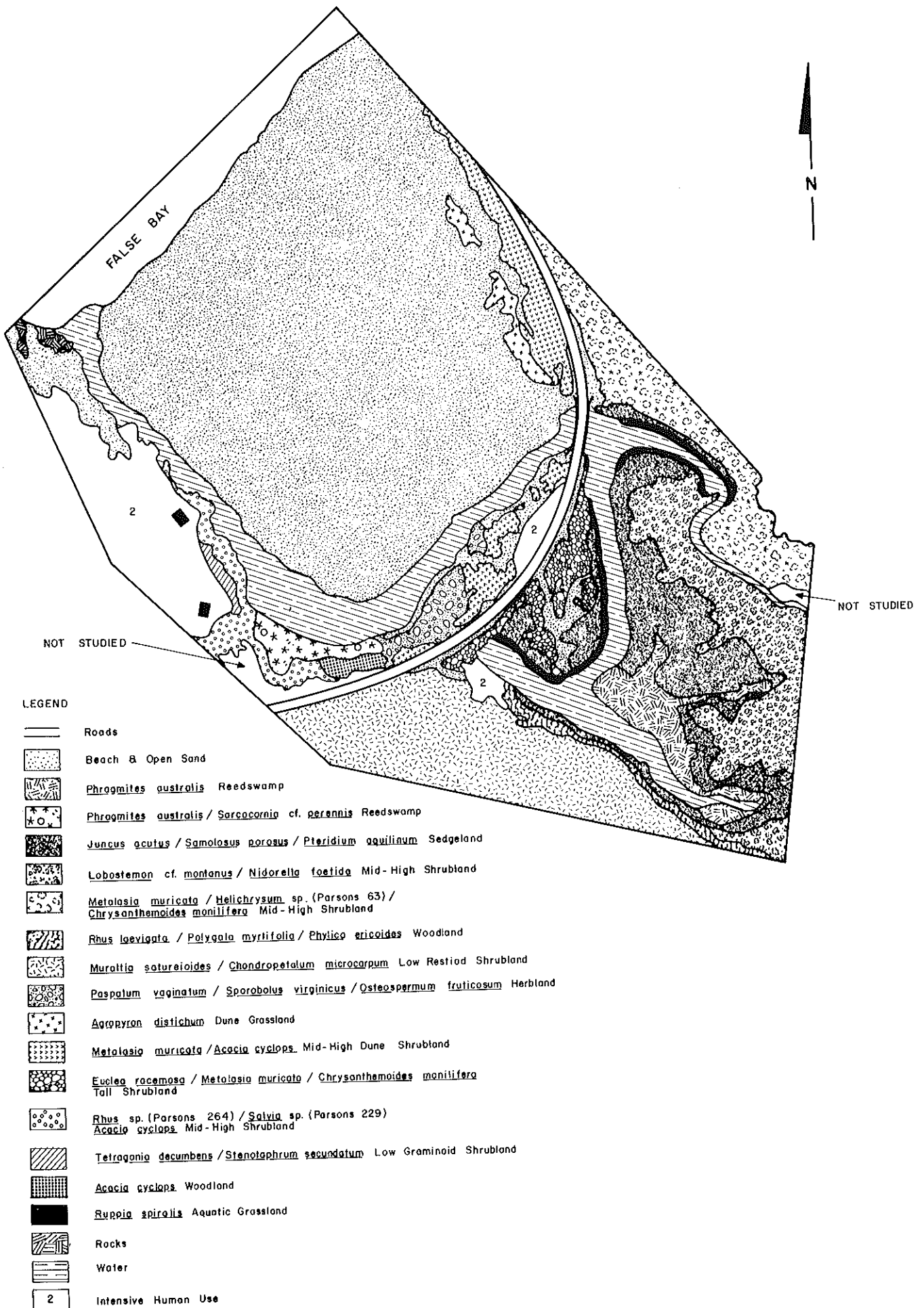
During the ECRU survey fifteen vegetation mapping units were identified and their spatial distribution can be seen in Fig 5. Species composition, structure and area of each mapping unit are shown in Appendix I. The Acacia cyclops Woodland has the highest cover (90 percent) and the Agropyron distichum Dune Grassland the lowest (25 percent). The Phragmites australis Reedswamp and the Ruppia spiralis Aquatic Grassland have the lowest species diversity with only one species recorded while the Muraltia satereioides/Chondropetalum microcarpum Low Restiod Shrubland has the highest with 27 species. Only dominant species were listed so that the species list is in no way comprehensive. The height of the communities varies from 3 m of the Acacia cyclops Woodland to 0,20 m of the Paspalum vaginatum/ Sporobolus virginicus/ Osteospermum fruticosum Herbland.

The mapping units can be consolidated into eight plant formations namely, tall shrubland (> 2 m), mid-high shrubland (1-2 m), low shrubland (0,25 - 1,0 m), woodland, herbland, grassland, sedgeland and reedswamp. The mid-high shrubland is the most extensive covering an area of 3,6 ha* of the total 19,1 ha studied. This is followed by sedgeland (1,3 ha), low shrubland (1,0 ha), reedswamp (0,54 ha), tall shrubland (0,34 ha), woodland (0,24 ha), herbland (0,20 ha) and grassland (0,15 ha).

Below the road the vegetation is disturbed and Acacia cyclops has invaded fairly extensive areas. This is probably because embankments have been made for the construction of the road and houses of Rooiels. This would have resulted in disturbance of the natural vegetation allowing A.cyclops to invade the area. Above the road there is disturbance at the picnic/camping site mainly due to trampling. However, on 14 July 1981 a fence had been erected including this into the Mountain Catchment Area, thus prohibiting access by the general public (See Section 3.5 (b)). The rest of the vegetation is in a good condition and shows virtually no sign of disturbance.

**Estimated areas*

FIG. 5: VEGETATION MAPPING UNITS OF THE ROOIELS ESTUARY
APPROXIMATE SCALE - 1:5000



Fauna :Zooplankton

No data

Fauna on hard substrates, soft substrates and vegetation(a) on hard substrates

No sampling was undertaken during the ECRU surveys. A survey carried out by the Zoology Department of the University of Cape Town in 1979, however, indicates that the following species are present in the intertidal zone on the southern side of the Rooiels estuary (Smith 1981).

Limpets	- <u>Helicon pectunculus</u>	Periwinkels	- <u>Littorina africana</u>
	<u>Siphonaria deflexa</u>		var. <u>knysnaensis</u>
	<u>Patella granularis</u>		<u>Oxysteles variegata</u>
	<u>P. oculus</u>		<u>O. sinensis</u>
	<u>P. granitina</u>	Whelks	- <u>Thais dubia</u>
	<u>P. cochlear</u>		<u>Burnupena limbosa</u>
	<u>P. barbara</u>	Ribbed mussel	- <u>Aulacomya ater</u>
	<u>P. longicosta</u>	Brown mussel	- <u>Perna perna</u>
	<u>P. tabularis</u>	Sea urchin	- <u>Parechinus angulosus</u>
Barnacles	- <u>Tetraclita serrata</u>	Starfish	- <u>Patiriella exigua</u>
	<u>Octomeris angulosa</u>	Cape reef-worm	- <u>Gunnarea capensis</u>
	<u>Chthamalus dentatus</u>	Mussel worm	- <u>Pseudonereis variegata</u>

(b) on soft substrates

The presence of the sandprawn, Callianassa throughout the system was noted by Van Wyk (1958 unpublished), Grindley (1978 unpublished) and by ECRU in December 1979 and March 1981.

Table 2 lists the species found by S Grindley on a transect line from low water spring tide level to the road bridge during a UCT Zoology Department field trip carried out in April 1978. At each sampling site on the transect a hole of 25 cm² x 30 cm deep was dug and the sand sieved and sorted. The most abundant animals in the mid-tide zone (sites A-G (See Table 2)) were isopods, but the whelk, Bullia digitalis and the white mussel, Donax serra also occurred in this region. The flat beach area (sites G-K) had few benthic organisms which were however dominated by the isopods, Pontogeloides latipes and Eurydice longicornis.

Talorchestia sp. and the crab Hymenosoma orbiculare were found in the upper tidal area while in the estuarine area E. longicornis, Melita zeylanica, Talorchestia sp., Assiminea ponsonbyi and the shrimp Palaemon pacificus also occurred. The greatest species diversity was found at site K in the estuarine environment (Grindley 1978 unpublished).

(c) on vegetation

No published data could be traced.

Insects

No published data available.

Other invertebrates

No published data available.

Fish

In September 1968, G F van Wyk netted White Steenbras (Lithognathus sp.), Gobies (Gobiidae) and "nice big" Harders (Mugilidae).

S Grindley recorded Psammogobius knysnaensis, Heteromyteris capensis, Lithognathus mormyrus and Hepsetia breviceps during her field trip in 1978 (See Table 2). The following species were noted by ECRU in December 1979 and March 1981; juvenile Mullet (Mugilidae), Gobies (Gobiidae) and Steenbras (Lithognathus sp.). According to Smith (1981), estuarine fish remains were retrieved from the Rooiels cave excavations.

TABLE 2 : Aquatic fauna of the Rooiels estuary (Adapted from Grindley 1978 unpublished).

<u>Species list</u>	<u>SITES</u>												
	Low Water Mark to Neap tide bank						Flat beach to estuary					Above road bridge	
	A	B	C	D	E	F	G	H	I	J	K	L/M	
<u>Bullia digitalis</u>	2												
<u>Eurydice longicornis</u>	1		6	2	13				13		3		
<u>Sipunculida</u>	1		13										
<u>Nephytys capensis</u>			2										
<u>Callianassa kraussi</u>								2		2			
<u>Hymenosoma orbiculare</u>													1
<u>Cyathura carinata</u>													6
<u>Pontogeloides latipes</u>		37	1		26				7	1			
<u>Talorchestia sp.</u>							3		20	1			
<u>Melita zeylanica</u>										3			6
<u>Palaemon pacificus</u>													6
<u>Assimineia ponsonbyi</u>											5		
<u>Donax serra</u>				2									
<u>Cerebratulus fuscus</u>											43		
<u>Psammogobius knysnaensis</u>							1		2				
<u>Heteromyteris capensis</u>							1						
<u>Lithognathus mormyrus</u>													1
<u>Hepsetia breviceps</u>											6		

Reptiles and amphibians

During the ECRU survey in December 1979, a Common Puff-adder, Bitis arietans was seen on the southern slope above the estuary.

Information supplied by R C Boycott and A L de Villiers of the Cape Department of Nature and Environmental Conservation indicate that the following species of reptiles and amphibians have been recorded or are likely to occur within the area covered by the 1:50 000 Topo-cadastral Sheet of Hangklip 3418 BD which includes the Rooiels estuary.

Tortoises : Two species which are likely to occur in the region are the Angulate Tortoise, Chersina angulata and the Padloper tjie or Parrots-beak Tortoise, Homopus aerolatus which were recorded by Greig and Burdett (1976 unpublished), from a neighbouring grid locality.

Snakes : The Black House Snake, Lamprophis inornatus and the Spotted House Snake, Boaedon guttatus have been recorded by the Cape Department of Nature Conservation whereas Fitzsimons records the following species from neighbouring grid localities :

Common Water Snake	-	<u>Lycodonomorphus rufulus</u>
Black House Snake	-	<u>Lamprophis inornatus</u>
Common Mole Snake	-	<u>Pseudaspis cana</u>
Common Egg-eater	-	<u>Dasypeltis scabra</u>
Boomslang	-	<u>Dispholidus typus</u>
Cross-marked Grass Snake	-	<u>Psammophis crucifer</u>
Cape Cobra	-	<u>Naja nivea</u>
Aurora House Snake	-	<u>Lamprophis aurora</u>
Spotted House Snake	-	<u>Boaedon guttatus</u>
Common Slug-eater	-	<u>Duberria lutrix</u>
Herald Snake	-	<u>Crotaphopeltis hotamboeia</u>
Spotted Skaapsteker	-	<u>Psammophylax rhombeatus</u>
Dapple-backed Sand Snake	-	<u>Psammophis notostictus</u>
Spotted Dwarf Garter Snake	-	<u>Elaps lacteus</u>
Common Puff-adder	-	<u>Bitis arietans</u>

Pelamis platurus the yellow and black sea-snake may occasionally be washed up on the beaches in the area.

Amphibians :

Cape Chirping Frog	-	<u>Arthroleptella lightfooti</u>
Common Platanna	-	<u>Xenopus laevis</u>
Cape Ghost Frog	-	<u>Heleophryne purcelli</u>
Raucous Toad	-	<u>Bufo rangeri</u>
Cape Sand Frog	-	<u>Tomopterna delalandii</u>
Cape River Frog	-	<u>Rana fuscigula</u>
Clicking Stream Frog	-	<u>Rana grayii</u>
Banded Stream Frog	-	<u>Rana montana</u>
Common Caco	-	<u>Cacosternum boettgeri</u>

Birds

The general conditions at Rooiels estuary would seem to favour certain species of aquatic avifauna but as can be seen from Table 3 there is a scarcity of these birds at the estuary. Disturbance by people over weekends has perhaps reduced numbers.

TABLE 3 : Birds of the Rooiels estuary

Roberts No.	Species	WCWSG* 75-12-15	ECRU 79-12-04	WCWSG (J Cooper pers. comm.) 81-01-05	ECRU 81-03-11	
289	Hartlaubs Gull		3	No waders recorded	present	
89	Egyptian Goose		2			
50	Reed Cormorant		1			
287	Blackbacked Gull		2			
289&291	Swift & Common Tern		107			
258	Common Sandpiper		1			
235	White-fronted Sandplover	1				
394	Pied Kingfisher					1
686	Cape Wagtail					1
745	Redwing Starling		present			present
812	Yellow Bishop Bird		2			
502	Larger Striped Swallow		present			

*WCWSG = Western Cape Wader Study Group

Dr G Currie who owns a cottage at Rooiels has recorded the following species which were observed over several years from periodic visits to the estuary.

<u>Roberts No. & Species</u>	<u>Habitat Preference</u>	<u>Status</u>
47 White-Breasted Cormorant	Beach	Common visitor
48 Cape Cormorant	Beach	Common visitor
50 Reed Cormorant	Estuarine, Aquatic	Common visitor
59 Little Egret	Upper estuarine, Aquatic	Common visitor
96 Yellow-billed Duck	Upper estuarine, Aquatic	Common visitor
89 Egyptian Goose	Upper estuarine, Aquatic	Common visitor
123 Rock Kestrel	Krans, Mountain fynbos, Valley fynbos	Common visitor
169 Black Harrier	Upper estuarine vegetation, Valley fynbos	Rare visitor
133 Black Eagle	Mountain fynbos	Common visitor
287 Southern Black-backed Gull	Beach	Common visitor
	Lower estuary	
289 Silver Gull (Hartlaubs)	Beach	Common visitor
	Lower estuary	
291 Common Tern	Beach	Common visitor
296 Sandwich Tern	Beach	Summer migrants
298 Swift Tern	Beach	Common visitor

<u>Roberts No. & Species</u>	<u>Habitat Preference</u>	<u>Status</u>
311 Rock Pigeon	Krans	Common breeding resident
316 Cape Turtle Dove	Upper estuary, Valley fynbos	Common breeding resident
235 White-fronted Sandplover	Beach, Lower estuary	Common resident
367 Cape Eagle Owl	Valley fynbos	Rare resident
380&386 Black Swift and Alpine Swift	Airspace over Rooiels	Common visitor
493 European Swallow	Upper estuary, Valley fynbos	Common visitor Summer migrant
495 White-throated Swallow	Upper and lower estuary	Breeding summer migrant
502 Greater Striped Swallow	Upper estuary, Valley fynbos	Common visitor Summer migrant
506 Rock Martin	Krans, Upper estuary, Valley fynbos	Common breeding resident
524 White-Necked Raven	Krans, Valley fynbos	Common visitor
543 Cape Bulbul	Upper estuary, Valley fynbos, Kloof forest	Common breeding resident
553 Olive Thrush	Upper estuary, Kloof forest	Uncommon resident
581 Cape Robin	Upper estuary, Valley fynbos, Kloof forest	Common breeding resident
570 Familiar Chat	Valley fynbos	Common breeding resident
599 Cape Rock Thrush	Krans, Valley fynbos	Common breeding resident
638 Grey-backed Cisticola	Valley fynbos	Common resident
637 Neddicky	Valley fynbos	Common resident
618 Cape Grassbird	Valley fynbos	Common breeding resident
604 Rufous Reed Warbler	Upper estuary	Common resident
651 Karoo Prinia	Valley fynbos	Common resident
665 Fiscal Flycatcher	Valley fynbos, Kloof forest	Uncommon resident
672 Cape Batis	Kloof forest	Uncommon resident
686 Cape Wagtail	Beach, Lower estuary, Upper estuary, Valley fynbos	Common resident
733 European Starling	Township, Upper estuary	Common breeding resident
745 Red-winged Starling	Valley fynbos, Krans	Common breeding resident
753 Orange-breasted Sunbird	Valley fynbos	Common resident
749 Cape Sugarbird	Valley fynbos	Common resident
799 Cape Weaver	Upper estuary, Valley fynbos	Common resident
786 Cape Sparrow	Township, Upper estuary, Valley fynbos	Common breeding resident
810 Cape Widow (Yellow Bishop)	Upper estuary, Valley fynbos	Common breeding resident
873 Cape Bunting	Valley fynbos	Common resident

A description of the habitats referred to under "Habitat preference" is as follows:

- Lower estuary : The aquatic habitat in the region of the road and the old wooden bridge pylons (See Fig 1).
Valley fynbos : Fynbos of the lower slopes, with abundant "tree forms" of Protea.
Mountain fynbos : Fynbos of the higher slopes, low scrub forms.
Krans : Where the valley narrows into the kloof.
Kloof forest : This habitat lies within the fenced off Forestry Mountain Catchment Area, therefore only birds noticed on the margins were recorded.

Mammals

Remains of various species of mammals have been recovered from excavations in the Rooiels cave, the main terrestrial species being Steenbok/Grysbok (Raphicerus sp.), Duiker (Silvicapra grimmia) and Klipspringer (Oreotragus oreotragus), remains of large bovids such as Eland/Buffalo (Taurotragus/Syncerus) and Hartebeest (Alcelaphus sp.) were also present (Smith 1981).

Van Wyk (1958 unpublished) recorded that baboon (Papio ursinus) and Klipspringer (Oreotragus oreotragus) were present in the vicinity of the estuary during his survey in September 1958. Spoor of the Cape Clawless Otter (Aonyx capensis), Water Mongoose (Atilax paludinosus) and indications of rodents were noted during the ECRU visits to the estuary in December 1979 and March 1981. Dr G Currie (1981 unpublished) has recorded the following species at the estuary.

Baboon	(<u>Papio ursinus</u>)
Dassie	(<u>Procavia capensis</u>),
Cape Clawless Otter	(<u>Aonyx capensis</u>)
Grey Mongoose	(<u>Herpestes pulverulentus</u>)
Leopard	(<u>Panthera pardus</u>)
Water Mongoose	(<u>Atilax paludinosus</u>).

According to Mr R Attwell the Large-spotted Genet (Genetta tigrina) and the Red Rock Hare (Pronolagus crassicaudatus) also occur at Rooiels.

5. SYNTHESIS

The Rooiels estuary is a small but ecologically healthy system on the eastern shores of False Bay. It appears to be very much in the same state as it was 23 years ago when surveyed by Van Wyk in 1958 (compare Fig 4 and Plate II, see also Fig 6 below).

The original river-course was displaced towards the sea by the present bridge and road embankment, creating a small lagoon with an interconnecting channel on the southern side of the floodplain. The system has, however, adapted to this change with no apparent ill-effect. Reasons for the relatively undisturbed state of the estuary can be attributed to the effective protection of the catchment and floodplain by the Directorate of Forestry and to the conservation orientated approach of the residents of Rooiels township.



FIG 6 : Historic photograph of the Rooiels estuary taken in 1934
(R I G Attwell, December 1934).

The small water surface area, restricted interaction with the sea and the brown acid waters from the catchment, result in a system which is likely to have a low productivity and which could easily become degraded if over-utilized and not adequately protected. Furthermore, the present unpolluted condition of the estuary would not continue if septic tank drainage and storm water run-off from houses built against the southern slopes above the estuary were to occur. In this respect the recommendations made by Currie (1981 unpublished) are supported i.e., (a) that subdivision of farmland adjacent to the Rooiels township and adjoining the estuary should not be allowed and that this land should be incorporated into the Hottentots Holland Mountain Catchment Area, and (b) that the public open space between the upper part of the estuary and the existing developments should be retained as an undeveloped natural area (See Fig 1).

As is the case with many other South African estuaries, the aesthetic appeal and high recreational potential of the Rooiels estuary has led to the development of a township consisting almost entirely of holiday houses. It is therefore essential that the features which led to this development in the first instance are not destroyed through excessive additional developments, be this in the form of extensions to the township, overloading through additional picnicking facilities, or roadworks. In view of current plans to upgrade the scenic coastal drive which crosses the Rooiels estuary, roadworks would seem to hold the most serious implications. If the widening of the existing road and bridge is absolutely necessary then it should be planned and carried out with the greatest circumspection.

6. ACKNOWLEDGEMENTS

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- abiotic: non-living (characteristics).
- aeolian (deposits): materials transported and laid down on the earth's surface by wind.
- alien: plants or animals introduced from one environment to another, where they had not occurred previously.
- alluvium: unconsolidated fragmental material laid down by a river or stream as a cone or fan, in its bed, on its floodplain and in lakes or estuaries, usually comprised of silt, sand or gravel.
- anaerobic: lacking or devoid of oxygen.
- anoxic: the condition of not having enough oxygen.
- aquatic: growing or living in or upon water.
- arcuate: curved symmetrically like a bow.
- barchanoid (dune): crescent-shaped and moving forward continually, the horns of the crescent pointing downwind.
- bathymetry: measurement of depth of a water body.
- benthic: bottom-living.
- berm: a natural or artificially constructed narrow terrace, shelf or ledge of sediment.
- bimodal: having two peaks.
- biogenic: originating from living organisms.
- biomass: a quantitative estimation of the total weight of living material found in a particular area or volume.
- biome: major ecological regions (life zones) identified by the type of vegetation in a landscape.
- biotic: living (characteristics).
- breaching: making a gap or breaking through (a sandbar).
- calcareous: containing an appreciable proportion of calcium carbonate.
- calcrete: a sedimentary deposit derived from coarse fragments of other rocks cemented by calcium carbonate.
- Chart Datum: This is the datum of soundings on the latest edition of the largest scale navigational chart of the area. It is -0,900 m relative to land levelling datum which is commonly called Mean Sea Level by most land surveyors.
- coliforms: members of a particularly large, widespread group of bacteria normally present in the gastro-intestinal tract.
- community: a well defined assemblage of plants and/or animals clearly distinguishable from other such assemblages.
- conglomerate: a rock composed of rounded, waterworn pebbles 'cemented' in a matrix of calcium carbonate, silica or iron oxide.
- cusp: a sand spit or beach ridge usually at right angles to the beach formed by sets of constructive waves.
- "D" net: a small net attached to a "D" shaped frame riding on skids and pulled along the bottom of the estuary, used for sampling animals on or near the bottom.
- detritus: organic debris from decomposing plants and animals.
- diatoms: a class of algae with distinct pigments and siliceous cell walls. They are important components of phytoplankton.
- dynamic: relating to ongoing and natural change.
- ecology: the study of the structure and functions of ecosystems, particularly the dynamic co-evolutionary relationships of organisms, communities and habitats.
- ecosystem: an interacting and interdependent natural system of organisms, biotic communities and their habitats.
- eddies: a movement of a fluid substance, particularly air or water, within a larger body of that substance.
- endemic: confined to and evolved under the unique conditions of a particular region or site and found nowhere else in the world.
- enon: most striking formation in the Cape. Crammed with pebbles and boulders, phenomenally embedded and massive, yellow or brilliantly red in colour, producing remarkable hills. Curiously carved into crags and hollows.

epifauna: animal life found on the surface of any substrate such as plants, rocks or even other animals.

epiphyte: a plant living on the surface of another plant without deriving water or nourishment from it.

episodic: sporadic and tending to be extreme.

estuary: a partially enclosed coastal body of water which is either permanently or periodically open to the sea and within which there is a measurable variation of salinity due to the mixture of sea water with fresh water derived from land drainage (Day 1981).

eutrophication: the process by which a body of water is greatly enriched by the natural or artificial addition of nutrients. This may result in both beneficial (increased productivity) and adverse effects (smothering by dominant plant types).

flocculation (as used in these reports): the settlement or coagulation of river borne silt particles when they come in contact with sea water.

fluvial (deposits): originating from rivers.

food web: a chain of organisms through which energy is transferred. Each "link" in a chain feeds on and obtains energy from the preceding one.

fynbos: literally fine-leaved heath-shrub. Heathlands of the south and south-western Cape of Africa.

geomorphology: the study of land form or topography.

gill net: a vertically placed net left in the water into which fish swim and become enmeshed, usually behind the gills.

habitat: area or natural environment in which the requirements of a specific animal or plant are met.

halophytes: plants which can tolerate salty conditions.

HAT (Highest Astronomical Tide) and LAT (Lowest Astronomical Tide): HAT and LAT are the highest and lowest levels respectively, which can be predicted to occur under average meteorological conditions and under any combination of astronomical conditions; these levels will not be reached every year. HAT and LAT are not the extreme levels which can be reached, as storm surges may cause considerably higher and lower levels to occur (South African Tide Tables 1980).

hummock (dune): a low rounded hillock or mound of sand.

hydrography: the description, surveying and charting of oceans, seas and coastlines together with the study of water masses (flow, floods, tides etc.).

hydrology: the study of water, including its physical characteristics, distribution and movement.

indigenous: belonging to the locality; not imported.

intertidal: generally the area which is inundated during high tides and exposed during low tides.

isohyets: lines on maps connecting points having equal amounts of rainfall.

isotherms: lines on maps joining places having the same temperature at a particular instant, or having the same average, extremes or ranges of temperature over a certain period.

lagoon: an expanse of sheltered, tranquil water. (Thus Langebaan lagoon is a sheltered arm of the sea with a normal marine salinity; Knysna lagoon is an expanded part of a normal estuary and Hermanus lagoon is a temporarily closed estuary (Day 1981)).

limpid: clear or transparent.

littoral: applied generally to the seashore. Used more specifically it is the zone between high- and low-water marks.

longshore drift: a drift of material along a beach as a result of waves breaking at an angle.

macrophyte: any large plant as opposed to small ones. Aquatic macrophytes may float at the surface or be submerged and/or rooted on the bottom.

marls: crumbly mixture of clay, sand and limestone, usually with shell fragments.

matrix: medium in which a structure is embedded.

meiofauna: microscopic or semi-microscopic animals that inhabit sediments but live quite independently of the macrofauna, or benthos.

metamorphic: changes brought about in rocks within the earth's crust by the agencies of heat, pressure and chemically active substances.

MHWS (Mean High Water Springs) and MLWS (Mean Low Water Springs): the height of MHWS is the average, throughout a year when the average maximum declination of the moon is 23°, of the height of two successive high waters during those periods of 24 hours (approximately once a fortnight) when the range of the tide is greatest. The height of MLWS is the average height obtained by the two successive low waters during the same periods (South African Tide Tables 1980).

morphometry: physical dimensions such as shape, depth, width, length etc.

osmoregulation: the regulation in animals of the osmotic pressure in the body by controlling the amount of water and/or salts in the body.

pathogenic: disease producing.

photosynthesis: the synthesis of carbohydrates in green plants from carbon dioxide and water, using sunlight energy.

phytoplankton: plant components of plankton.

piscivorous: fish-eating.

plankton: microscopic animals and plants which float or drift passively in the water.

quartzite: rock composed almost entirely of quartz recemented by silicon. Quartzite is hard, resistant and impermeable.

riparian: adjacent to or living on the banks of rivers, streams or lakes.

rip current: the return flow of water which has been piled up on the shore by waves, especially when they break obliquely across a longshore current.

salinity: the proportion of salts in pure water, in parts per thousand by mass. The mean figure for the sea is 34,5 parts per thousand, written 34,5

secchi disc: a simple instrument used to measure the transparency of water.

sheet flow: water flowing in thin continuous sheets rather than concentrated into individual channels.

slipface: the sheltered leeward side of a sand-dune, steeper than the windward side.

teleost: modern day bony fishes (as distinct from cartilaginous fishes).

trophic level: a division of a food chain defined by the method of obtaining food either as primary producers, or as primary, secondary or tertiary consumers.

trough: a crescent shaped section of beach between two cusps.

wetlands: areas that are inundated or saturated by surface or ground water frequently enough to support vegetation adapted to life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas.

zooplankton: animal components of plankton.

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MAPS

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Aerial Photography

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APPENDIX I : Species composition and physical features of the vegetation mapping units of the Rooiels estuary (See Fig. 5).

PHRAGMITES AUSTRALIS - Reedswamp

Total cover (%) 60
 Height (m) 0-2,5
 Area (ha) 0,4
 % of Studied area 2,15
 No. of species 1

Phragmites australis (4)

AGROPYRON DISTICHUM - Dune Grassland

Total cover (%) 25
 Height (m) 0-0,75
 Area (ha) 0,12
 % of Studies area 0,63
 No. of species 5

Agropyron distichum (1), Psoralea repens (+), Senecio cf. elegans (+), Tetragonia decumbens (+), Trachyandra divaricata (+).

PHRAGMITES AUSTRALIS/SARCOCORNIA
Cf. PERENNIS - Reedswamp

Total cover (%) 60
 Height (m) 0-2,0
 Area (ha) 0,13
 % of Studied area 0,68
 No. of species 7

Chenolea diffusa (+) Juncus acutus (r), Phragmites australis (3), Sarcocornia cf. perennis (+), Scirpus nodosus (+) Sporobolus virginicus (1), Stenotaphrum secundatum (1).

PASPALUM/VAGINATUM/SPOROBOLUS VIRGINICUS
OSTEOSPERMUM FRUTICOSUM - Herbland

Total cover (%) 75
 Height (m) 0-0,20
 Area (ha) 0,2
 % of Studied area 1,10
 No. of species 10

Chenolea diffusa (1), Juncus acutus (+), Limonium scabrum var. corymbulosum (1), Osteospermum fruticosum (2), Paspalum vaginatum (1), Plantago carnososa (+), Psoralea repens (+), Solanum quadrangulare (+), Sporobolus virginicus (2), Tetragonia decumbens (1).

RUPPIA SPIRALIS - Aquatic Grassland

-
 -
 0,03
 0,16
 1

Ruppia spiralis (4)

ACACIA CYCLOPS - Woodland

90
 0-3,0
 0,08
 0,42
 5

Acacia cyclops (4), Chrysanthemoides monilifera (1), Colpoon compressum (1), Rhus sp. (Parsons 264) (1), Stenotaphrum secundatum (+).

TETRAGONIA DECUMBENS/STENOTAPHRUM
SECUNDATUM - Low Graminoid Shrubland

70
 0-0,25
 0,03
 0,16
 8

Acacia cyclops (+), Cotyledon orbiculata (r), Gazania rigens (r), Helichrysum crispum (+), Metalasia muricata (+), Solanum quadrangulare (+), Stenotaphrum secundatum (1), Tragonia decumbens (3).

METALASIA MURICATA/ACACIA CYCLOPS - Mid-high Dune Shrubland

40
 0-1,5
 0,55
 2,89
 10

Acacia cyclops (2), Aspalanthus forbesii (+), Carpobrotus edulis (+), Colpoon compressum (1), Metalasia muricata (3), Passerina falcifolia (+), Pentachistis cf. ecklonii (+), Salvia sp. (Parsons 229) (+), Sporobolus africanus (+), Trachyandra divaricata (+).

JUNCUS ACUTUS/SAMOLUS POROSUS/
PTERIDIUM AQUILINUM - Sedgeland

Total cover (%)	75	65
Height (m)	0-0,75	0-1,5
Area (ha)	1,28	0,24
% of Studied area	6,72	1,26
No. of species	12	14

Chrysanthemoides monilifera (+)
Juncus acutus (2), Juncus sp.
(Parsons 82) (+), Nidorella
foetida (1), Orphium frutescens
(+), Phragmites australis (r),
Pteridium aquilinum (2), Restio
callistachyus (+), Samolus
porosus (1), Scirpus nodosus
(1), Scirpus sp. (Parsons 58)(+),
Sporobolus virginicus (+).

Total cover (%)	80	70
Height (m)	0-1,75	0-1,25
Area (ha)	1,2	1,62
% of Studied area	6,67	8,50
No. of species	19	19

Athanasia crithmifolia (+), Berzelia
lanuginosa (+), Chrysanthemoides
monilifera (+), Cliffortia
lanceolata (1), Clutia pulchella
(+), Conyza scabrida (+),
Helichrysum crispum (+), Helichrysum
so. (Parsons 55)(1), Leucospermum
cf. conocarpodendron (+),
Lobostemon cf. montanus (1),
Nidorella foetida (1), Pelargonium
angulosum (+), Phragmites australis
(r), Podalyria calyptrata (+),
Psoralea pinnata (+), Pteridium
aquilinum (+), Restio callistachyus

RHUS LAEVIGATA/POLYGALA MYRTIFOLIA/
PHYLICA ERICOIDES - Woodland

Total cover %	60	75
Height (m)	0-2,5	0-2,0
Area (ha)	0,16	0,34
% of Studied area	0,84	1,78
No. of species	21	21

Acacia cyclops (2), Asparagus
stipulaceus (+), Carpobrotus
edulis (+), Cassine peragua (+),

RHUS SP. (PARSONS 264)/SALVIA SP. -
(PARSONS 229) ACACIA CYCLOPS
Mid-high Shrubland

Acacia cyclops (1), Carpobrotus
edulis (+), Chrysanthemoides monilifera
(1), Colpoon compressum (+), Kedrostis
nana (+), Linciera foveolata (r),
Maytenus oleoides (1), Metalasia
muricata (r), Passerina falcifolia (+),
Rhus sp. (Parsons 264)(2), Salvia sp.
(Parsons 229)(1), Stenotaphrum
secundatum (+), Tetragonia cf.
fruticosa (r), Zantheschia aethiopica (r).

Acacia cyclops (+), Chironia baccifera
(+), Chrysanthemoides monilifera (1),
Coleonema album (+), Cullumia setosa (+),
Haemanthus rotundifolius (r),
Helichrysum crispum (+), Helichrysum sp.
(Parsons 55)(+), Helichrysum sp.
(Parsons 63)(1), Leucadendron
cf. sabulosum (+), Leucospermum sp. cf.
conocarpodendron (+), Metalasia
muricata (2), Myrica cordifolia (+),
Myrica quercifolia (+), Passerina
rigida (+), Phylica ericoides (+),
Polygala myrtifolia (+), Protea cf.
compacta (+), Scirpus nodosus (r).

EUCLEA RACEMOSA/METALASIA MURICATA/
CHRYSANTHEMOIDES MONILIFERA -
Tall Shrubland

Acacia cyclops (r), Carpobrotus edulis
(r), Cassine peragua (1),
Cassytha ciliolata (+), Chrysanthemoides

Cassytha ciliolata (+),
Chondropetalum microcarpum (+),
Felicia cf. fruticosa (+),
Hilipterum sp. (Parsons 253) (+),
Kedrostis nana (r), Linociera
foveolata (+), Maurocenia
frangularia (+), Metalasia
muricata (+), Myrica quercifolia
 (+), Passerina falcifolia (+),
Phyllica ericoides (1), Polygala
myrtifolia (1), Psoralea
fruticans (+), Rapanea
melanophloeos (+), Rhus laevigata
 (2), Rhus sp. (Parsons 264) (2),
Senecio laevigatus (+).

monilifera (2), Colpoon compressum (+),
Cussonia thyrsoflora (1), Euclea
racemosa (2), Helichrysum sp.
 (Parsons 55) (r), Indigofera
brachystachya (r), Malvastrum
scabrosum (+), Metalasia muricata (2),
Nidorella foetida (+), Passerina
glomerata (+), Polygala myrtifolia (r),
Restio eleocharis (r), Rhus Glauca (+),
Rhus laevigata (1), Samolus porosus (r),
Solanum quadrangulare (+), Thesidium
fragile (+).

MURALTIA SATUREIODES/CHONDROPETALUM MICROCARPUM - Low Restiod Shrubland

Total cover (%)	45
Height (m)	0-0,50
Area (ha)	1,0
% of Studied area	5,30
No. of species	27

Cassytha cipiopata (1), Chondropetalum microcarpum (2), Coleonema juniperinum
 (+), Cullumia setosa (r), Disparago cf. ericoides (+), Elegia stipularis (+),
Erica imbricata (r), Felicia bergerana (+), Leucadendron salignum (+), Leucospermum
 cf. conocrapodendron (+), Metalasia muricata (+), Muraltia satureioides (2),
Myrica quercifolia (1), Passerina sp. (Parsons 239) (r), Phyllica ericoides (1),
Phyllica stipularis (r), Protea repens (+), Protea cf. compacta (+), Psoralea
fruticans (r), Restio cuspidatus (+), Rhus sp. (Parsons 264) (+), Salvia sp.
 (Parsons 229) (r), Senecio laevigatus (+), Struthiola dodecandra (+), Sutera
intergrifolia (+), Tetraria cuspidata (1), Zygophyllum sp. (Parsons 250) (+).

	<u>OPEN WATER</u>	<u>BEACH and SAND</u>
Area (ha)	1,8	8,3
% of Studied area	9,55	44,02
	<u>ROCKS</u>	<u>ROADS</u>
Area (ha)	0,08	0,4
% of Studied area	0,42	2,20
	<u>INTENSIVE HUMAN USE</u>	<u>TOTAL AREA STUDIED</u>
Area (ha)	0,88	19,07 ha
% of Studied area	4,62	

Notes : The Parsons numbers, eg. (Parsons 264) refer to species unidentified by the Botanical Research Institute at the time of writing.

The symbols in brackets following each species name, represent Braun-Blanquet Cover Classes as follows :

- r 1 - few individuals, cover less than 0,1% of area
- + occasional plants, cover less than 1% of area
- 1 abundant, cover 1 - 5% of area
- 2 any number, cover 6 - 25% of area
- 3 any number, cover 26 - 50% of area
- 4 any number, cover 51 - 75% of area
- 5 any number, cover 76 - 100% of area

APPENDIX II : Summary of available information

ESTUARY / RIVERMOUTH / LAGOON		BIOTIC		ABIOTIC		Summary of available information		YEAR (DATE OF INFORMATION)																																
		Food	Webs	Flora	Other					Geomorphology	Physics																													
Sources of information		Mammals	Birds	Reptiles & Amphibians	Fish	Fauna on soft substrates	Fauna on hard substrates	Terrestrial	Phytoplankton	Halophytes	Historical	Utilization	Conservation	Modelling	Aquaculture	Management	Bacteriology	Pesticide residues	Metal residues	Eutrophication	General chemistry	Sediment transport & deposition	Paleoenvironment	Geology	Circulation & mixing	Density variations	Hydrology	Morphology	Catchment characteristics											
																														Acocks	1975							*		
Avery	1981										*																													
Boucher	1978											*											*																	
Cape Provincial Administration	1973											*																												
Currie	1981											*																												
Fitzsimons	1974																																							
Greig and Burdett	1976																																							
Grindley	1978																																							
Harris	1978												*																											
Heydorn and Tinley	1980												*																											
Isaac	1949																																							
Roberts	1978																																							
Shipley	1964																										*													
Smith, A.B.	1981																											*												
Smith, M.M.	1975																																							
S.A. Mountain Catchment Areas Act	1970																																							
South African Tide Tables	1979																																							
Summers	1976																																							*

ESTUARY / RIVERMOUTH / LAGOON		ABIOTIC		BIOTIC		Summary of available information		
		Physio- graphy	Physics	Geomor- phology	Chemistry			Other
YEAR (DATE OF INFORMATION)		Sources of information	Food Webs					
	1958		Van Wyk	*	*	*	*	*
	1981	Attwell, R.I.G. (pers. comm.)	*					
	1981	Boycott, R.C. (pers. comm.)					*	
	1981	Caledon Div. Council (pers. comm.)			*			
	1981	Cooper, J. (pers. comm.)					*	
	1981	Currie, G.A. (pers. comm.)					*	
	1981	De Villiers, A.L. (pers. comm.)					*	
	1981	Directorate of Forestry (pers. comm.)	*		*			
	1981	Ratepayers Ass. - Rooiels (pers. comm.)			*			
	1979	ECRU Survey (December)	*	*	*	*	*	*
	1981	ECRU Survey (March)	*	*	*	*	*	*
		MAPS:						
	1975	S.A. 1:50 000 Sheet 3418 BD	*					
	1977	S.A. 1:500 000 Sheet SE 35/17½	*					
	un- dated	Surv. Gen. Office, Gen. Plan 690 LD			*		*	
		AERIAL PHOTOGRAPHY: (Trig. Survey)						
	1938	Job No. 126	*				*	
	1977	Job No. 786	*				*	

APPENDIX II : (Cont.)

			Summary of available information		YEAR (DATE OF INFORMATION)		
							BIOTIC
ESTUARY / RIVERMOUTH / LAGOON	Fauna	Food Webs					
		Flora	Mammals				
			Birds				
			Reptiles & Amphibians				
			Fish				
			Fauna on soft substrates				
			Fauna on hard substrates				
			Insects				
			Other invertebrates				
			Zooplankton				
	Other	Terrestrial					
		Phytoplankton					
		Halophytes					
		Historical					
		Utilization					
		Conservation					
		Modelling					
		Aquaculture					
		Management					
		Chemistry	Bacteriology				
			Pesticide residues				
	Metal residues						
	Eutrophication						
	Geomorphology	General chemistry					
		Sediment transport & deposition					
		Paleoenvironment					
	Physiography	Geology					
		Circulation & mixing					
		Density variations					
	Hydrology						
Morphology							
Catchment characteristics							
Sources of information							
				*			
			*	*			
			*	*			
AERIAL PHOTOGRAPHY (Univ. of Natal - Land Surv.)		1979					
Job No. 326		1980					
Job No. 374							

PLATES I, II AND III OVERLEAF

PLATE I :

Main water body of the Rooiels estuary showing the old bridge pylons and Phragmites reedbeds on the river bank.
(ECRU 79-12-04)



PLATE II :

Top end of the southern arm of the estuary showing steep slopes in the background and discolouration of riverbank vegetation caused by high tide in the estuary.
(ECRU 81-03-11)



PLATE III :

Rooiels beach, with the river flowing out on the southern side of the bay.
(ECRU 79-12-04)

