

COASTAL RESERVES BYRON SHIRE

A Report for the Public Works Department
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COASTAL RESERVES - BYRON SHIRE

INTRODUCTION

The aims, definitions and methodology used as a basis for this report were as for report entitled, "Coastal Reserves - Tweed Shire", compiled February, 1983. Data from the Byron Bay - Hastings Point Erosion Study have formed the basis of decisions and a model; which proposes an area of dune, reserved and managed specifically for the purposes of providing a protective buffer against wind erosion; adopted.

Erosion of the dune reserves occurs as a result of the effects of wave attack, wind transport of destabilized sand and by influences which can cause deterioration of native dune vegetation. It has been assumed that the dunes of Byron Shire will suffer wave attack at least once annually and, on average experience, the effects of a tropical cyclone every second year. At these times of raised sea level, erosion will take place principally by undercutting of the steep enduring erosion scarp, and, in the case of the major events there will be overtopping of lower sections of frontal dune and possibly the complete removal of narrow dunes by prolonged undercutting resulting in inundation of considerable areas of low-lying land.

Much of the frontal dune in Byron Shire has undergone major reconstruction during periods of mining in 1960's and shoreline defence in 1974/75, however with the exception of sites D and F north of Cape Byron - and H on Tallow Beach - undisturbed profiles were selected for sampling.

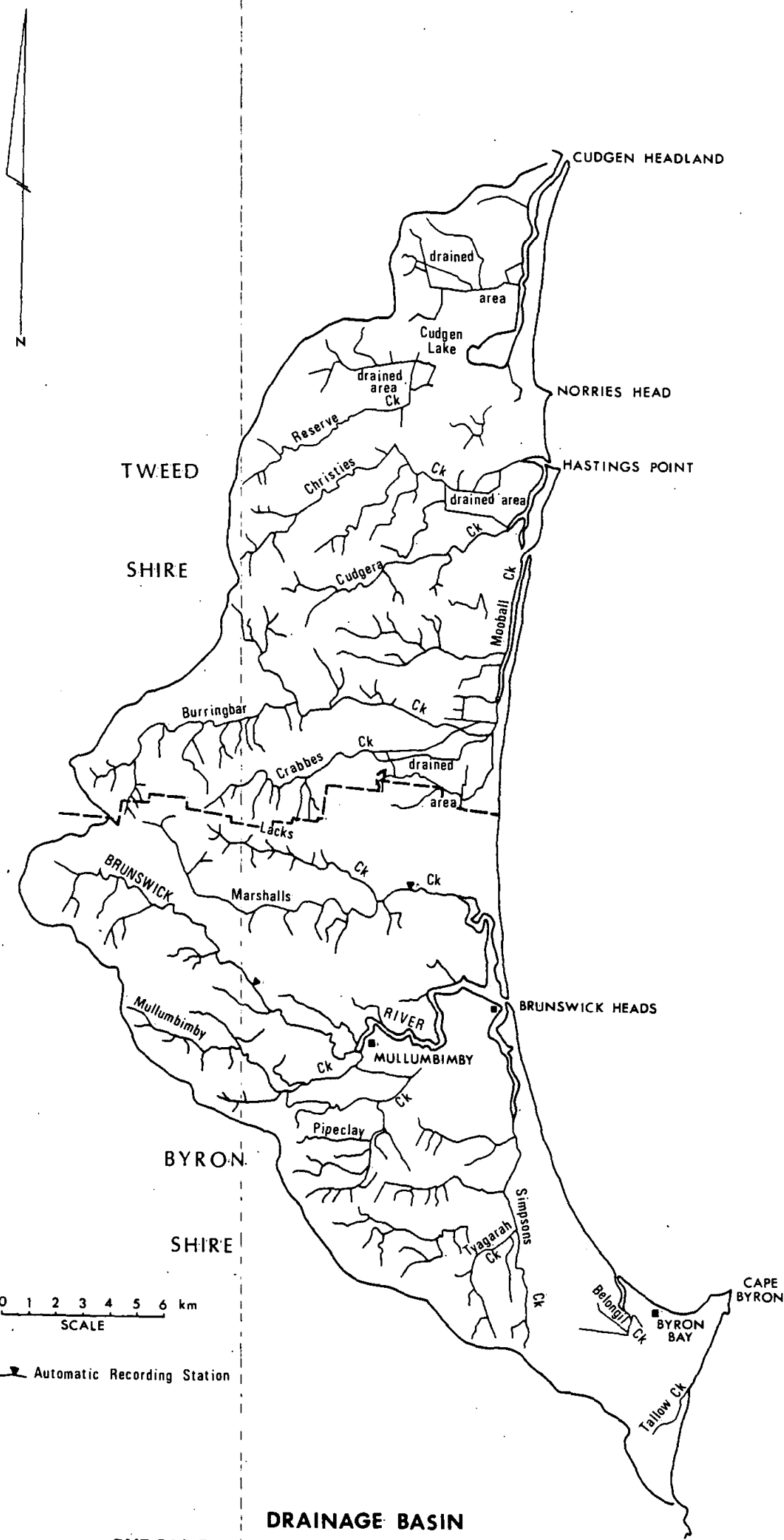
Beach zones referred to in this report, are those previously described in figure 3 of report "Coastal Reserves - Tweed Shire". Vegetation is similar to Tweed Shire apart from the fact that there has generally been less disturbance which has resulted in much less *Chrysanthemoides* (bitou bush) and *Cas. equisetifolia* (horsetail oak), in zone 4 and retention of dense stands of *Banksia integrifolia* (Coast honeysuckle) in zone 5.

Gradual, long-term erosion, in response to differential drift rates has been identified for Byron Shire beaches, creating the need for the establishment of 'Recession Reserves' to provide room to allow erosion to proceed without causing severe damage and to dispense with the need for shoreline structures such as groynes and training walls.

In maintaining a 'Dune Reserve' it must be recognized that it will exhibit certain features in response to coastal processes and that these features will reflect the long-term erosion identified at Byron Bay. Periodically the foredune will be removed, permanent frontal dune undercut, sand reserves, mobilized and blown landward. (See Figure 4 Coastal Reserves - Tweed Shire.)

Presently dunes exhibit a conformation which, to a large extent, belies their long term erosion. This is a reflection principally of the long absence of cyclonic erosion and, to a lesser extent, to modification by mining and relatively low levels of damage by beach users. Vigorous enduring stands of sand spinifex have developed on the fore-dune, giving the appearance of abundant sand reserves, however it is proposed that there will be periods when vegetation is disturbed leading to die-back accompanied by short-term sand drift.

In these instances it is important that the Dune Reserve is allowed to operate unhindered to re-stabilize the dune. At such times dune vegetation must not be interrupted by development or activity which upsets the re-establishment of primary colonizers, and secondary protection.



**DRAINAGE BASIN
BYRON BAY TO HASTINGS POINT EMBAYMENT**

DUNE SURVEY

A total of nine beach profiles were selected from air photos, and assumed to be representative of the dunes of Byron Shire. Seven profiles (A - G) were selected from the Hastings Point - Cape Byron embayment and two from Cape Byron to Broken Head. Areas already developed for urban purposes were not considered directly, but comments are included on various village developments at South Golden Beach, New Brighton and Suffolk Park.

The readily disposable section of dunes above the beach, i.e. comprising zones 3 and 4 were generally of the order of 50-100 metres wide with only rapidly receding points at New Brighton and Belongil Creek being less than 50 metres at the date of measurement.

Therefore it must be concluded that large reserves of sand can be mobilized by storms of moderate to high intensity indicating a highly sensitive response to short-term changes in sea-level.

The volume of sand disturbed, as such, is very important to the amount and type of vegetation which exists in the protective 'Dune Reserve' since the activity will result in fluctuations between eroded and accreted dune forms on a regular basis. Unless a stabilizing influence is applied then the mobility of disturbed sand would rapidly contribute to losses which were permanent and hastened long-term erosion.

The survey of Byron Bay beaches indicated that strand vegetation generally comprised almost exclusively *Spinifex hirsutus* with some *Casuarina* and *Chrysanthemoides* stands, associated with beach disturbance by mining or urban development. Similar to Tweed Shire, this gives the dunes a good potential to recover following low - moderate storms however having established that the low dune barrier is very sensitive to moderate to high changes in sea level, it is important to appreciate that the highly developed nature of the banksia canopy (i.e. wind sculpture), and the absence of secondary species could result in die-back and sand drift of a significant nature following seas of 3.5 - 5.0 metres.

Since dune stability relies heavily on regeneration of spinifex in the early accretion phase it is obvious that activities which hamper this active growth period are to the detriment of the stability of dunes.

One of the important functions of secondary species such as *Acacia* is to reinforce the stabilizing effect of *Spinifex*. It does so by developing a low grade 'symbiosis' with spinifex providing much needed nitrogen in return for seedling protection. Without *Acacia*, *Spinifex* becomes unstable in the advanced stages of accretion since its nitrogen source is cut off by its own seaward advance and die-back results in the zone 4. The instability is aggravated by making this zone more accessible to traffic when wattle is absent and so more likely to damage by increase usage.

Chrysanthemoides (bitou bush) though not widespread in Byron Shire, is certainly obvious at some points (i.e. Suffolk Park) and poses a distinct threat to the character of beaches, particularly where secondary species are not in evidence, die-back has been a feature of coastal processing or human intervention has disturbed the permanent canopy.

Banksia integrifolia (Coastal honeysuckle) is the dominant species on undisturbed dunes, colonizing zone 5 almost exclusively with minor components only of *Cupaniopsis anarcardoides* (tuckaroo) *Acacia sophorae* (Coast wattle), *Melaleuca quinquenervia* (paperbark)

(pandanus palm) and small areas of littoral rainforest.

The *Banksia integrifolia* canopy in undisturbed sites has been wind sculptured to provide edge protection to zone 5. Thus the community comprises individuals of highly modified habit varying from those with leaves developed to windward, near the sea to specimens which have grown more erect leeward of the frontal dune. This community will suffer considerably from removal of edge protection and will be very slow to recover. Their ultimate survival could well depend on careful management of the foredune involving the introduction of *Acacia* and *Casuarina* in some instances.

Where mining has taken place, permanent vegetation has been changed by the inclusion of *Casuarina equisetifolia*, *Acacia sophorae*, *Acacia cyanophylla*, and *Leptospermum laevigatum*. Revegetation has established successfully and indicates that re-planting of Dune Reserves is a feasible management option in Byron Shire particularly where the rapid growth characteristics of species such as *Casuarina equisetifolia* and *Acacia sophorae* can be utilized in transformations from Dune Reserve to disposable reserves and from Recession Reserve to Dune Reserve. (See Coastal Reserves - Tweed Shire for further detail.)

BOUNDARY CONDITIONS

Where a high recession rate is measured, then Recession and Dune Reserves will undergo more frequent change (i.e. if recession in 1.5 - 2.0 metres per year, then a new line of vegetation would need to be established every two years on average). This can constitute a very rapid transition of usage where management of the Recession Reserve is markedly different from dune management. In such instances a buffer zone might need to be introduced between the two reserves.

From previous discussion it is obvious that very careful management of the Dune Reserve and its surrounds is required if it is to provide the desired protection. The maintenance of a *Spinifex*-stabilised foredune is essential to proper function, and this will depend on proper management strategies being maintained on the backshore.

During periods of early accretion, considerable pressure is directed to this zone by the narrowed beach section. Activities involving off-road vehicular transport can be particularly damaging. Byron Shire presently maintains a policy of strict control on these vehicles and our recommendation would assume that these policies were continued and even made temporarily more restrictive during critical periods.

Any degradation of the foredune would require remedial works to regain stability. Such works might entail any of these presently recommended by the Soil Conservation Service including the installation of fencing, brush matting, accessways or seed and fertiliser programmes. Access through the Dune Reserve would require controls to prevent lowering of the permanent dune, and possibility of 'blowout' development. Such measures might entail construction of control fencing and roadway protection where usage was high.

Where repair and improvements entail the use of replacement trees it is essential to preserve and improve species diversity, and to provide communities which can compete successfully with *Chrysanthemoides monilifera* (bitou bush).

Where communities are allowed to degenerate towards monoculture, with uniformity of species and age, they will become increasingly susceptible to wholesale destruction by fire, pests or old age.

In some instances (notably Belongil Creek area) the frontal dune structure is large 12-13 metres high and 80-100 metres wide and vegetatively stable having developed a wind sculptured canopy of banksia in place of a degenerated secondary layer. It is obvious that these dunes are stable in their present level of usage. However they have the potential for die-back sand drift in conditions which disrupt the narrow edge protection afforded by sculptured banksias.

Because of their high level of sensitivity it is seen as essential that the entire elevated dune structure be retained as a 'Dune Reserve', to avoid the man-made pressures which are destroying similar dunes at Suffolk Park. (See attached report to Byron Shire.)

In sections of Byron Shire the dune barrier is so low as to represent only a transient structure. In these instances the establishment of a permanent Dune Reserve using vegetative means will prove extremely difficult; if not impossible; and such areas cannot be treated in the general context of the conclusions of this report. Such areas are identified in the Byron Bay - Hastings Point Erosion Study figure 9.3.1.

CONCLUSIONS

Historically, development in N.S.W. has proceeded with little regard for forces which shape the coastline and the impact that man's activities might have on coastal processes. This has frequently necessitated building expensive protection in the form of sea walls, groynes, etc. However the need for these structures, can be often overcome by reserving and maintaining stable dunes as naturally-occurring protection.

Tropical cyclones moving into N.S.W. from the Coral Sea, and storms generating in the Tasman, produce erosive waves in Byron Bay, leading to rises in seal level as the atmospheric disturbance approaches the coast.

The magnitude of some storm events can result in wave erosion being maintained for several months. Additionally, for reasons outlined in the Byron Bay - Hastings Point erosion study; beaches can suffer gradual irreversible losses of sand.

The combination of these processes causes significant perturbation to sensitive dunes and their protective vegetation.

To minimise permanent losses from the foreshore zone it is necessary to maintain continuing protection from wind erosion by providing a permanent barrier of stable and enduring vegetation.

An elevated body of sand is required to provide the required ecologically diverse sites for a complete range of coastal species. Four to five rows of suitable strand vegetation will provide the necessary shelter to more sensitive species such as *Banksia integrifolia* which must otherwise develop its own protection by gradual wind sculpturing in combination with an elevated frontal dune.

However if the leeward side of the dune can be maintained as 'Dune Reserve' then a more diverse community of dune vegetation is possible and the change from 'Recession Reserve' to 'Dune Reserve' forced by gradual coastal erosion is less disruptive.

The edge protection afforded by species *Acacia sophorae* and *Casuarina equisetifolia* are seen as essential to maintaining flexibility and stability of zone 4, particularly in situations of gradual recession

and constant human activity. It is necessary to appreciate that the effectiveness of a functioning Dune Reserve may require replanting these species from time to time as the foreshore is eroded.

The adequacy of a 50 metre 'Dune Reserve' will also be dependent on several other important conditions, viz.:

- (i) The ability of *Spinifex* to regenerate after storm demand, i.e. that plant material is available *in situ* or is planted during early accretion phase as required and that steps are taken to ensure that beach traffic does not interrupt its critical establishment period.
- (ii) The introduction of secondary species *Acacia sophorae* (coast wattle) on zones 3/4/5. Protective vegetation of this type will add flexibility to vegetative cover in that it will enhance performances of *Spinifex* and tertiary species *Casuarina equisetifolia* (horsetail oak) *Banksia integrifolia* (Coast honeysuckle) and *Cupaniopsis anarcardoides* (Tuckaroo). Its presence will create greater diversity in plant species and age distribution which is essential to offset the possibility of catastrophic population deaths.
- (iii) A programme to control the spread of weed species *Lantana camara* (lantana) and *Chrysanthemoides monilifera* (bitou bush). This programme would include curbing clearing activities which allow invasion of stable canopies (see report Suffolk Park and Tallow Beach to Byron Shire 1982) as well as removal, spraying fertilizing and replanting to reduce the impact of these weeds.
- (iv) The inclusion of an entire elevated dune sections to give a complete array of ecological niches. This comment relates specifically to sections where the dune structure is more than 50 metres wide as at Belongil Creek where development of any kind needs to be sited landward of the dune mass which is of the order of 80 - 100 metres wide. The other area of concern is low dune in region of Golden Beach and New Brighton where overtopping and inundation is probable. 'Dune Reserves' as described in this report are inappropriate here and alternative strategies will need to be developed.
- (v) Steps are taken to aid transition of zonal vegetation as Dune Reserve (zone 5) is converted to zone 3/4 by recession. Measures which might be necessary could include temporary closure to vehicular traffic, replanting, mulching fencing and fertilizing.
- (vi) Activity within the 'Dune Reserve' be limited strictly to controlled access.
- (vii) The reserved areas are managed to maintain species composition and density with a high degree of fire stability and low risk.

Some coastal species have a low tolerance of repeated burning which tends to favour rapidly growing annual grasses and weeds at the expense of enduring species. Frequent hazard reduction firings must be discouraged in dune reserves.

REFERENCES

Byron Bay - Hastings Point Erosion Study - Department of Public Works
of N.S.W. 1978

Coastal Reserves - Tweed Shire : Report - Soil Conservation Service
of N.S.W. 1983

Tallow Beach - Suffolk Park Internal report - Soil Conservation
Service of N.S.W. 1982

APPENDIX

Details of sampled cross sections:

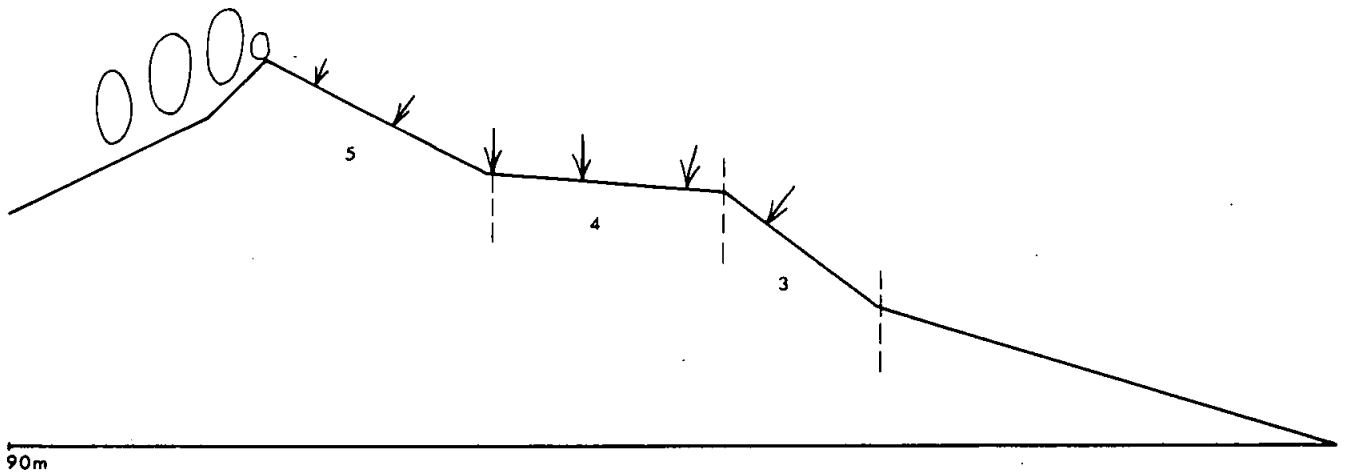
Scale indicates the approximate height above MSL

Vegetative symbols:

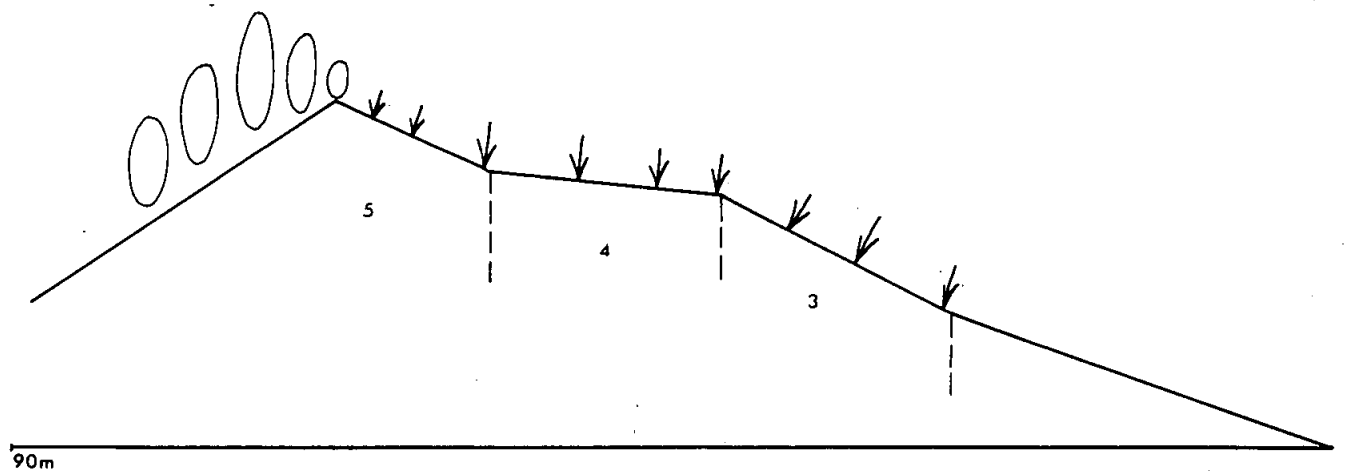
∨	<i>Spinifex hirsutus</i>
Y	<i>Casuarina equisetifolia</i>
○	<i>Chrysanthemoides monilifera - rotundata</i>
∩	<i>Acacia sophorae</i>
∪	<i>Banksia integrifolia</i>
∩	<i>Cupaniopsis anarcardooides</i>
4 3	Beach Zones based on McDonald
T	<i>Leptospermum laevigatum</i>

APPENDIX GENERALIZED DUNE PROFILES

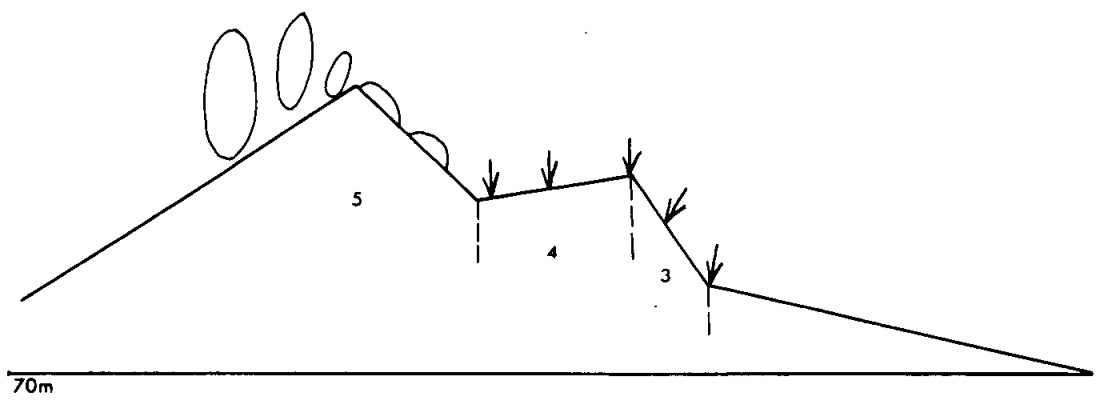
CRABBES CREEK A



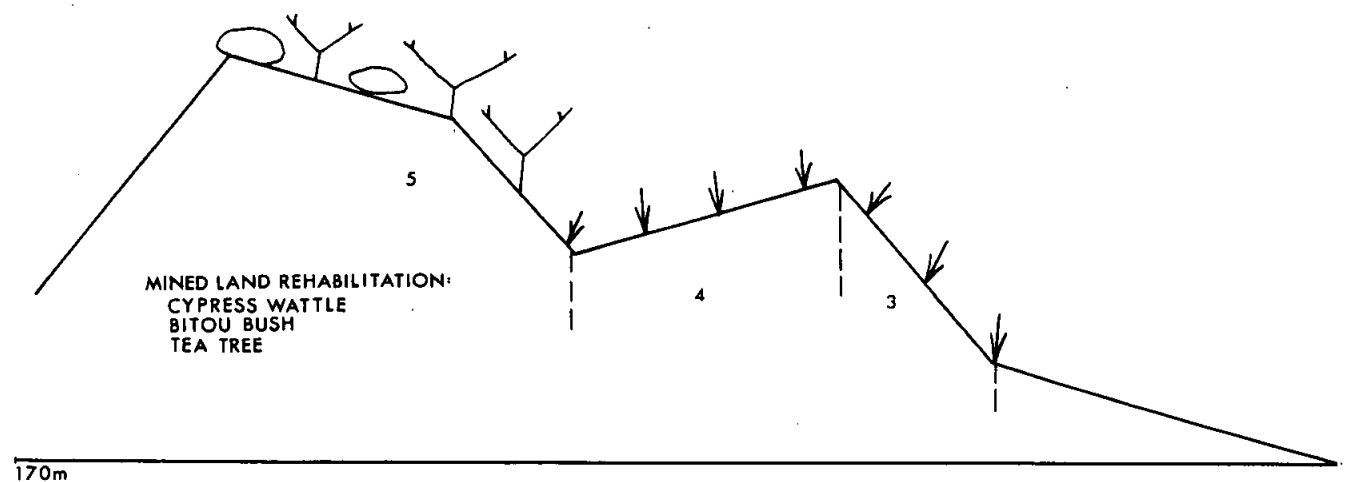
GOLDEN BEACH B



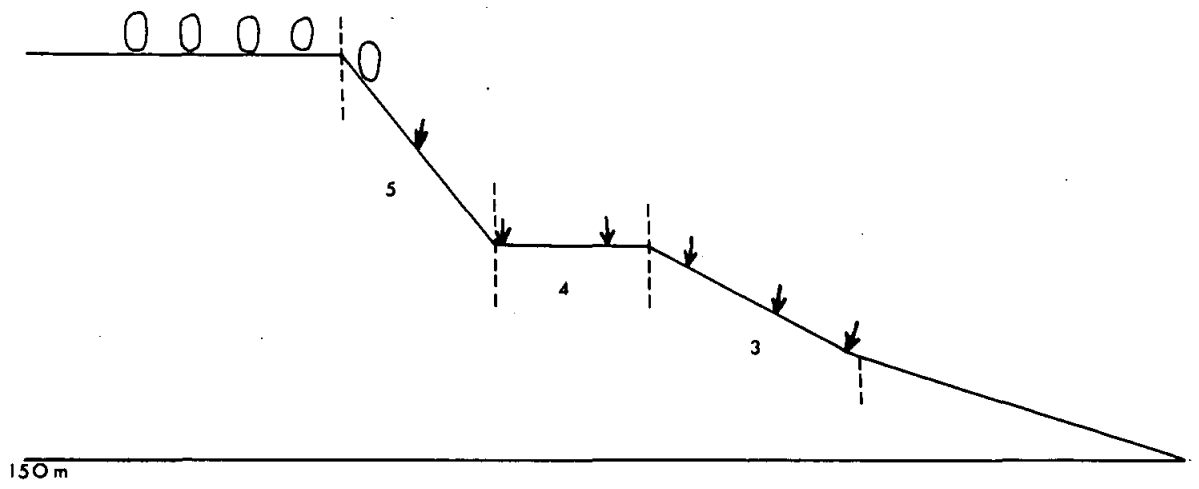
NEW BRIGHTON C



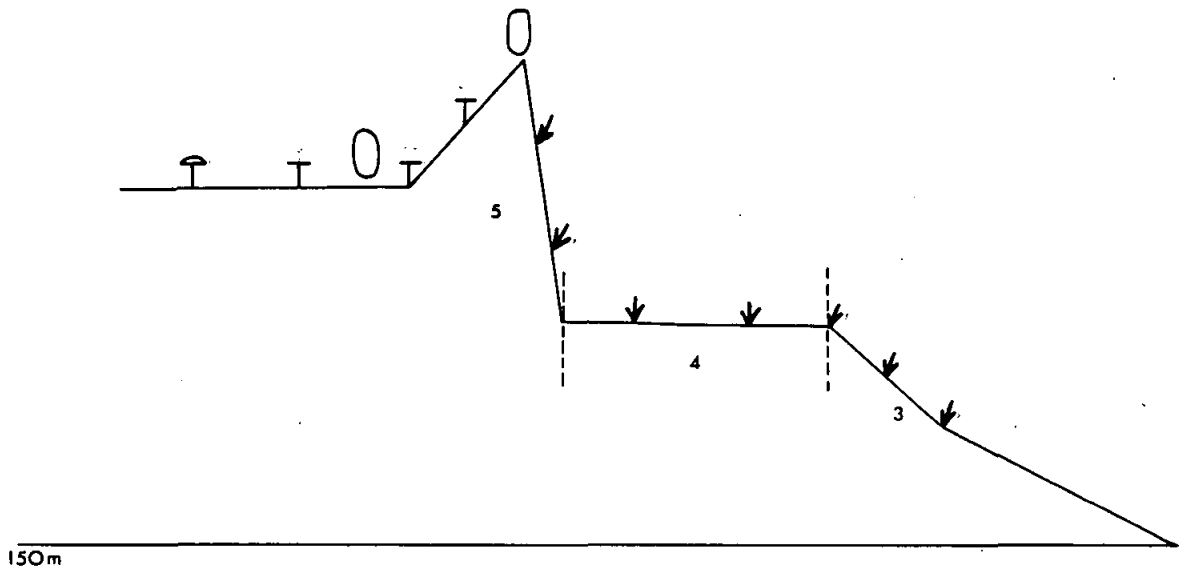
SOUTH BRUNSWICK D



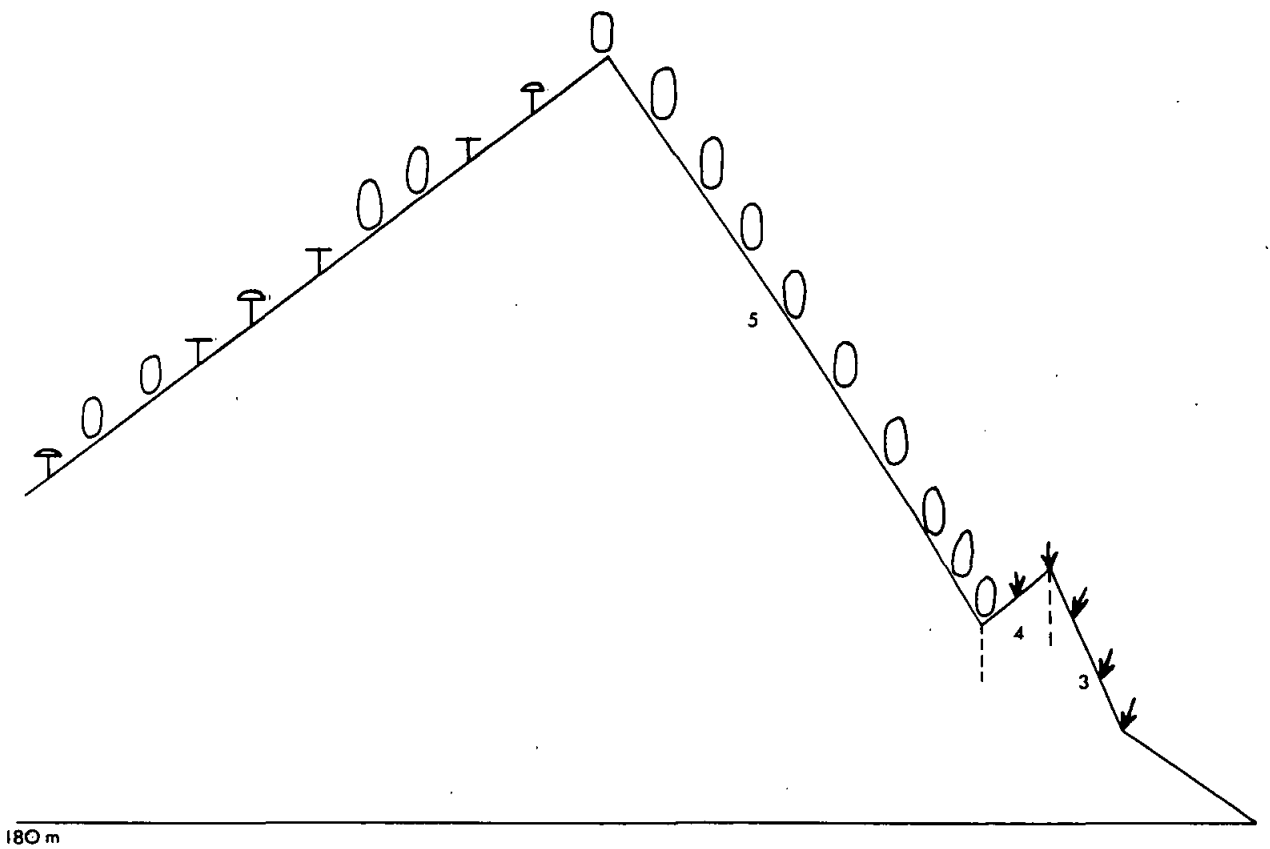
BRUNSWICK RIVER E

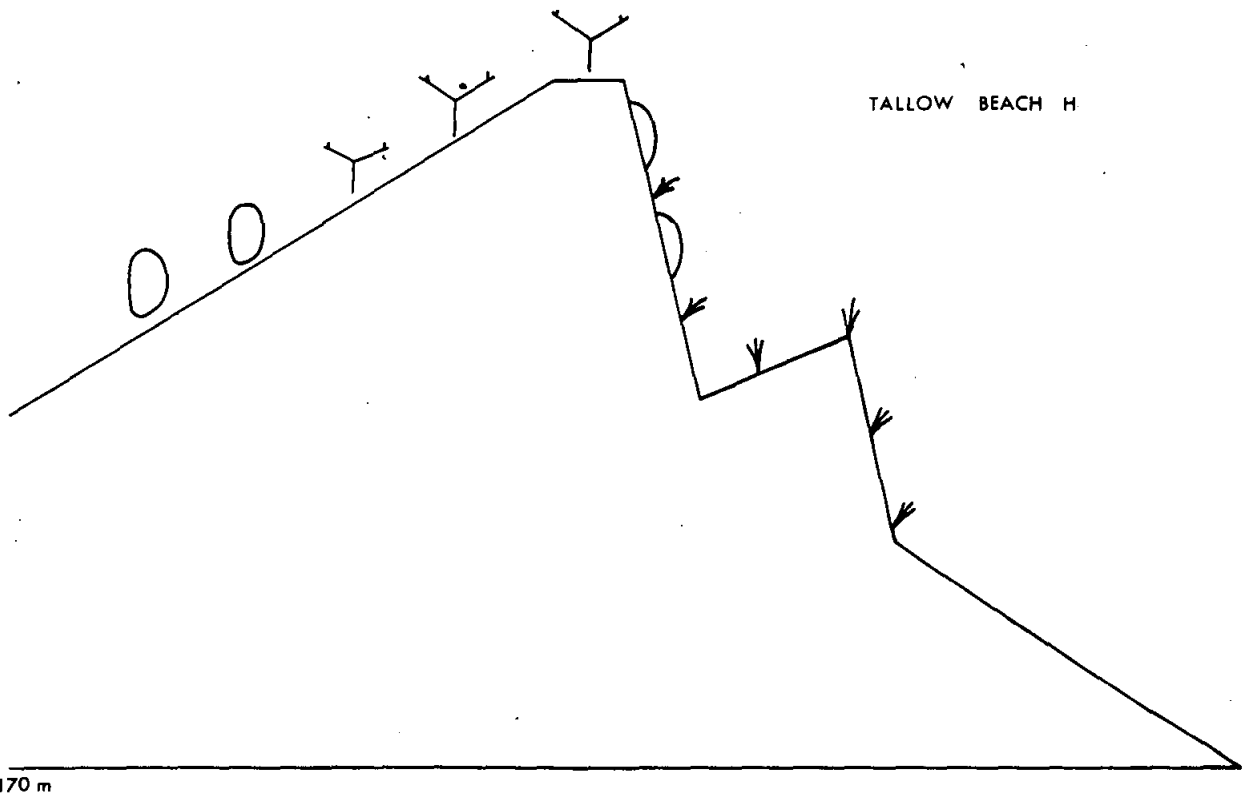


SOUTH ARM CREEK F



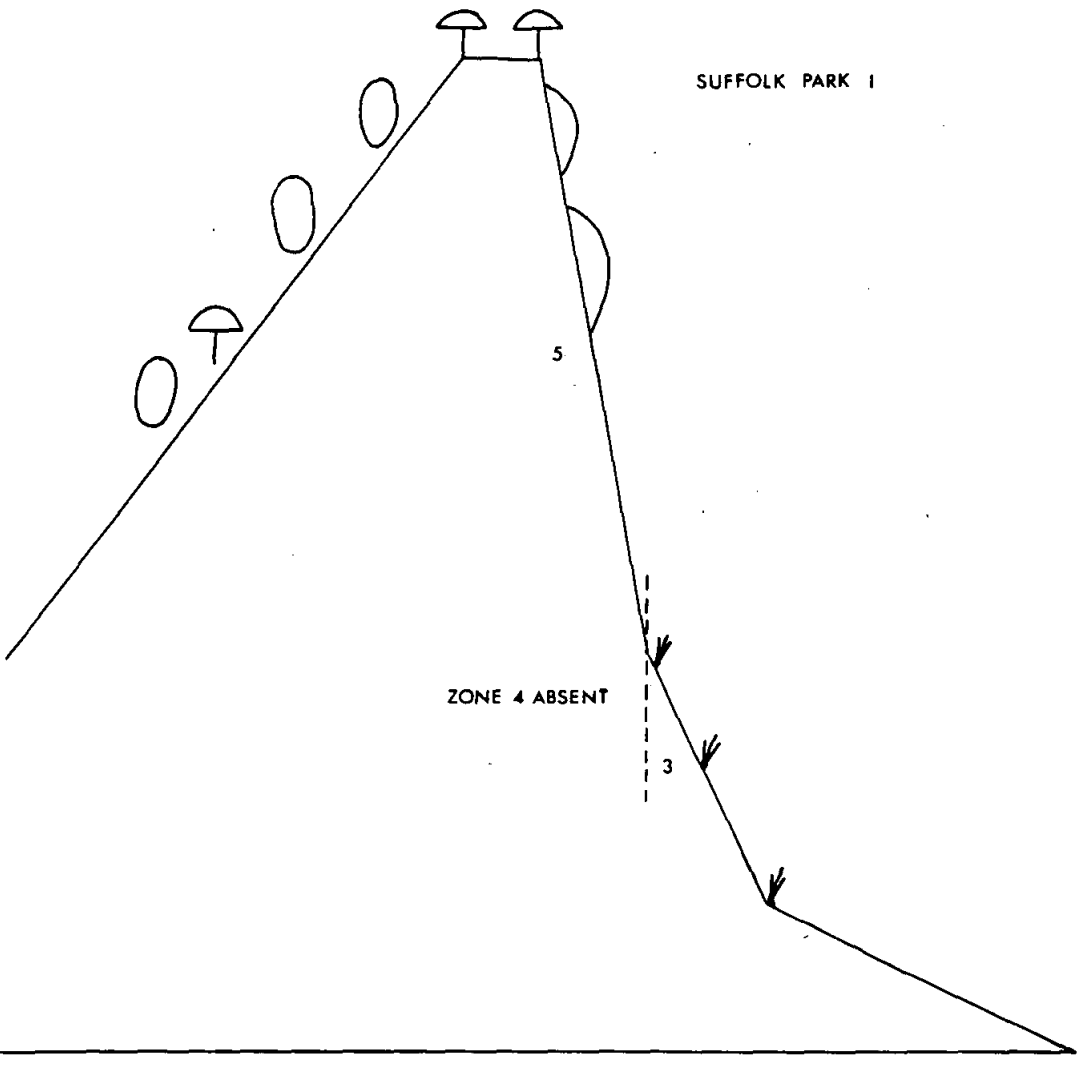
BELONGIL CREEK (NORTH) G





TALLOW BEACH H

170 m



SUFFOLK PARK I

170m

ZONE 4 ABSENT