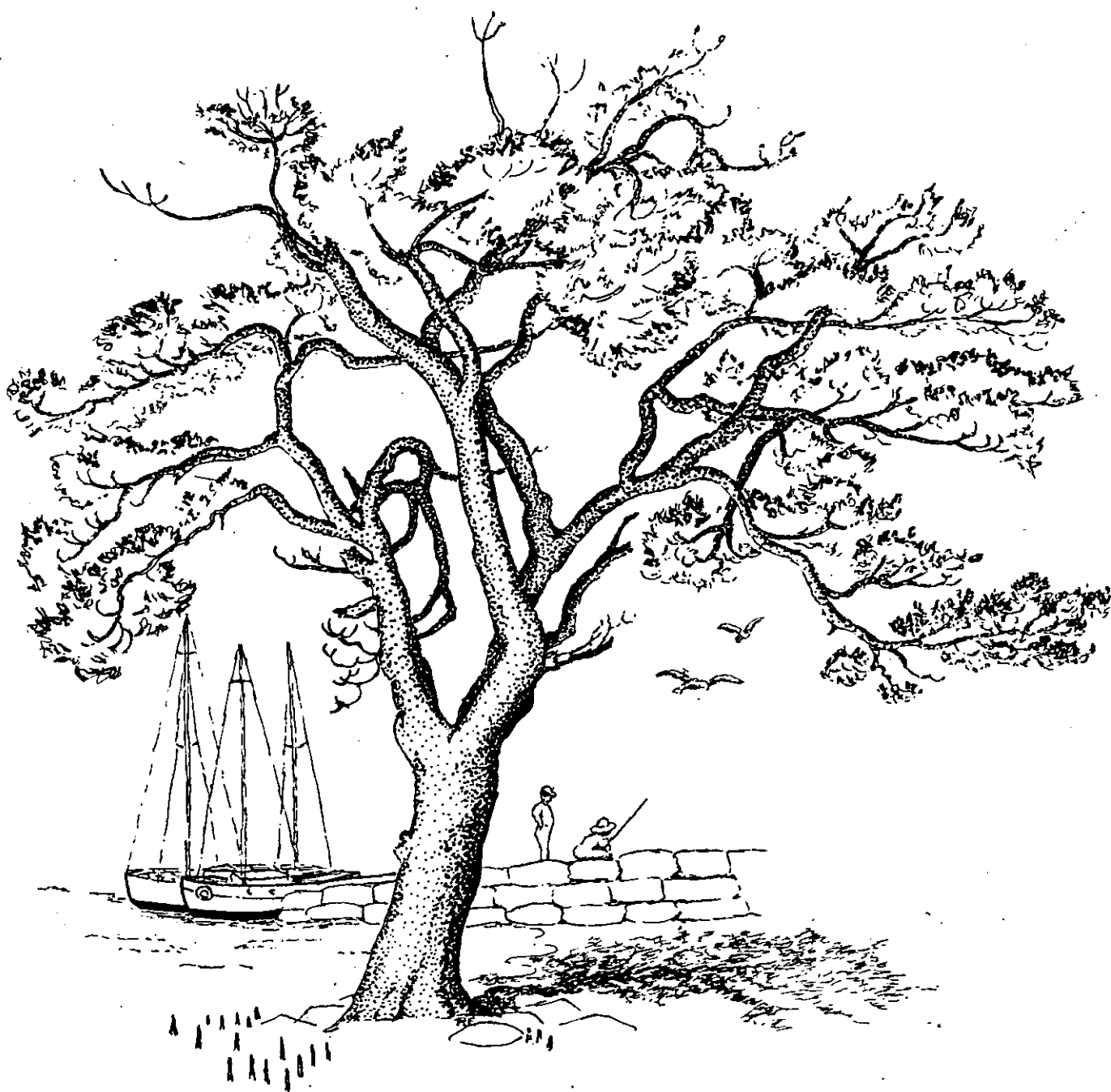


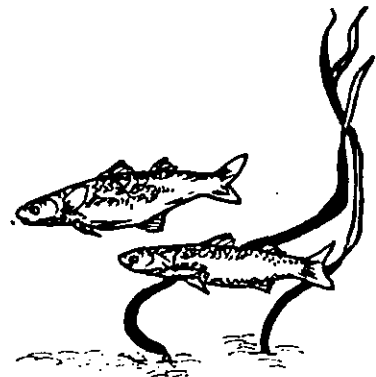
BOUDDI PENINSULA STUDY

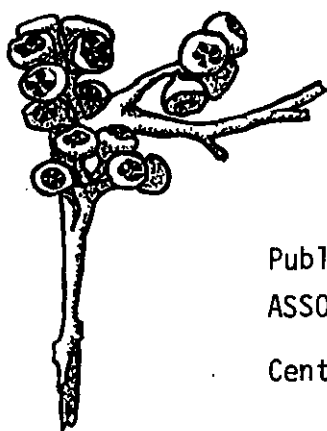


“Coastwatch”

BOUDDI PENINSULA STUDY

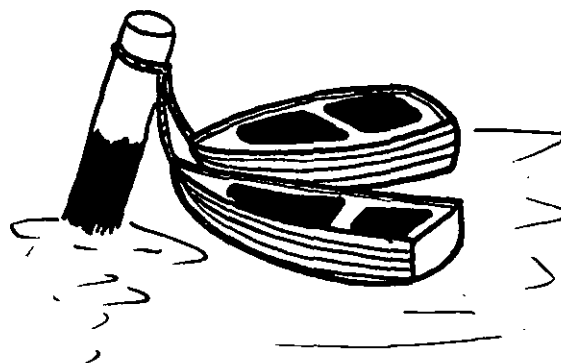
“Coastwatch”





Published by
ASSOCIATION FOR ENVIRONMENTAL
EDUCATION (N.S.W.)
Central Coast Region

230 SCENIC ROAD
KILLCARE HEIGHTS 2256



National Library of Australia
card number and ISBN
0 9593154 1 1

Printed by
GOSFORD PRINTING PTY. LIMITED

Foreword

This booklet was produced to the stage where it could be commercially copied and printed, entirely by the Coastwatch group. Contributors are named on this page, and special thanks expressed to Gary and Mary Nipperess for making available their computer system and skills.

As well as those who helped produce this report, there were many others involved in the actual Study. We acknowledge and thank them all.

The Study grew from a desire to record the resources and values of the Bouddi Peninsula, and highlighted the urgent need for a Development Control Plan for the area. Such a plan has now been devised and presented to Gosford City Council.

If this booklet assists in getting the Plan adopted soon by Council, the effort that has gone into its production will have been very well rewarded.

BERYL STROM
Editor

April, 1986

+ + + + +

Written Contributions:

Judy Adderley
David Dufty
Helen Dufty
Jenny Edwards
Gary Nipperess
Robert Payne
Allen Strom
Beryl Strom

Artwork and Maps:

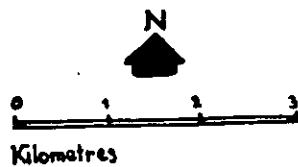
Judy Adderley
Jenny Edwards
Pat Evans
Don McConchie
Robert Payne
Allen Strom

Word Processing and Printing:

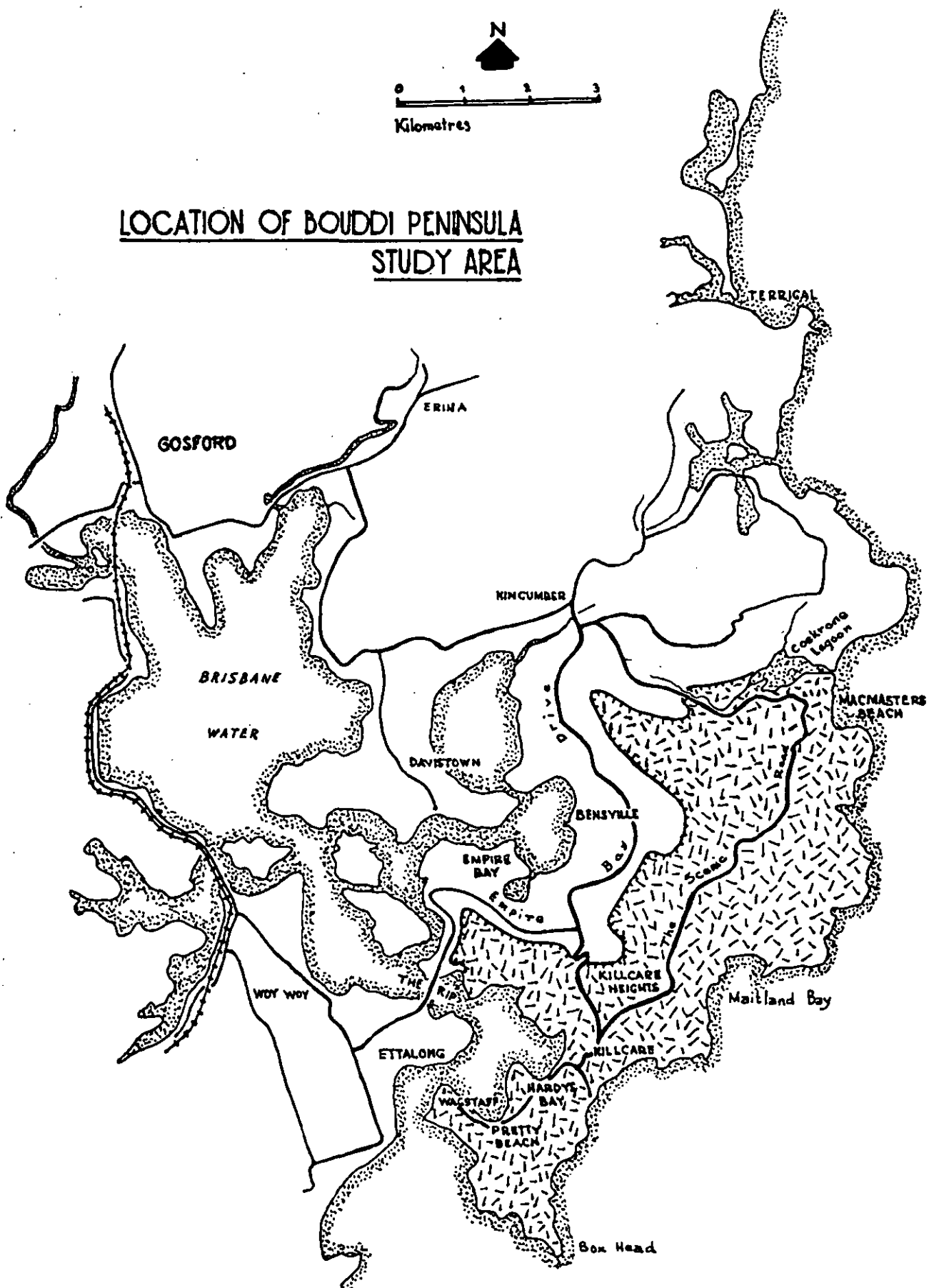
Jeanette Blomfield
Bob Edwards
Jenny Edwards
Gary Nipperess
Mary Nipperess
Margaret Payne
Beryl Strom

Other Help:

Judy Adderley
Gordon Adkins
Margaret Adkins
Helen Warliker
John Webster



LOCATION OF BOUDDI PENINSULA STUDY AREA



CONTENTS

	Page
INTRODUCTION	6
(I) Stimulus for the Study	
(II) An Overview of the Study Area	
"BOUDDI"	11
EUROPEAN SETTLEMENT AND LANDUSE	12
BOUDDI NATIONAL PARK	18
NATURAL RESOURCES OF THE STUDY AREA	
Rocks, Soils and Landforms	24
Vegetation - Communities	27
- Understorey	35
Birds	40
Mammals	44
Marine Organisms	50
THE ABORIGINES	58
WATERS AND SHORES	65
CURRENT LANDUSE	70
THE LANDSCAPE	75
APPENDIX 1 - Birds of Bouddi Peninsula	81
APPENDIX 2 - Vegetation Communities	87
APPENDIX 3 - Understorey Species	96

INTRODUCTION

(I) STIMULUS FOR THE STUDY

The charm of the Bouddi Peninsula from MacMasters Beach to Wagstaff is well known and appreciated by its residents and visitors. The natural systems of rocks, vegetation, bays and waterways are a satisfying background to human habitation and enjoyment, and have so far survived our tendency to exploit such resources for short term pleasure or for monetary gain.

The Aboriginal people used the area and the surrounding waters for many centuries, it is believed, deriving sustenance and accommodation therefrom and the opportunity to practise their particular culture. They were relatively few in numbers and their demands upon the resources were determined by the sustained yield of the environment. In less than 200 years, Europeans have been far more demanding, far more profligate, careless and downright selfish. Despite the great advances which nature conservation and environmental awareness have made over the last half century, widespread lack of concern could yet destroy the very features that make the Bouddi Peninsula a place of special appeal.

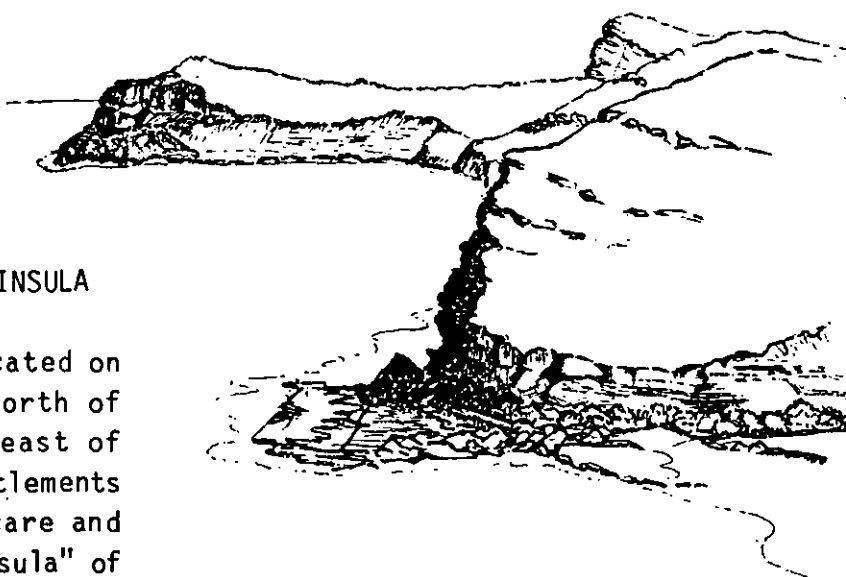
Too often, our understanding of "loss through change" is clouded by the fact that we have little or no idea of what has been lost! The last 150 years of resource loss on the Bouddi Peninsula may be insignificant compared to that of the next 15 years, if planning measures and development controls fail to address the problem adequately.

.

In 1980, some residents and visitors of the Bouddi Peninsula responded to an offer by the Association for Environmental Education (NSW) to organise a short educational activity centred on the peninsula. It aimed to show how the existing environment developed over the years and how the natural resources determined the use which Aborigines and Europeans made of the area. To round off the activity, an attempt was made to assess the effects of modern day usage of the place and to cogitate upon the consequences.

This adventure into community learning attracted a number of people who were prepared to set their sights on something more ambitious. The result has been that over the last few years, a group of variable size (averaging about fifteen persons) has met regularly each month for fieldwork, with additional research as necessary, to collect information about the landforms, vegetation, landscape, landuse and other features reported in this booklet. We called the exercise: "Coastwatch".

A basic catalogue of the resources of the Bouddi Peninsula has thus been produced. In addition, we who participated now have a far better understanding and appreciation of what makes the peninsula a magnificent environment and how it is threatened this booklet is an attempt to share that understanding with others.



(II) AN OVERVIEW OF THE PENINSULA

The Bouddi Peninsula is located on the coastline immediately north of Broken Bay. It lies south-east of Gosford and includes the settlements of MacMasters Beach, Killcare and Wagstaff. The actual "peninsula" of land extends west to Cockle Creek (part of Brisbane Water) but, for the purposes of this study, the Bouddi Peninsula is defined as the area shown hatched on the "location map" at front of book. It does not include developments around Kincumber, Bensville, Empire Bay and so on. From MacMasters Beach to Box Head (the extremities of Bouddi Peninsula), it is about 10km by direct line.

An outstanding feature of the study area is the elevated spine which reaches its highest point (160 m) at Mount Bouddi, between MacMasters Beach and Killcare Heights. Because of the horizontal rock formations in the "spine", a narrow plateau land has been established, from which there are (in places) spectacular seascapes and views across the inland estuary. The plateau offered level land for residential development but the history of land alienation was such that residential development has clustered around the waterways in the south and on the slopes and flats in the MacMasters Beach area.

Fortuitously, the establishment of Bouddi "Natural" Park in 1935 and the policy of its Trust to acquire additional lands to protect the oceanfront natural systems, succeeded in retaining a substantial part of the plateau and slopes between MacMasters Beach and Killcare Heights free of residential development. The National Parks and Wildlife Service later added to these protected areas, and Gosford City Council (assisted by the Department of Environment and Planning), has been developing its Coastal Open Space System by acquiring land above Daleys Point and along the MacMaster Ridge. The critical part of the plateau area, now, is the land not yet returned to public ownership between Killcare and Wagstaff.

.

Within the study area there are three ocean beaches of major recreational significance: MacMasters Beach, Maitland Bay Beach (which is wholly within Bouddi National Park) and Putty Beach (which is partly within the national park). Large numbers of people use these beaches — from within the study area, from surrounding settlements in the City of Gosford and (as tourists) from Sydney and elsewhere. Maitland Bay is accessible only by foot, a feature which has successfully served to maintain its natural charm.



The study area touches onto Brisbane Water at Pretty Beach, Hardys Bay and Rileys Bay, and onto Broken Bay at Lobster Beach. The estuarine waters are ideal for boating, being calm and protected, and one of the matters that must be resolved very soon is the intensity of their use.

Lobster Beach has only "foot access" by land, but is well patronised by boating enthusiasts. It is under the administration of the National Parks and Wildlife Service.

Practically the whole of the waterfront, facing both the estuary and the ocean, is used by amateur fishermen. There is a "marine extension" of the national park from Gerrin Head north to Bombi Head, where fishing is prohibited in order to protect "fishes" and plant life as described under the Fisheries and Oyster Farms Act.

There is still a very considerable length of coastline and waterway for fishing enthusiasts, making locations such as Tallow Beach and Little Beach significant also for limited camping. Both these beaches are within the national park.

.

Rainfall on the peninsula averages about 1200 mm with the wettest months in summer and autumn when high humidity is also experienced. In common with most of the eastern seaboard of New South Wales, hot days in late spring and summer are followed by southerly winds, sometimes of high velocity. Potentially dangerous winds in the summer come from the north-west on days of high temperature and low humidity. Because the peninsula carries a high vegetative cover and has steep slopes facing the west, fires can be difficult to control on days of extreme bush fire risk.

From time to time, low pressure cyclones build up off the coast in the winter periods and develop winds of high velocities. They have limited effect upon the beaches except for part of the MacMasters Beach region, but they do affect houses on plateaux and the limited number that face the ocean.

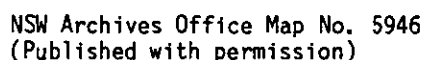
As previously indicated, most of the populous live in the sheltered areas of Wagstaff, Pretty Beach, Hardys Bay and Killcare. They are protected from coastal winds by the elevation of the plateaux.



.

The predominant vegetation is eucalypt forest which was "cut over" for more than a century. There are nevertheless some quite large specimens of eucalypts. In protected gullies, particularly those facing the south, there are pockets of rainforest -- the gullies of the Bouddi Grand Deep within the national park having special significance because of their near-pristine condition. The other outstanding vegetative feature is the heathland on the shallow and barren soils of the moorlands.

There is little in the way of biotic systems that could be called "unique"; the value lies in the survival of such a large remnant of what was once commonly-present biota, in a region that is under great human population pressure now, and likely to come under even greater pressure in the future.



"BOUDDI"

The name "Bouddi" is Aboriginal in origin and appears to have various meanings ranging from "a heart" to "water breaking over rocks". The name was first recorded in 1831 when Assistant-Surveyor Felton Mathew wrote the word (with phonetic symbols) on his Survey of the Principal Ranges between Tuggerah Lake and Brisbane Water.

Like all surveyors of the time, Felton Mathew had an instruction that "Native Names of Places are to be in all cases inserted when they can be ascertained." Apparently Bouddi (as in "moody") was the Aboriginal name for the northern headland of Maitland Bay. It has become synonymous with the national park which now occupies much of the study area.

EARLY SIGHTINGS BY EUROPEANS

At least two sightings of the Bouddi Peninsula were recorded before 1800. Captain James Cook, on his journey up the east coast of Australia in 1770, noted and named Broken Bay. He was, at the time, becalmed off "some pretty high land which projected out in 3 bluff Points, and occasioned my calling it Cape Three Points." The cape comprises almost half the coastline of the Bouddi Peninsula. Its naming was commemorated 200 years later by the erection of an obelisk and plaque on First Point, at the northern end of MacMasters Beach.

Another early sighting of the area is recorded in the Journal of William Bradley, one of the officers who accompanied Governor Phillip on his exploration of Broken Bay in March 1788, in search of agricultural lands. Bradley's record of Monday 3rd March begins thus: "At daylight, went into the N. branch of the harbour, which has a shoal and narrow entrance ... proceeded up this branch after passing a very shoal flat and 2 or 3 coves, we found (the ebb tide) set out so strong that we could not pull ahead through/between 2 projecting points ..."

The coves to which Bradley referred were later called Pretty Beach, Hardys Bay and Rileys Bay. The passage between the "projecting points" is now The Rip. By 1825 the north branch of Broken Bay had been named Brisbane Water, in honour of the incumbent Governor. The name also identified the surrounding district.

EUROPEAN SETTLEMENT AND LANDUSE

Settlement of the Bouddi Peninsula has been largely determined by the possibilities for gaining access to the area (mainly from Sydney) to exploit its natural resources, at first for "primary production" and later for recreation plus residency.

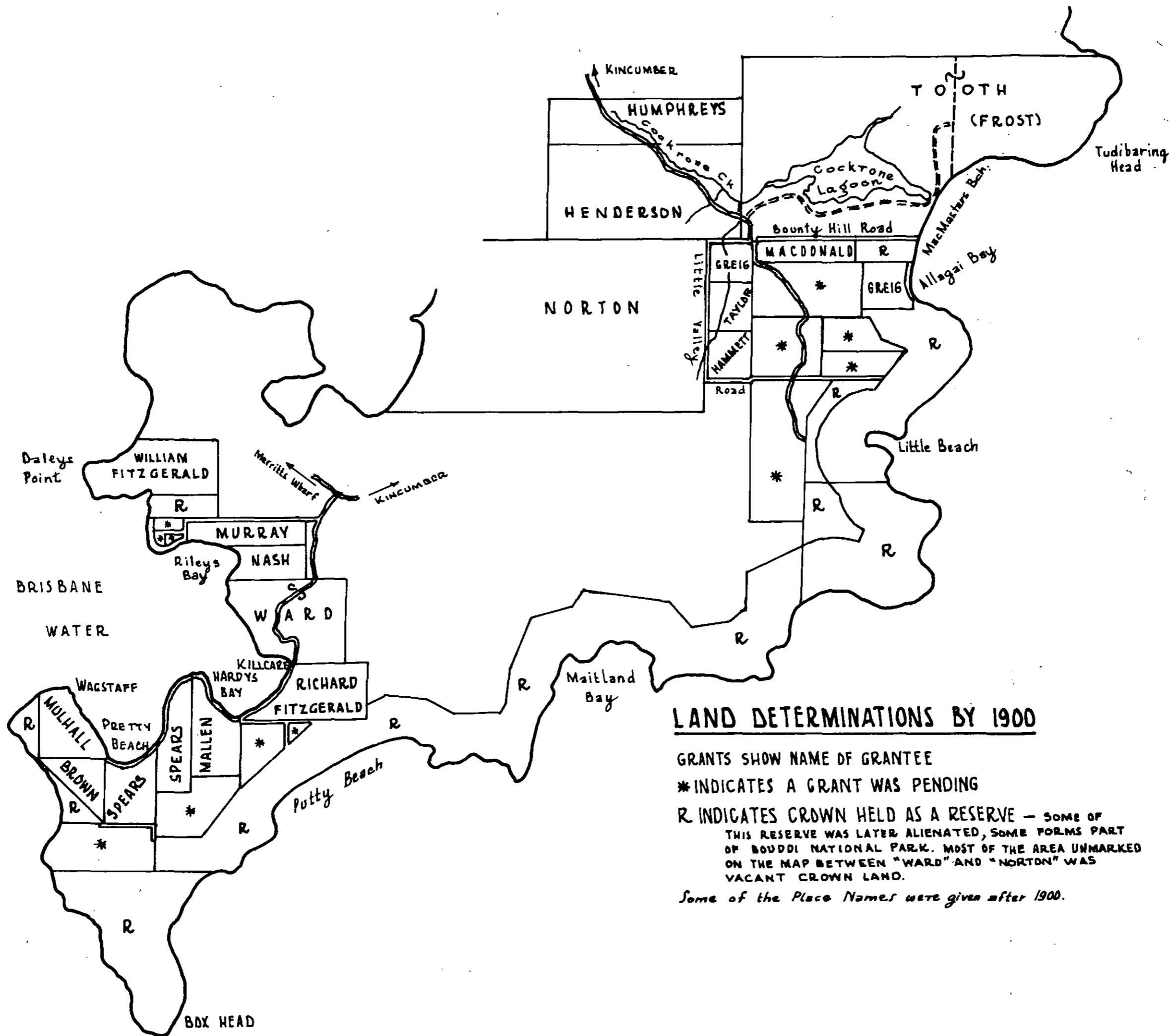
THE PIONEERING PERIOD - ACCESS BY SEA

Occupation of the Bouddi Peninsula by Europeans began in the 1820s when the Brisbane Water district was "opened up" for settlement. This followed the removal of the penal establishment from Newcastle to Port Macquarie, and a growing interest in the area by settlers entitled to small land grants.

Early access to the district was by sea and the very first settlers occupied the foreshores of Brisbane Water close to the ocean entrance of the waterway. A few ventured "inland" to places like Cockrone which was accessible by a track over the hills behind today's Bensville. There is no evidence of early settlers using the small coastal harbours or beaches of the peninsula to gain access to land.

The first European residents of the Bouddi Peninsula were Peter Campbell at Cockrone and James Mallen on Brisbane Water, both of whom were farmers. Peter Campbell's land (300 acres) was located on the main arm of Cockrone Creek where, in 1826, he was farming in the vicinity of the property known today as "Spring Vale". James Mallen settled in the southern corner of Hardys Bay, on land enclosing a small watercourse. By 1828 he had cleared and cultivated ten of his fifty acres.

There were several suitable sites for small settlers in the Brisbane Water section of the Bouddi Peninsula. As well as Mallen, four others were in residence in the 1830s: Patrick Mulhall at "Mount Pleasant" (Wagstaff), William Spears at "Somerset Place" (Pretty Beach), William Ward at Killcare Extension and John Murray at Rileys Bay. These early settlers on the waterway were subsistence farmers only. They made a living cutting logs and shingles, gathering shells (for lime manufacture) and so on.



They also became involved in shipbuilding and shipping, and one settler (William Spears) secured a licence for "spirituous liquor" during 1838/39, converting his home into an inn.

Until the 1850s, Peter Campbell's land was the only grant to be occupied in the Cockrone area, due no doubt to the problems of access. (Campbell had died in 1828 and his land is shown on maps as being granted to Robert Henderson.) The population of Cockrone swelled in 1855 with the arrival of the MacMaster family who purchased the 600-acres property known as Tooth's Grant. It was bounded by "a beach on the seacoast called Tudibaring" and enclosed Cockrone Lagoon.

By 1855 there was a track to Cockrone from Kincumber where a Government Village had been established. The track became a public road a few years later and extended towards Little Beach. Some additional settlers moved into the area in succeeding years but by 1891 (when a census of the colony was taken) the total population of the Cockrone/Little Beach area was still only eleven.

At the turn of the century, the Bouddi Peninsula was relatively unaffected by development. There was a small farming community at one end, and a handful of settlers (twenty two in 1891) with diverse occupations at the other.

There had been no interest in occupying the land between Little Beach and Box Head in the 19th century. A good deal of the MacMaster Ridge had been alienated as part of a large grant to James Norton in 1842, but occupation of that grant was confined to the low country -- the Bensville of today. A ribbon of land on the seaboard of the peninsula had been included, in 1876, in a Reserve for Coal which extended from Port Stephens to Jervis Bay.

By the turn of the century there was a network of tracks on the peninsula, including two public roads providing formal access from Kincumber to Little Beach (via Dajani Drive) and Wagstaff (via Frazer Road). There was no official route connecting the two areas.

THE INFLUENCE OF THE RAILWAY

The completion of the railway through Gosford in 1889 was responsible for a dramatic change in landuse on the Bouddi Peninsula, particularly in the Brisbane Water section. The event coincided with a growing health-and-leisure consciousness in the community, and the movement towards shorter working hours, free weekends and annual holidays for all workers.

WAGSTAFFE'S POINT ESTATE

Woy Woy

TORRENS TITLE

Purchasers of lots not fronting water will be given one of the smaller water frontage allotments for Wharf and Boating facilities.

Government Reserve

Surveyor to the Estate
PERCY W. NELSON
121 PITT STREET
SYDNEY

Easy terms.
Viz:
10% Deposit - Balance
in 36 monthly payments
with interest at 5%.

Vendors Solicitor
C. L. Tange.
10 Bligh St. Sydney.



THE MANLY OF BRISBANE WATER

For Sale by Public Auction
on the Ground on

and undeniably the pick of the District.

SATURDAY 22ND DECEMBER 1906.

AT 2 P.M.

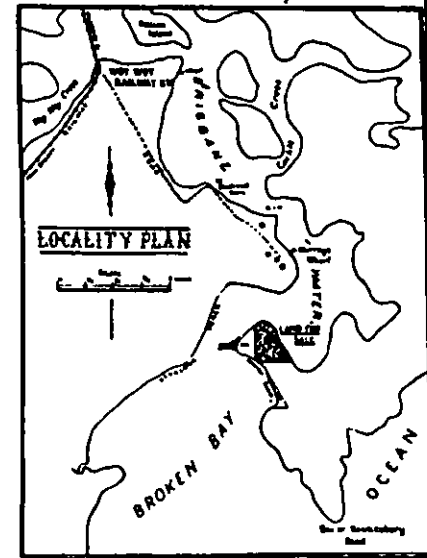
RAINE AND HORNE AUCTIONEERS
86 PITT ST SYDNEY

Direct Road Access from Brisbane Water to Broken Bay.

Good Frontages.
Liberal Depths.

Adjoining large Government Reserve.

Cheap Railway and Steamer Takers can be obtained upon application to the Auctioneer



Local Agent for the Estate, F. WHEELER, Gosford

Consequently, large estates of private land in the Gosford district were subdivided from the 1880s onwards, initially for "model farms" and then for recreational purposes. ("Model farms" were somewhat similar in concept to the "hobby farms" of today, but there was more emphasis on making a living from them, independent of any other source of income.)

The first of the estates to be cut up for sale after the coming of the railway, was "Mount Pleasant" at Wagstaff. In 1904 it was advertised as being three miles from Woy Woy Railway Station, with rich agricultural land suitable for orchards, maize growing, etc. There were eleven allotments for sale, one with a comfortable four-roomed cottage -- formerly occupied by George Wagstaffe.

Two years later, the same land was re-subdivided into 82 lots with Torrens Title. The advertising blurb now emphasised the opportunities for boating and bathing at "The Manly of the Brisbane Water". Also, purchasers of lots not fronting the water, would be given a small water frontage allotment (free of charge) for "Wharf and Boating facilities".

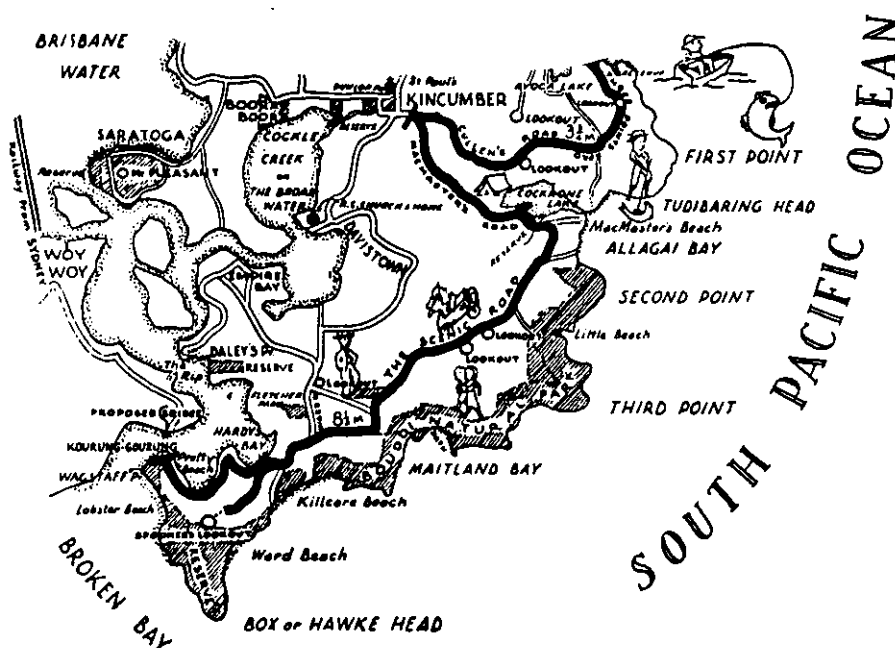
Following subdivision of Wagstaffe's Point Estate by the owners of the land, the remaining land grants on the waterfront between Wagstaff and Killcare Extension were purchased by the N.S.W. Realty Company (Arthur Rickard & Co.), converted to Torrens Title -- a big selling point, it seems -- and offered for sale by auction. The "estates" were given the names: Pretty Beach, Hardy's Bay, Killcare and Killcare Extension. They were all subdivided by 1920. An attempt by the owner to subdivide Nash's Grant at the southern end of Rileys Bay in 1908, was abandoned when there were problems with providing Torrens Title.

In the Cockrone area, Peter Campbell's land (Henderson's Grant) was subdivided into small-farm lots in 1920, as was the MacMaster family's in 1923. One of the lots in the MacMasters Subdivision, close to the ocean, was purchased by the surveyor of the subdivision and immediately cut up as the "Tudibaring Ocean Beach & Lake Estate". Another seaside estate was offered in 1927 by John MacMaster -- a cousin of the resident MacMasters -- who had built a holiday house near his relatives on the land (Grieg's Grant) fronting Allagai Bay.

The sale of land in these estates was nowhere near as rapid as in those on Brisbane Water, because of the difficulties of reaching them. The Brisbane Water holiday-makers had a launch service from Woy Woy Railway Station, literally to the door of their "weekenders" in many cases, but the Cockrone (MacMasters Beach) folk were dependent on road transport from Gosford or Kincumber. In the 1920s, this was no simple matter.

THE SCENIC ROAD

The formation of the Scenic Road in the late 1920s and its upgrading during the next decade, did give a fillip to land sales at MacMasters Beach. It also brought about the subdivision known as Killcare Heights Estate in 1928, although it had no significant effect on access to either Killcare Heights or the holiday resorts around the waterway, for many years. These places continued to be serviced by ferries.



On Killcare Heights, a large area of the plateau embracing the so-called "Triangle" (land enclosed by Wards Hill Road, Maitland Bay Drive, The Scenic Road and Stewart Street) was applied for in 1918/1919 by two persons seeking its purchase by "conditional sale". C.B.M. Ford completed his payment for 18 acres (portion 283) in 1936, but A.G. Davis was more tardy ... in 1939 the land which he had sought (over 300 acres) was subdivided by the Crown into several portions including 23 in the "triangle". Maitland Bay Drive was reserved at this time to give access from Empire Bay to the newly-established Reserve for Public Recreation at Boat Harbour -- the embryo of Bouddi National Park.

RECENT DEVELOPMENTS AFFECTING SETTLEMENT

Road access did not become an important factor in the development of the Bouddi Peninsula until the early 1960s. By then, the Scenic Road had been re-formed and sealed through subsidies from the beach-sands mining companies whose depot was at Kinckumber. By the 1960s also, the motor car was well established as part of our way-of-life, and for those not equipped with their own vehicles, a local bus company provided a reasonable, regular service to and from Gosford.

Other important factors affecting settlement since 1960 have been the electrification of the railway line, the building of the Expressway, the opening of The Rip Bridge and the re-forming of Wards Hill Road. These things have made it feasible to commute to Sydney and at the same time reside in an area of high scenic and recreational value. A number of people work locally, of course, whilst others come to the area at weekends only. Many now live in their "weekenders" of yesteryear.

It is reasonable to assume that pressures for settlement of the Bouddi Peninsula will continue to increase, and the present quality of the area will be maintained only by careful planning and implementation of a scheme to control future landuse.

+ + + + +

For REFERENCES and further reading:

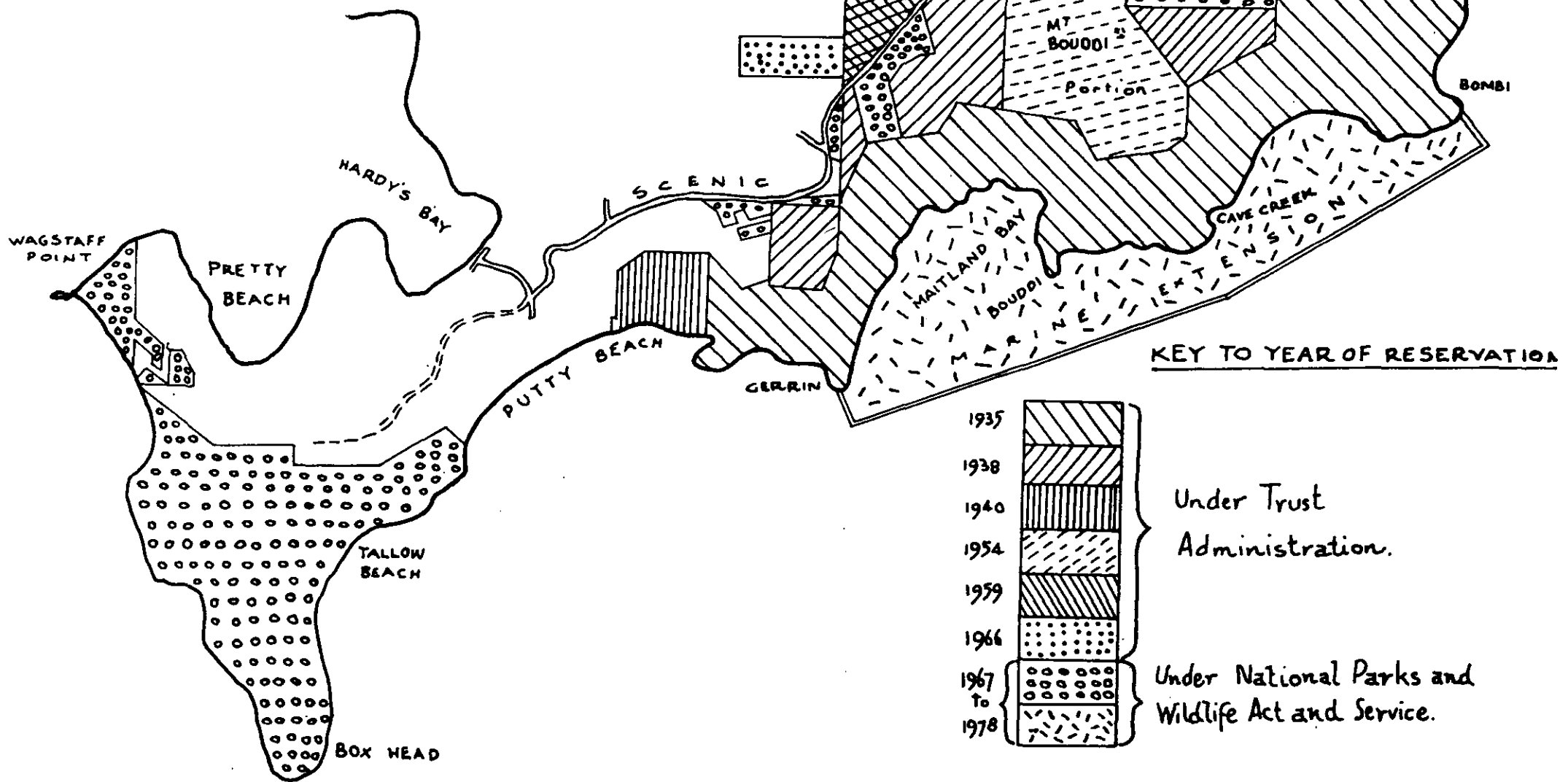
Strom, Beryl. Gosford/Wyong History & Heritage:
Gosford District Historical Research and
Heritage Association, 1982.

MacMasters Beach - A History:
G.D.H.R.H.A., 1985.



Diagram to show the pattern
and rate of change in
boundaries to March 1978

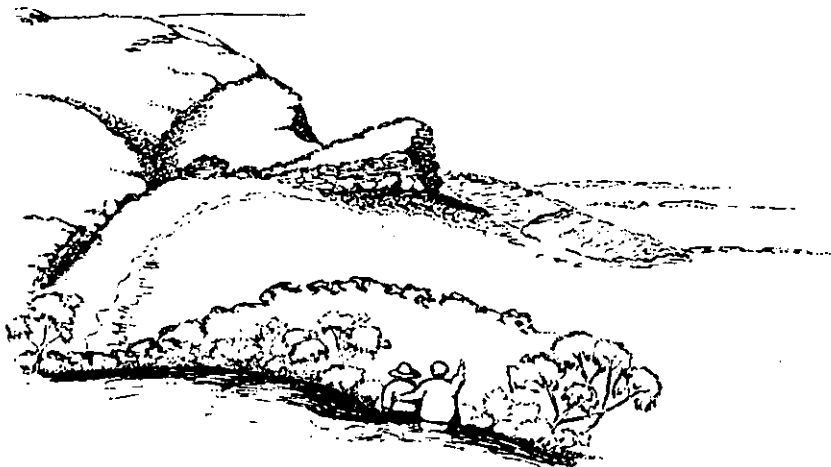
BOUDDI NATIONAL PARK



BOUDDI NATIONAL PARK

Bouddi National Park was originally a Reserve for Public Recreation under the Crown Lands Consolidation Act. It was notified on 5th July 1935 and defined as "Reserve No. 65,339 at Maitland Bay, area about 650 acres". Six trustees were appointed -- three from the New South Wales Federation of Bushwalking Clubs and three from Erina Shire Council.

The early bushwalking community was largely responsible for having the area reserved. Of particular importance was the role of Miss Marie Byles who had walked through the area in 1922 and recognised its natural values and its potential for parkland. It was her enthusiasm which prompted the newly formed Federation of Bushwalking Clubs to recommend to the Department of Lands, in the early 1930s, the reservation of the lands north and south of Maitland Bay.



The recommendation was accompanied by an imaginative proposal of the National Parks & Primitive Areas Council, for the inclusion of all the coastal Crown Lands from Wagstaff Point, through Box Head and Putty Beach to MacMasters Beach. This proposal was not accepted by the Department of Lands but the old reserve for coal, 20 chains (400 metres) wide, from Putty Beach to MacMaster's, was in fact reserved.

The first job of the trustees was to choose a name for the new reserve. They decided on "Bouddi Natural Park" -- "Bouddi" being the authenticated Aboriginal name of the most prominent feature of the park (the headland on the eastern end of Maitland Bay) -- "Natural" being the way the trustees hoped to keep the area. A list of regulations for the management of the park was submitted to the Department of Lands and approved.

The trustees then set about acquiring additions to the park to make it more viable. In 1938, as a result of their efforts, 95 hectares were added -- 23 hectares above Cave Creek and the remainder around Mount Bullimah and behind Maitland Bay. This was all vacant Crown land, within which (and fronting the Scenic Road) were two alienated portions that were to prove most difficult to acquire and were not in fact acquired until thirty years later.

In 1940, 18 hectares were added at the Putty Beach end of the park including a Crown subdivision of 38 portions. Much of this area was later mined for beach sands and is now used for camping, picnicking and so on.

Apart from securing additions to the park, the trustees had another major problem -- managing the area already in their care. There was no Government financial assistance in those early days, hence no staff could be employed to police the regulations or carry out a works programme. A system of voluntary patrols was instituted, and all work on tracks, water supply, campsites etc., was done by voluntary labour.

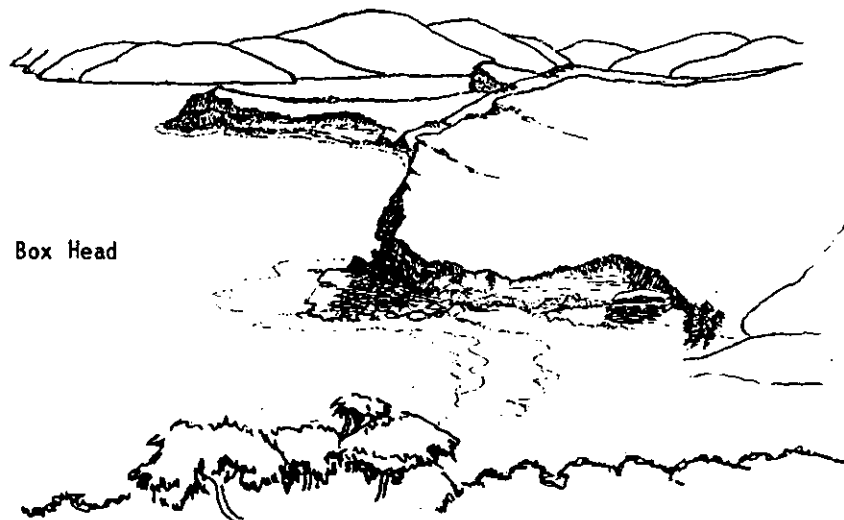
An annual event in the bushwalking world was the Working Bee at Bouddi, organised by the Federation and held each May. Over one hundred people usually attended. The first Government grant was received in 1948. It was a sum of twenty pounds and was used to buy stamps and some letterhead, and to pay off a debt for materials supplied for the previous working bee. It was not until 1960, that a sum of any significance was received -- fifteen hundred pounds which enabled the trust to employ a ranger part-time.

The trustees were always mindful of the need to secure the entire catchment of Maitland Bay, if its natural and scientific qualities were to remain unspoilt. Proposals were submitted, and re-submitted, to the Department of Lands concerning several important portions fronting the Scenic Road and draining into Maitland Bay. The largest of these, "Scott's Portion" (98 hectares), was added in 1954 and the remaining portions were eventually acquired between 1968 and 1974. Portion 370, a vital 6 hectares was finally secured from the owner by the chairman of the trustees purchasing the land personally, then selling it at its "unimproved value" to the Department of Lands.

In 1957, the Trust accepted control of an area of reserved land (44 hectares) on the northern side of the Scenic Road. This was added to the park on 12th June 1959, at which time all existing reserves comprising Bouddi Natural Park were revoked and re-reserved for Public Recreation and the Promotion of the Study and Preservation of Native Flora and Fauna.

In 1960, application was made to the Fauna Panel for the park to be made a Wildlife Refuge. It subsequently had the distinction of being proclaimed "Wildlife Refuge Number 1".

In 1965, a comprehensive proposal was submitted to the Department of Lands by the National Parks Association of N.S.W. for the addition of reserved lands in the Killcare/Box Head region. Though unknown to the Association at the time, this proposal was in line with the very early submission of the National Parks & Primitive Areas Council.



It was not until after the formation of the National Parks and Wildlife Service that the reserves on Box Head were added. The Putty Beach reserve was not acquired because of local hostility to the park's Plan of Management which embraced the reserve as well as a lot of freehold land. This was not a legal procedure in 1969, the date of the initial Plan.

In 1967, the park (by then totalling 530 hectares) was dedicated under the National Parks and Wildlife Act and re-named "Bouddi State Park". Dedication of the area would mean security of tenure, restriction on mining, greatly increased finance, improved administration -- all of which was good news to the Trust.

Management of the park became the responsibility of the National Parks and Wildlife Service, and in May 1969 the Trust was reconstituted as an advisory committee. It now had the job of keeping the Service "on its toes", seeing that old proposals were brought to fruition and that new projects were what it considered to be in the best interests of management. Within the limits of its "advisory" role, the committee continues to play an active part in the administration of Bouddi. (See ENDNOTE.)

Since 1967, the Service has effected many improvements to the boundaries of the park, especially with the additions on Box Head and also around Little Beach where the most significant addition has been the unmined section (39 hectares), of the area known as "The Dunlop Estate". Regarding the reserved lands on Box Head, these were added in 1972 and totalled 177 hectares. Two areas under mining leases within the reserves (Tallow Beach and its access road) were secured in 1973 when the leases expired. The total area of land on Box Head is currently being increased by the purchase of 26 hectares on the skyline by the National Parks and Wildlife Foundation. Purchase will be completed in 1980. (See ENDNOTE.)

On January 1st, 1974, the new National Parks and Wildlife Act dispensed with the category of "state" parks (for smaller areas), and Bouddi was re-named "Bouddi National Park". It now has an area of approximately 800 hectares, not including the 287 hectares of the Marine Extension gazetted in November 1971. A new Plan of Management is being prepared. (See ENDNOTE.)

ENDNOTE:

The above history of Bouddi National Park was written in March 1978. Purchase of the important area on the skyline at Box Head was completed sooner than expected and the addition gazetted in November 1978. The "sand mining" area at Little Beach was gazetted the following month. Other, smaller areas have since been acquired as part of a boundary rationalisation programme.

The new Plan of Management for the park, mentioned in the last sentence of the paper, went through all the statutory procedures including public exhibition, and was adopted by the Minister in February 1985.

Bouddi National Park Advisory Committee was disbanded, in January 1985, in favour of a Hawkesbury District Advisory Committee with responsibility for all three parks of the District: Bouddi, Brisbane Water and Dharug.

The total area of the park in February 1985 was 1,159 hectares.



NATURAL RESOURCES
OF
THE STUDY AREA

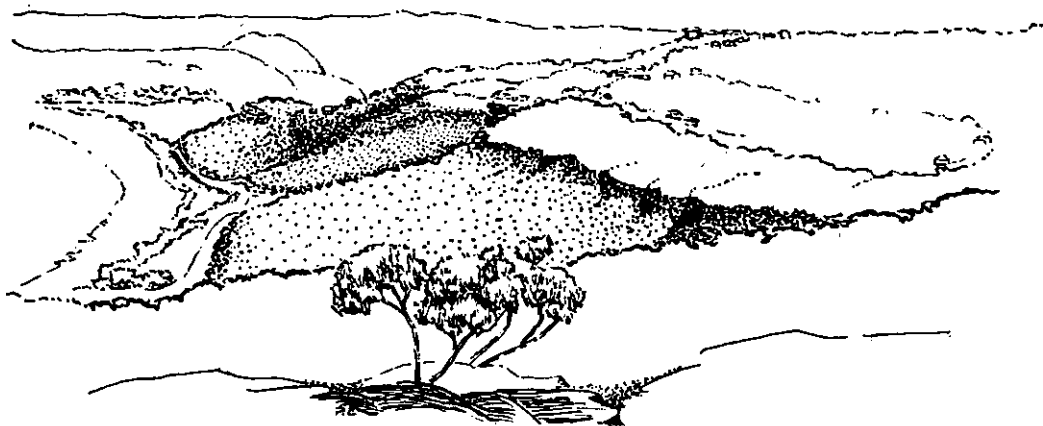
ROCKS, SOILS AND LANDFORMS

The whole of the Bouddi Peninsula is based upon two sedimentary rocks: sandstone and shale.

In much of the area, the tops of the ridges are covered by sandstone - Hawkesbury Sandstone - producing small plateaux. In several places however, particularly in the north, this sandstone does not occur and the ridge tops are shaley and more narrow.

The Hawkesbury Sandstone is characteristically in massive lumps of hard rock with thin layers of soft shale. The massive material forms cliffs with perpendicular drops of up to six or seven metres. The shale layers encourage the formation of caves and the "weathering off" of large boulders which roll down the escarpment. The Hawkesbury Sandstone produces poor sandy soil which has been avoided for farming.

The Gosford Formations occur below the Hawkesbury Sandstone and are composed of a series of rock beds ... mostly shale with occasional layers of reddish sandstone. Being softer than the Hawkesbury Sandstone, they develop a far less rugged profile, with rounded contours. The Gosford Formations account for the sloping sides of the ridges, or "the escarpment".



The shale country has been used for agriculture. Around Wagstaff, Pretty Beach and Hardys Bay, there were only limited sites available but in the MacMasters Beach area, with its greater exposure of shale, there were many suitable places.

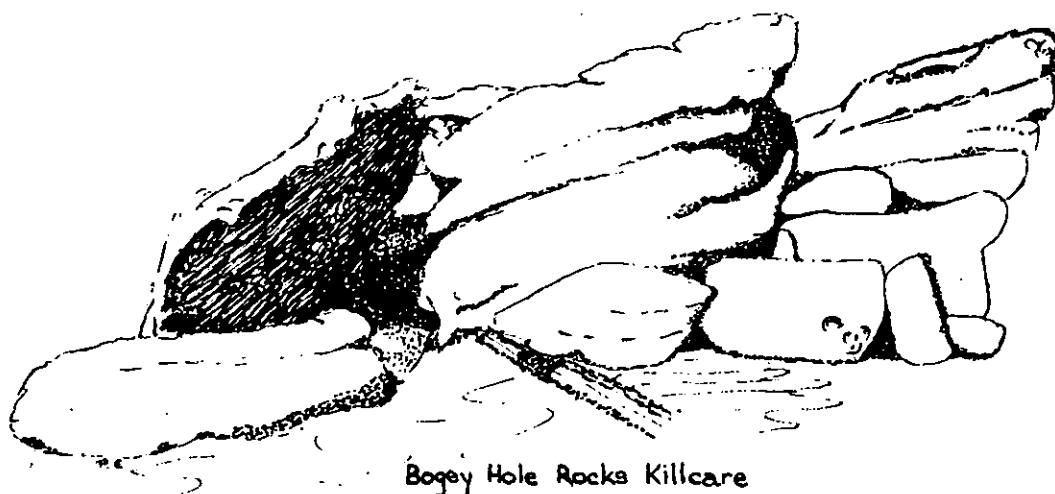
It is apparent that the best agricultural lands in the study area were on "secondary deposits" of soil where silt had built up from the weathering of the shale slopes and where alluviums from the waterways had accumulated.

There are two other "secondary deposits" of importance on the Bouddi Peninsula:

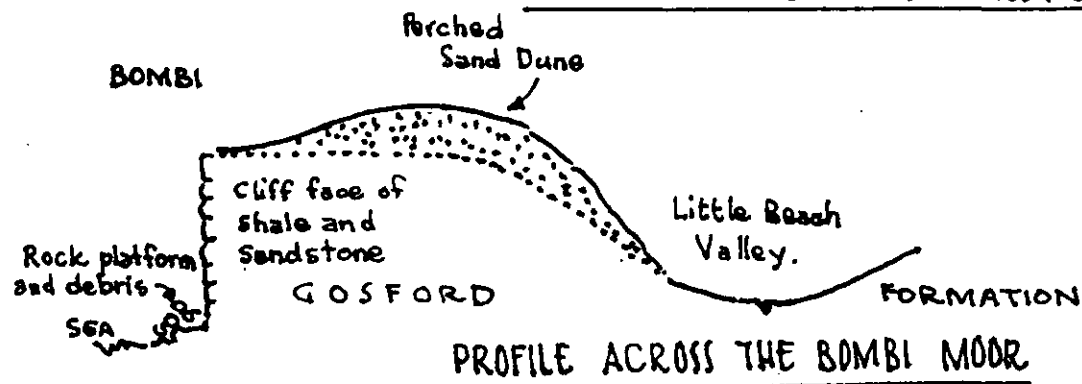
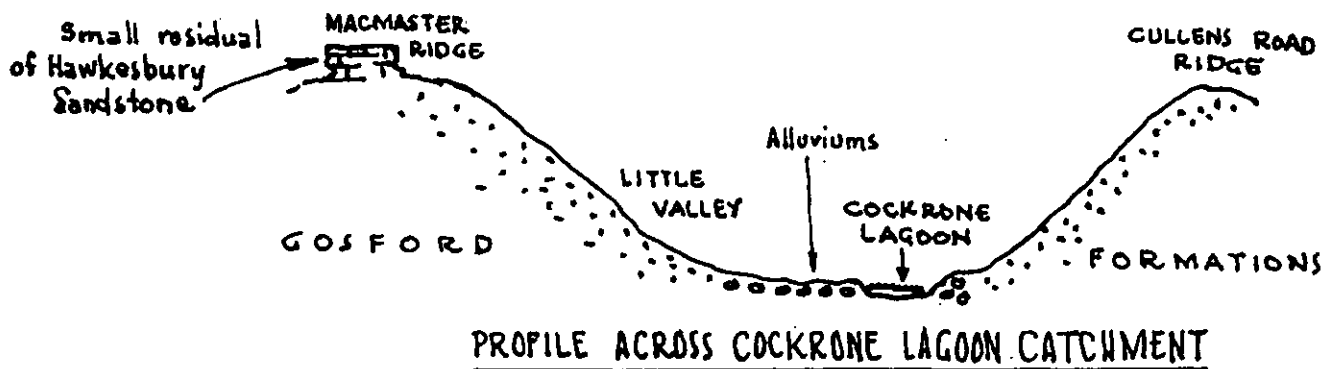
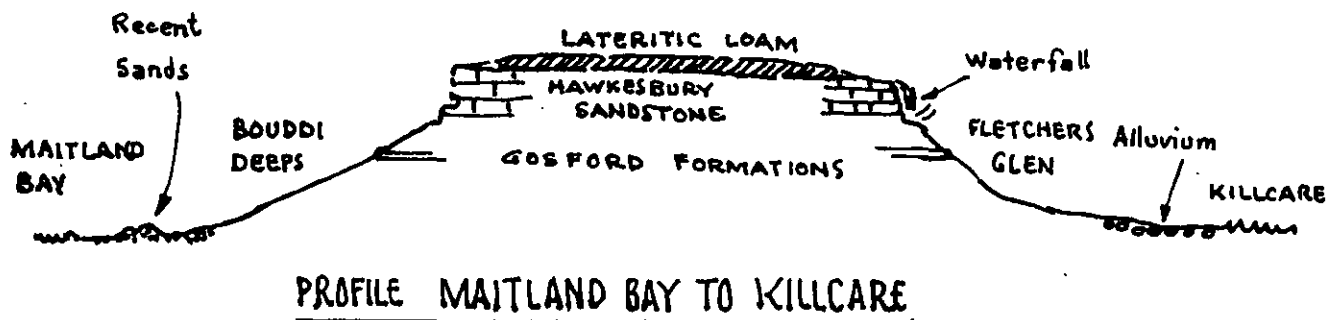
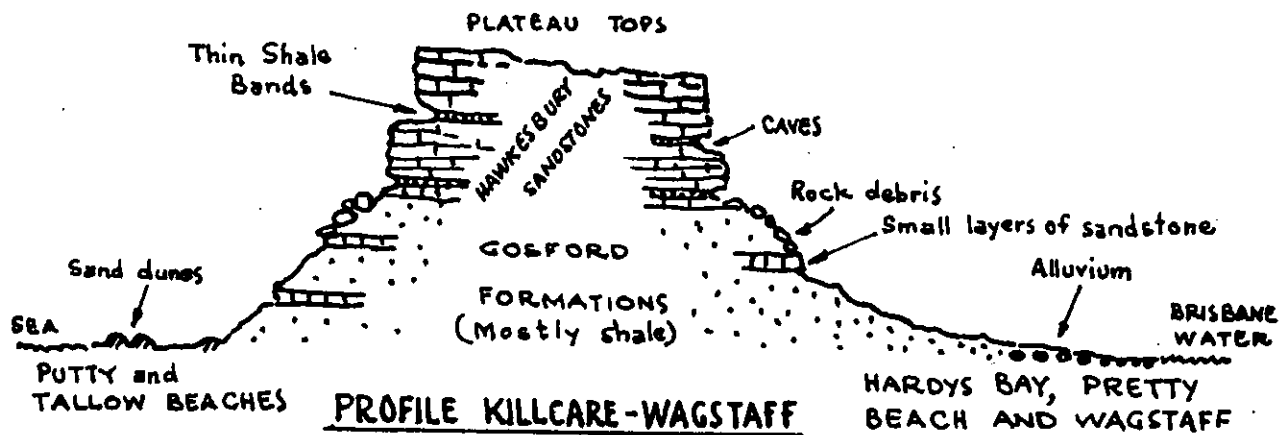
- an area of lateritic loam on Killcare Heights, and
- the sand deposits along the beach strands, and on the moorlands in the vicinity of Little Beach.

The red, lateritic loam was exploited for vegetable growing (requiring heavy manuring from the concurrently operating poultry farming). The beach sands at Putty Beach and Tallow were mined for heavy metals (rutile, zircon etc.) whilst the white sand on the moors was taken for optical and ceramic work. Deposits of the latter within the original section of the national park, still remain.

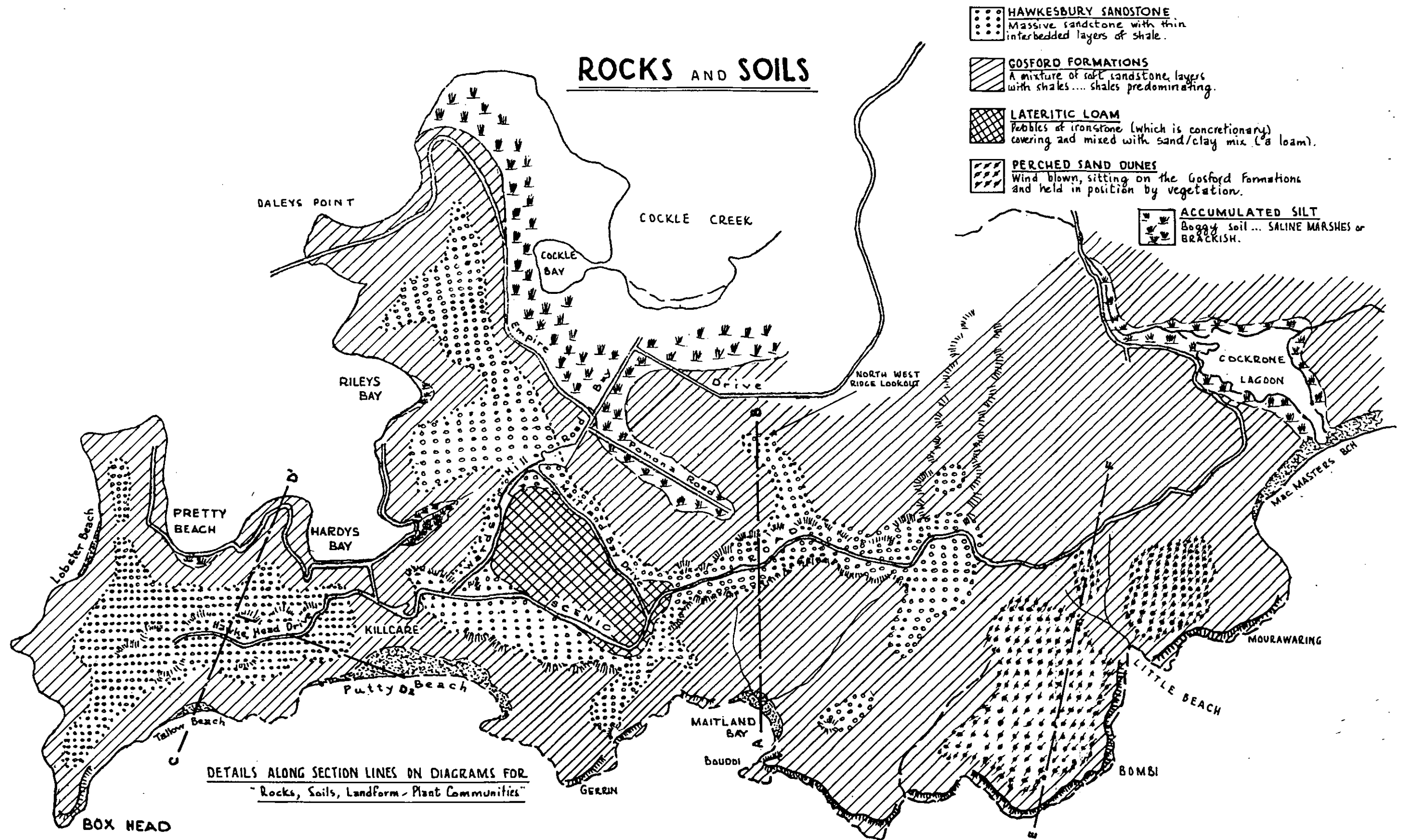
+ + + + +



ROCKS, SOILS AND LANDFORMS DETERMINE LANDSCAPE



ROCKS AND SOILS



MAITLAND BUMBORA

VEGETATION COMMUNITIES

This survey was carried out between the Box Head/Wagstaff Point headland and the shores of Cochrone Lake and included parts of the Daleys Point, North-West and Bouddi ridges. A small portion of low-lying lands behind Bensville was also included. The survey covered about 2700 hectares.

Much of the original vegetation of the study area is preserved within the Bouddi National Park but because of settlement and other landuse, some vegetation communities beyond the Park have disappeared.

The aim of this section of the study was not to survey the vegetation in detail, but to describe and map it in general terms as "community types". The community types would then be subdivided according to their dominant species, and termed "associations". This was considered a satisfactory method of recording vegetation over a fairly large area. At the same time, communities which have been greatly reduced or are at risk, could be recorded.

METHOD

Preliminary observations of the vegetation communities revealed that a correlation with the geological boundaries was probable. Black and white aerial photography (scale approximately 1:13,000) was used initially to outline the various vegetation communities and geological boundaries. These were then transferred more accurately onto orthophotomaps (scale 1:4000 and 1:2000), to produce a base map overlay. Each community outlined, was checked in the field on foot and descriptions were noted.

The base map overlays were photographically reduced onto a final base map at a scale of 1:10,000, then further reduced for the purpose of this booklet. As the study progressed, it was found that best results were obtained when an entire community type formation (e.g. Open Forest) was field checked and described. In this way, species contained in any vegetation community formation became fixed in the observer's mind and different associations were more easily recognised.

PLANT COMMUNITY CLASSIFICATION

Vegetation communities were classified according to structure and simple floristics. Classification was based on the study by Benson and Fallding (1981) and the structure devised by Specht (1970). Each plant community recognised was described noting its structure, its distribution throughout the Bouddi Peninsula, its habitat and the main "indicator" species.

RESULTS

The results of the plant community classification are shown on the accompanying map and in the Appendix at the back of this booklet.

DISCUSSION

Twelve structural vegetation forms were recognised throughout the Bouddi Peninsula, ranging from "Closed Forest" to "Grassland". The Gosford Formations has the greatest variety of vegetation forms, reflecting the diverse nature of habitats on this geological unit. The "Open Forest" form has the largest number of "associations" and these are confined to the Gosford Formations. The Hawkesbury Sandstones support a lesser number of "Woodland associations".

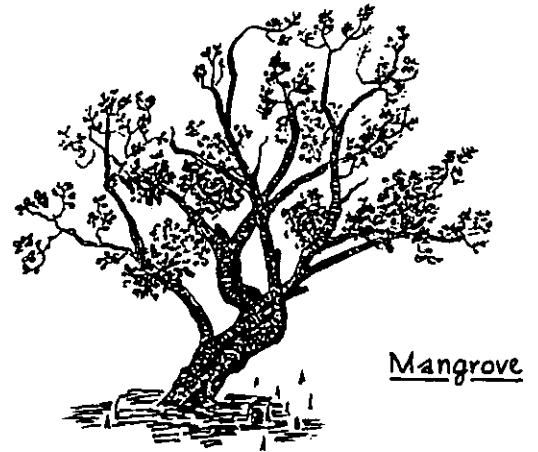
Some of the vegetation communities are uncommon and have a restricted distribution or occur only once within the area studied. These include all the communities identified on the Alluvial Flats, Perched Sand Dunes and Recent Coastal Dunes; several on the Gosford Formations; the Woodland community on the Hawkesbury Sandstones and the Low Woodland on the Lateritic soils.

Many of the vegetation communities are within the boundaries of the Bouddi National Park and some have been identified in its Plan of Management as areas of "special, scientific and ecological importance". Examples are the Tall Closed Forests and Open Forests of the Bouddi Grand Deepes, the Heathlands on the Bombi and Mourawaring Moors, and part of the coastal dune system at Putty Beach. The Open Heath (community 4:8:1) on the eastern end of Putty Beach and the pocket of Rulingia hermannifolia on Box Head could well be included in this category.

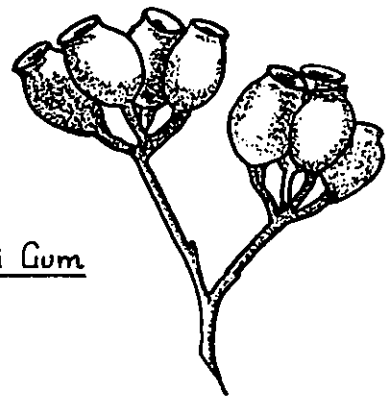
Outside the Park, some communities occur within Public Reserves or Open Space zonings, whilst the mangroves (in community 1:4) have protection under the Oyster Farms & Fisheries Act.

Other communities, however, are being reduced or modified by urban development, including the Bluegum Forests (community 1:1), the Rainforests (4:2), the Spotted Gum Forests (4:3:2), the Grey Gum Forests (4:3:5), the Bangalay communities (1:2:2) and the Stringybark Woodlands (community 5:1:2).

Portions of these communities should be added to the existing public reserve system, as they are not currently well represented. Pertinent examples are the Rainforest Gully north of Pomona Road; community 4:3:2 above Pretty Beach; community 4:3:5 above Hardys Bay and community 6:1:2 north of Hawkes Head Drive.



Mangrove

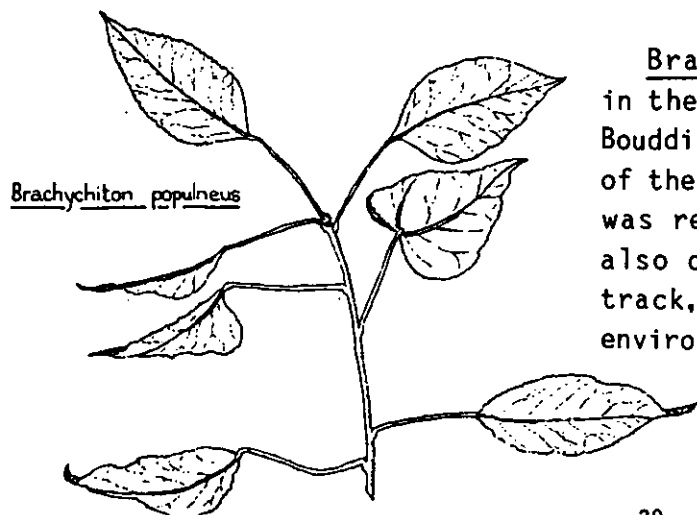


Spotted Gum

.

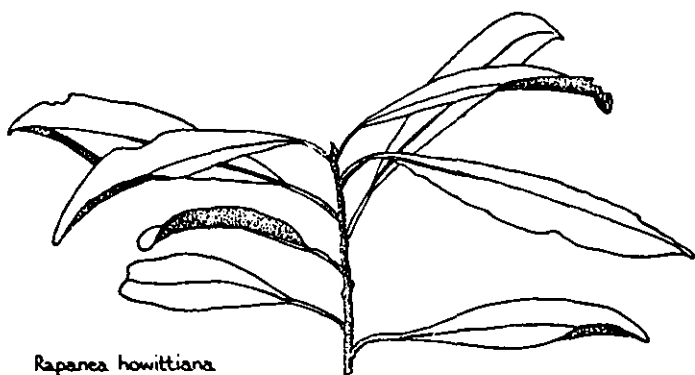
Certain "indicator" species from the vegetation communities were observed to be uncommon throughout the area studied —

Doryphora sassafras: This species was recorded from one location only at the ford on Little Valley Road. It is more common in the north-eastern part of the Gosford area.



Brachychiton populneus

Brachychiton populneus: Deep in the rainforest gullies of the Bouddi Grand Deepes, a single stand of these trees, with dense crowns, was recorded. A few specimens also occur along the Mt. Bouddi track, but not in a Closed Forest environment.



Rapanea howittiana

Rapanea howittiana: The Brush Muttonwood was recorded only in a single dense stand, as understorey trees along the roadside verge at Cockrone Lake. This species is not common in the Gosford area although it is known from the valleys in the north-east.

Ficus rubiginosa: Large mature specimens of the Port Jackson Fig are rare on the Peninsula, but shrubby specimens are found in the gullies. A single tree exists at Rileys Bay and further specimens are contained within the Fletchers Glen Reserve.

Avicennia marina var. australasica: The mangrove community has been depleted but a few colonies remain around the foreshores of Hardys Bay, Rileys Bay and Pretty Beach. One large specimen is located by the roadside at Pretty Beach and is featured on the cover of this booklet.

Rulingia hermanniifolia: This species has been recorded by the National Herbarium of New South Wales, at two locations in the study area. In addition it was recorded in the Coastwatch survey as a small community of about 50 plants at Box Head. It is listed as a "rare" but not vulnerable species by Leigh, Briggs and Hartley (1981).

.

The boundaries between the vegetation communities are not always easily defined because of intergradation of species, particularly where the community exists on a narrow ridge or as a small isolated pocket.

Aspect differences also created problems during the survey. Where a small community existed, it had to be decided whether a separate community classification was warranted. Along the coastal fringe community 4:3:6 has so many variations in species alliance that it was difficult to determine the main "association". The problem increased closer to the ocean front. It was also encountered on the northern slopes above Killcare Extension.

Not all vegetation communities were confined to the observed geological boundaries. For example, the Heathlands dominated by Allocasuarina distyla occur on the Hawkesbury Sandstones and Perched Sand Dunes, but in both cases persist onto the Gosford Formations at the cliff edges.

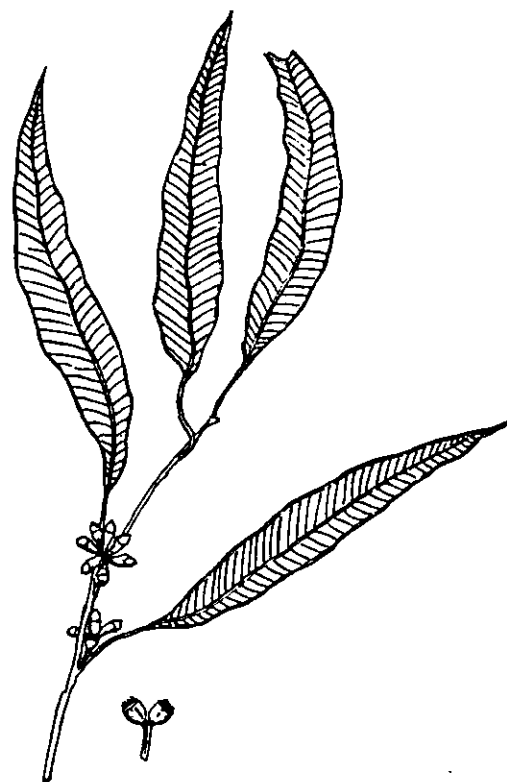
The study area contains a large number of diverse plant communities, with those in the western section being significantly different from those in the east. This is determined largely by the geological strata producing different soils although topography, aspect and climate also play important roles.

Where the Peninsula is narrow with cliffs, embayments and a maritime environment, many small habitats have evolved. On very exposed sites irrespective of soil type, Heathlands occur; on plateaux and slopes with some shelter, Woodlands and Open Forests predominate -- the "associations" differing according to the soil and other factors; and on tidal estuarine flats there are Open Scrub communities of mangroves.

The eastern section of the study area has comparatively few habitats spread over a much larger tract of land, due to the predominance of the Narrabeen Shales and a reduction in maritime environment.

Sheltered inland moist slopes on Narrabeen Shales are occupied by Blackbutt Forests, with the association: E. pilularis, E. punctata and E. paniculata. On lower slopes as moisture and nutrient content in the soil increases, E. paniculata disappears.

On the flats of rich alluviums where a high water table is present, Sydney Bluegum (E. saligna) was recorded. This species occurs as a co-dominant with the Cabbage Gum (E. amplifolia) and the Swamp Mahogany (E. robusta).... together referred to as the Bluefum Forests.



Euc. saligna

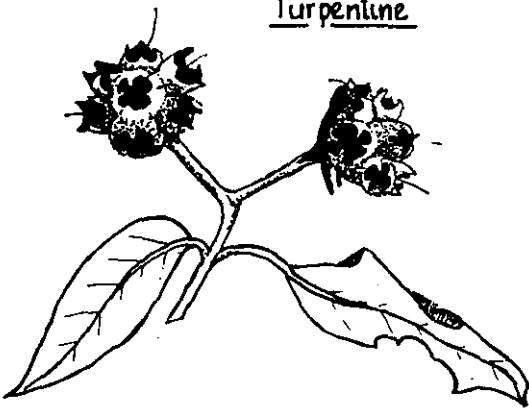


Euc. amplifolia

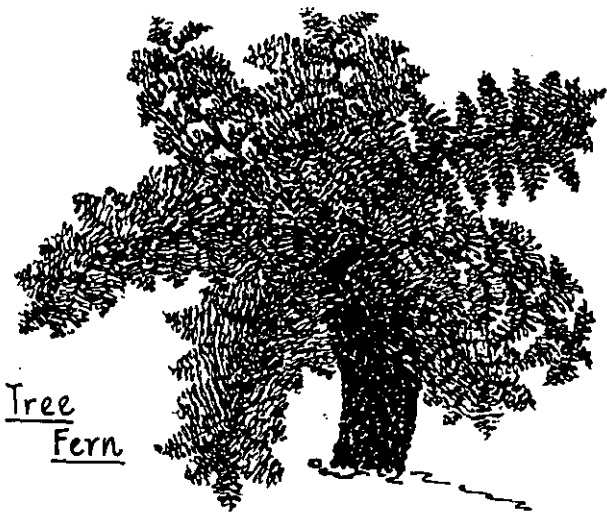


Euc. robusta

Turpentine

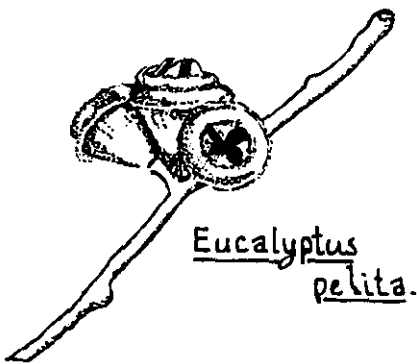


On seaward slopes, the Blackbutt Forests are replaced by E. umbra in dry higher parts, whilst moister "re-entrant" slopes are occupied by Syncarpia glomulifera (Turpentine), E. botryoides (Bangalay), E. pelita (Large-fruited Mahogany) and A. floribunda (Rough-barked Apple).



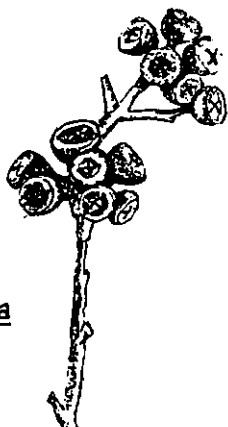
Tree
Fern

Both inland and seaward slopes are dissected by gullies containing important pockets of gully rainforest, described by Webb and Tracey (1980) as "refugia". Rainforests in the study area are confined to fire-proof niches and those on southern slopes, particularly in the Bouddi Grand Deep, are in near-pristine condition. Important rainforest trees from the families Lauraceae, Sapindaceae and Cunoniaceae are present along gully entrenchments whilst gully bottoms are occupied by Palm Forests of Archontophoenix cunninghamiana. The northern gullies are more open and there is evidence of bushfires. Epiphytes and orchids are absent and "emergent" trees such as E. saligna (Sydney Bluegum) occur. Here, fire has developed a mixed Eucalypt-Rainforest community and an impressive stand exists behind Pomona Road.



Eucalyptus
pelita.

Eucalyptus
umbra spp. umbra



The Perched Sand Dunes on top of the Gosford Formations in the north-east of the study area, are dry exposed environments subject to constant winds and salt spray. The leached soils are often poor in nutrient content. Vegetation on the windward slopes is restricted to heath-type plants specially adapted to combat drought and fire. The leeward slopes support the common woodland association: E. gummifera, E. umbra spp. umbra and A. costata.

CONCLUSION

This survey has been a community group's attempt to map the vegetation of a relatively large area. The method employed was found to be satisfactory, and is recommended for any further study of this type.

Although no detailed vegetation analysis was undertaken, certain communities were recognised as uncommon and undergoing change in the study area. The Bluegum/Cabbage Gum Forests, the Grey Gum Forests, the Spotted Gum Forests and the Closed Forests are particular examples and are poorly represented in existing public reserves. Several "indicator" species have been determined as uncommon on the Peninsula, and only a few have any real protection.

It is hoped that these findings, and the survey generally, will assist future landuse planning and conservation in the area.

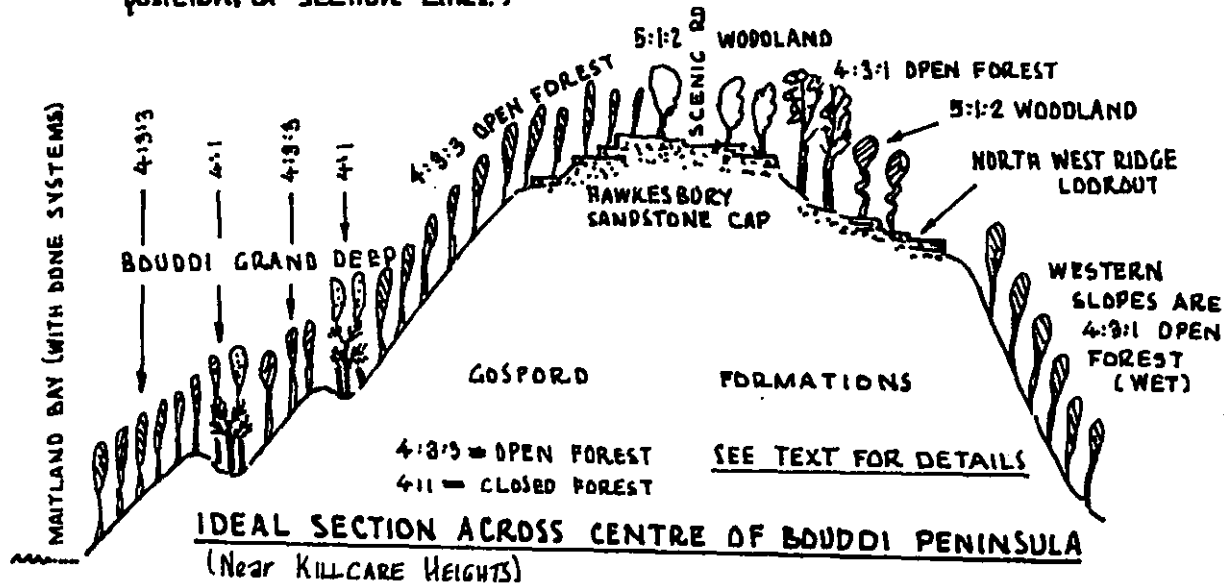
+ + + + +

REFERENCES

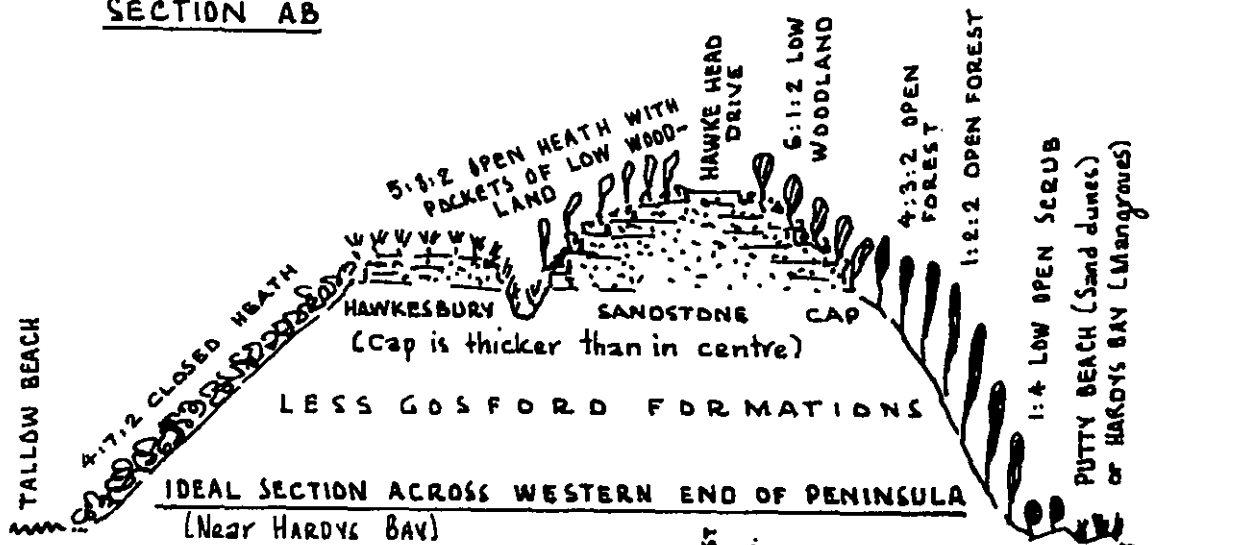
- | | |
|---|--|
| Benson, J.S. & Fallding
H. (1981) | Vegetation Survey of Brisbane
Water National Park and Environs.
<u>Cunninghamia</u> Volume 1. |
| Leigh John, Briggs John
and Hartley William (1981) | Rare or Threatened Australian Plants.
<u>Australian National Parks and Wildlife
Service - Special Publication No. 1.</u> |
| N.S.W. National Parks
and Wildlife Service (1985) | <u>Bouddi National Park Plan of
Management.</u>
New South Wales Government Printer. |
| Specht, R.L. (1970) | <u>Vegetation in the Australian
Environment.</u> (ed. G.W. Leepen)
4th Edition. Melbourne University
Press. |
| Webb, L.J. & Tracey, J.G.
(1980) | Australian Rainforests - Pattern and
Change in <u>Ecological Biogeography of
Australia</u> , edited by A. Keast.
TheHague: Junk. |

ROCKS, SOILS, LANDFORM DETERMINE PLANT COMMUNITIES.

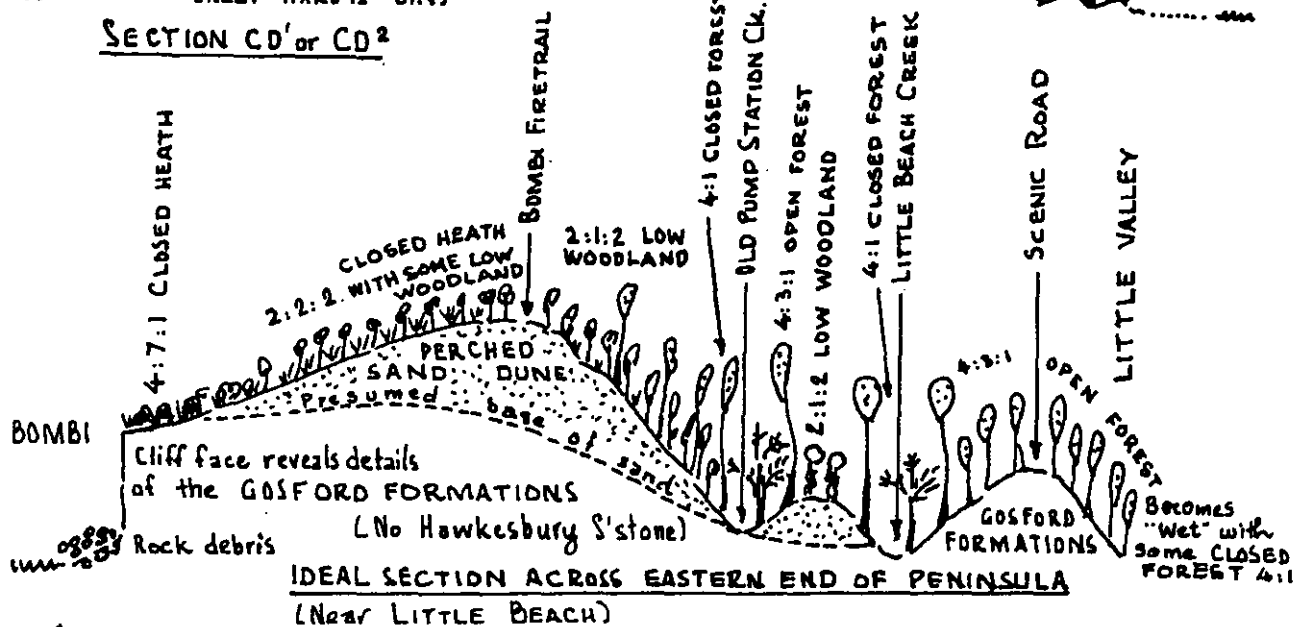
(See "Rocks and Soils" Diagram for positions of Section Lines.)



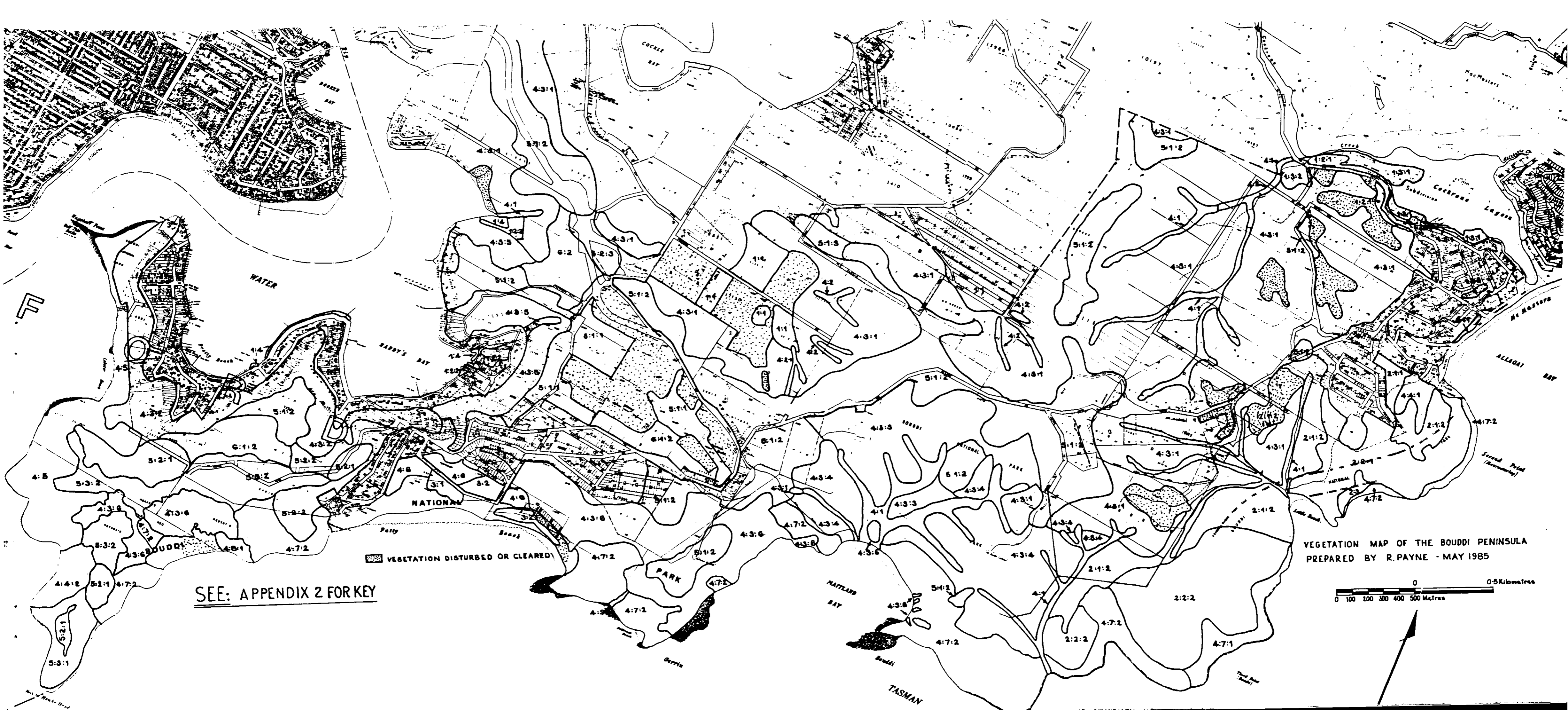
SECTION AB



SECTION CD or CD'



SECTION EF



UNDERSTOREY FLORA

This section of the study involved a small, enthusiastic group sharing knowledge and skills and securing some proficiency in identifying the smaller vegetation on the Peninsula over a period of two years. The reference Flora of the Sydney Region by Beadle et al., third edition, 1982, was used as a botanical key.

The main aim of the group was to compile a representative list of the flora found in the understorey. This was done by investigating various tree "associations" (identified in the Vegetation Communities survey) on various types of soils.

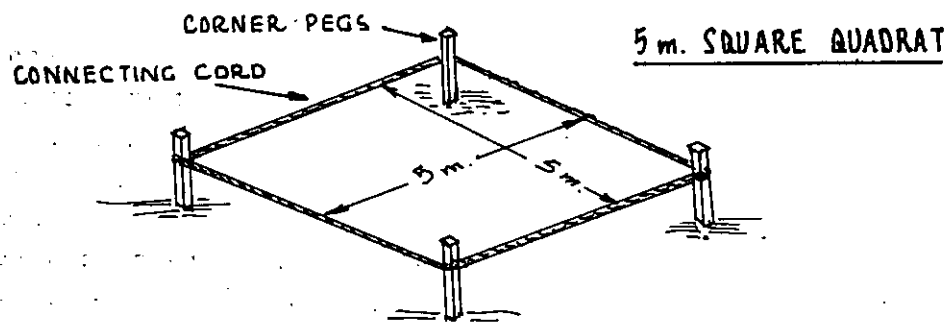
METHOD

Sites were chosen at random in the understorey in environments with the following Vegetation and Geological forms:

- Woodland on Hawkesbury Sandstone (15 quads)
- Forest on Gosford Formations (15 quads)
- Heath on Perched Dunes and Gosford Formations (10 quads)
- Rainforest on Gosford Formations (3 quads)
- Mangroves and Reedland on Alluviums (3 quads).

The accompanying map shows the distribution of these environments.

At each site, data was collected using quadrats (quads). Each quad was five metres square and was constructed by placing spikes at each corner and connecting them with string.



The shrubs, climbers, herbs, and grasses (if known) were identified and counted in each quad, and this information was methodically recorded.

Unknown plants were collected and pressed for identification later. From the 46 quads, five lists were made of the plants in the various environments, enabling compilation of a list of the most commonly occurring (abundant) plants of the Peninsula. The table which follows shows not only these "abundant" plants but also the type of Vegetation and Geolgocial environments in which they were found. It was compiled from the counting of more than 10,000 plants and the identification of 171 species. (The species are listed in Appendix 3.)

ABUNDANT PLANTS OF THE PENINSULA

<u>VEGETATION/GEOLOGY</u>	<u>FAMILY</u>	<u>GENERA/SPECIES</u>
WOODLAND ON HAWKESBURY SANDSTONE	Dennstaedtiaceae	Pteridium esculentum
	Mimosaceae	Acacia ulicifolia
	Papilionaceae	Pultanea retusa
	Thymelaeaceae	Pimelia linifolia
	Umbelliferae	Platysace linerifolia
FOREST ON GOSFORD FORMATIONS	Adiataceae	Adiantum aethiopicum
	Dennstaedtiaceae	Pteridium esculentum
	Dilleniaceae	Hibbertia dentata
	Myrtaceae	Glycine clandestina
	Myrtaceae	Leptospermum flavescens
	Papilionaceae	Dillwynia ericifolia
	Papilionaceae	Gompholobium latifolium
	Umbelliferae	Actinotus helianthi
	Umbelliferae	Platysace lanceolata
	Verbenaceae	Clerodendrum tomentosum
	Violaceae	Viola hederacea
HEATH ON PERCHED DUNES AND GOSFORD FORMATIONS	Casuarinaceae	Casuarina distyla
	Dennstaedticeae	Pteridium esculentum
	Dilleniaceae	Hibbertia nitida
	Epacridaceae	Epacris pulchella
	Epacridaceae	Woolsia pungens
	Lobeliaceae	Pratia purpurascens
	Rutaceae	Eriostemon australasius
	Thymelaeaceae	Pimelia linifolia
	Umbelliferae	Xanthosia pilosa
	Violaceae	Viola hederaceae
RAINFOREST ON GOSFORD FORMATIONS	Dennstaedtiaceae	Pteridium esculentum
	Palmae	Livistona australis
MANGROVES AND REEDLAND ON ALLUVIUMS	Cyperaceae	Schoenus paludosis
	Juncaceae	Juncus microcephalus
	Umbelliferae	Hydrocotyle vulgaris

VEGETATION AND GEOLOGY

1. Along many of the higher parts of the Bouddi Peninsula are extensive areas of infertile, sandy and often rocky soil on Hawkesbury Sandstone. Common plants in the understorey are Pteridium esculentum (Bracken) and Acacia ulicifolia (Prickly Moses).

Acacia ulicifolia is particularly prominent when flowering in late winter with masses of cream flower heads and pungent-pointed phyllodes.

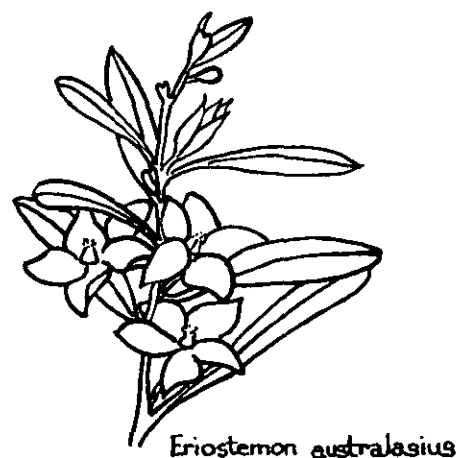
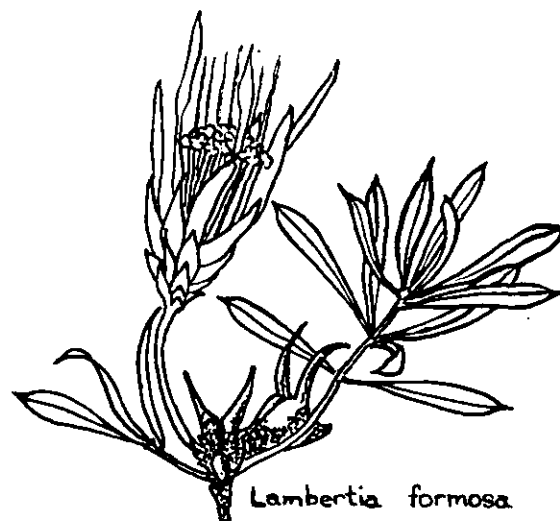
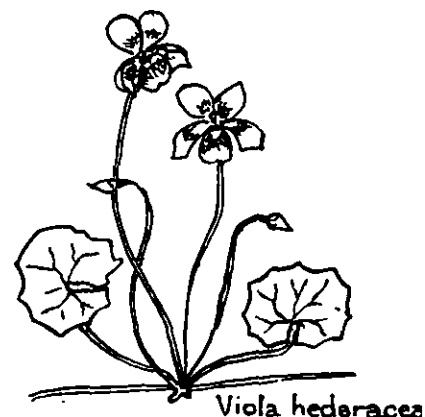
2. Underlying the Hawkesbury Sandstone are the Gosford Formations which have a higher nutrient content in their shaly soil. The Gosford Formations extend in places from near ridge tops to the creeks and foreshores. They are easily recognised by their sloping appearance which contrasts with the ridge tops.

Plants which are widespread in this environment are Pteridium esculentum, Glycine clandestina and Leptospermum flavescens (Yellow Tea-tree) which flowers in summer and likes damp situations.

3. In the Perched Sand Dune Heaths, Epacris pulchella and Woolisia pungens are widespread and difficult to distinguish. Eriostemon australasius (Pink Wax Flower) is also very prominent. All three are flowering at their best in August when the Bombi and Mourawaring Moors are covered with a quilt of cover.

The Heaths contain a rich variety of herbs (e.g. Viola hederacea), small shrubs (e.g. Comesperma ericinum) and larger shrubs (e.g. Banksia aemula).

4. In the rainforest of The Bouddi Deep and Fletcher's Glen, Pteridium esculentum and young plants up to 1 metre of Livistona australis (Cabbage Tree Palm) are the most abundant understorey flora.



5. In the moist Mangrove and Reedland environments, herbs thrive -- with Schoenus paludosis, Juncus microcephalus and Hydrocotyle vulgaris (Penny Wort) being the abundant examples.



SPECIAL MENTION

Although many species in the study area appear to favour certain environments (e.g. Casuarina distyla favours exposed windy areas), Pteridium esculentum (Bracken) was found growing over the entire Peninsula in almost every conceivable situation both moist and dry and even along the foreshores. It was the most widespread plant encountered in the survey.

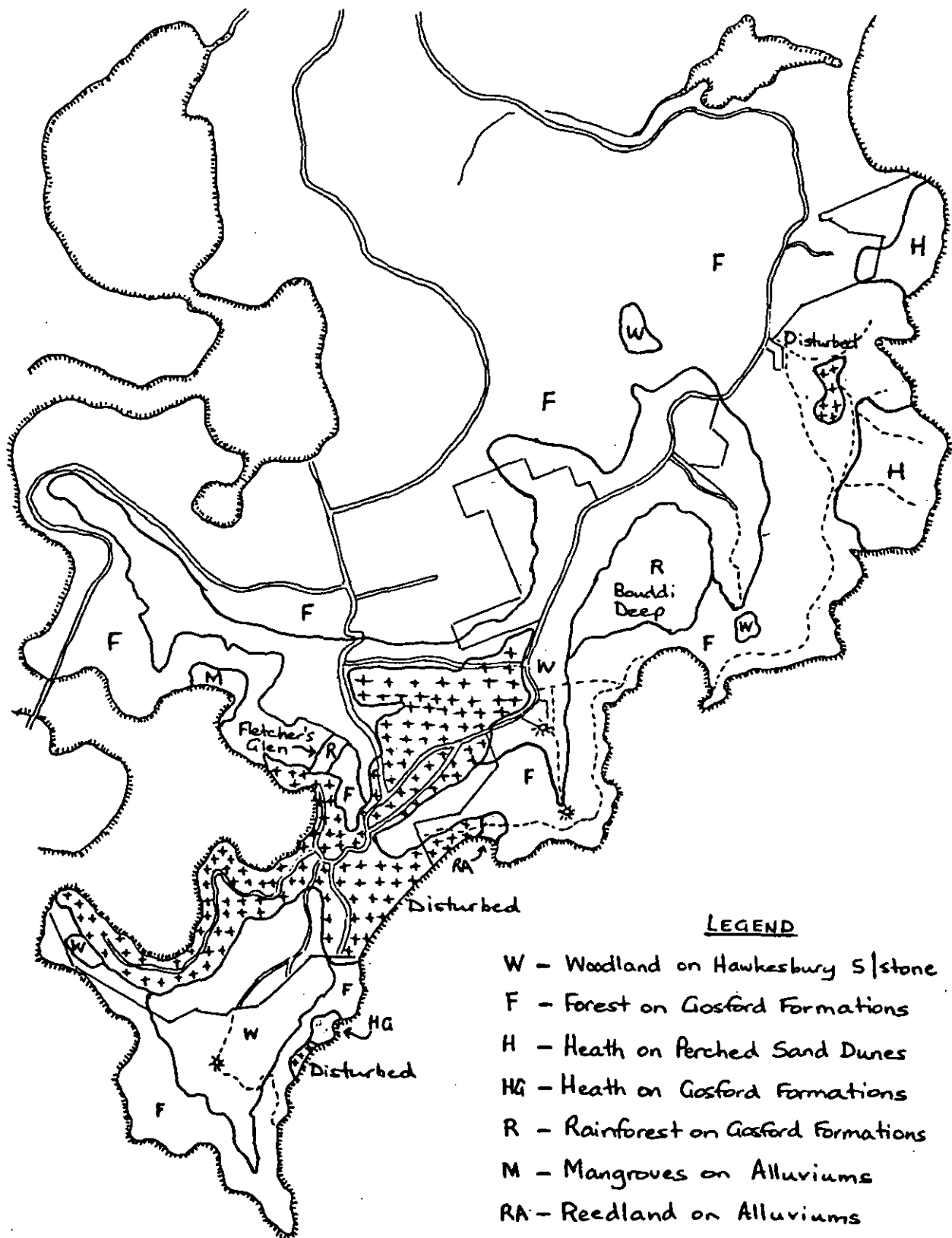
An orchid endemic to the Gosford district, Cymbidium canaliculatum, which flowers in spring-to-early-summer with variable colour, was found towards the end of the study.

.

CONCLUSIONS

It was thought from observations before the survey was undertaken that there was probably a far greater diversity of understorey plants on the poorer spoils, than on the relatively fertile soils of the Gosford Formations. In regard to the poor soil on the Perched Sand Dunes this has been borne out by the survey. However, as it applied to the Hawkesbury Sandstones, the widely-held supposition was not substantiated.

An equal number of quadrats was completed in Woodland on Hawkesbury Sandstone and in Forest on Gosford Formations. 74 species and 28 families were identified on the sandstone soils and 78 species and 39 families on the shale soils of the Gosford Formations. There is little data to suggest that either environment has a greater diversity of species. There are however slightly more plant families on the Gosford Formations.



VEGETATION AND GEOLOGICAL ENVIRONMENTS

BIRDS

For the purpose of this report, the study area was extended to include parts of Empire Bay as shown on the accompanying map.

Observations were made by a small group of residents of Bouddi Peninsula during the year preceeding June 1985 and a provisional list of birds and their habitats was compiled. The list has been included in this booklet, as an Appendix.

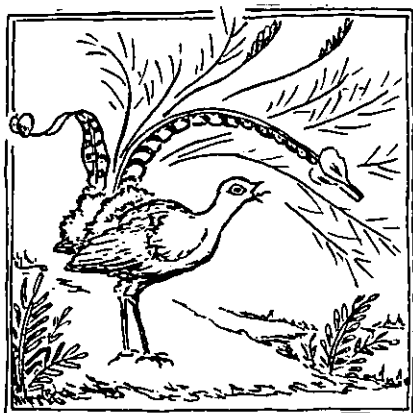
.

Bouddi Peninsula has a wide range of distinct habitats for birds. The distribution of most of the birds is correlated with assemblages of plants which provide suitable food and/or breeding locations. For example, the food of the Glossy Black Cockatoo is the seed of Casuarina trees, so this species is found in woodland where such trees occur. There are seven broad divisions of habitat in the study area:



1. MOIST FOREST IN DEEP GULLIES

Deep gullies run from the Hawkesbury sandstone plateau down to the coastal beaches and Brisbane Water.



Low in these gullies is remnant rainforest vegetation, a haven for the fruit-eating rainforest birds, Green Catbird, Brown Pigeon, Wonga Pigeon, Satin and Regent Bowerbirds.

On the steep sides of the gullies Lyrebirds call and Brush-turkeys build their mounds, scratching for insects in the deep forest litter.



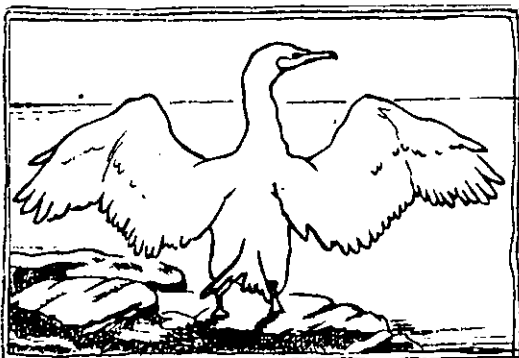
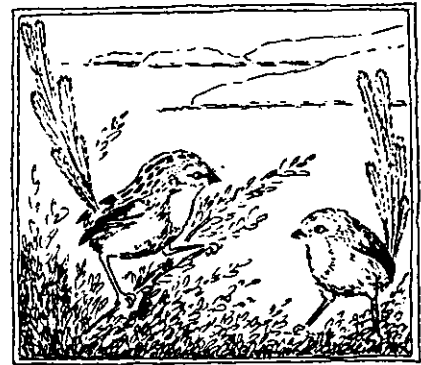
2. WOODLAND

Dry sclerophyll woodland, dominated by Eucalypts and Angophoras, covers the greater part of the Peninsula. There are two levels of vegetation, the taller trees above and an understorey of flowering shrubs and herbaceous plants below. This supports the greatest variety of bird species because of the range of feeding and nesting places.

Nectar, insects, fruit and seed provide feeding niches at different levels, for the Lorikeets in the top blossom through Bellbirds, Thornbills and Pardalotes to Wrens in the lower shrubbery.

3. HEATH

Facing seawards above the cliffs are three heathlands, Bombi and Mourawaring Moors and the Box Head Heath. The first two are perched sand dunes and the third is on Hawkesbury Sandstone with many rock outcrops. All three carry a wide variety of stunted flowering shrubs dominated by Banksia, Casuarina, Hakea, Lambertia and Callistemon. This supports a large population of Honeyeaters, mainly White-cheeked and New Holland, and Little Wattlebirds. Other residents are Tawny-crowned Honeyeaters, Emu-wrens and Variegated Fairy-wrens. The heaths are visited by many of the woodland birds including Spinebills, Grey Shrike-thrushes, Red-browed Firetails and passing migrants such as Rufous Whistlers and Yellow-faced Honeyeaters.



4. ESTUARINE BAYS

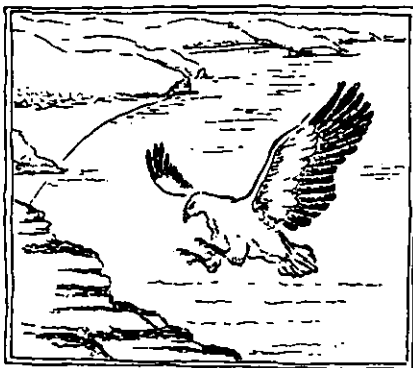
In Rileys Bay, Hardys Bay and Empire Bay there is a succession from deep water through intertidal alluvial flats, mangroves, samphire and reeds to she-oaks. This produces food and roosting places for fishing birds, waders and smaller insectivorous birds.

At times the population is greatly increased by the arrival of migrants and nomads such as Black Swans and Pelicans.

5. COASTAL DUNE SCRUBLAND AND LAGOONS

On recent sand dunes behind Putty Beach, Maitland Bay and MacMasters Beach are reedy lagoons and tall scrub dominated by *Leptospermum*, *Melaleuca* and *Banksia*.

Although considerably disturbed by human intrusion there is still a large population of smaller birds such as Honeyeaters, Wrens, Robins, Finches, Silvereyes and Thornbills.



6. MARINE RESERVE AND SHORE

Bouddi National Park has many sandy coastal beaches, cliffs and rock platforms. The Marine Reserve covers a half kilometre seawards between Gerrin and Bombi Points. The most common birds are Silver Gulls, Crested Terns and Australasian Gannets.

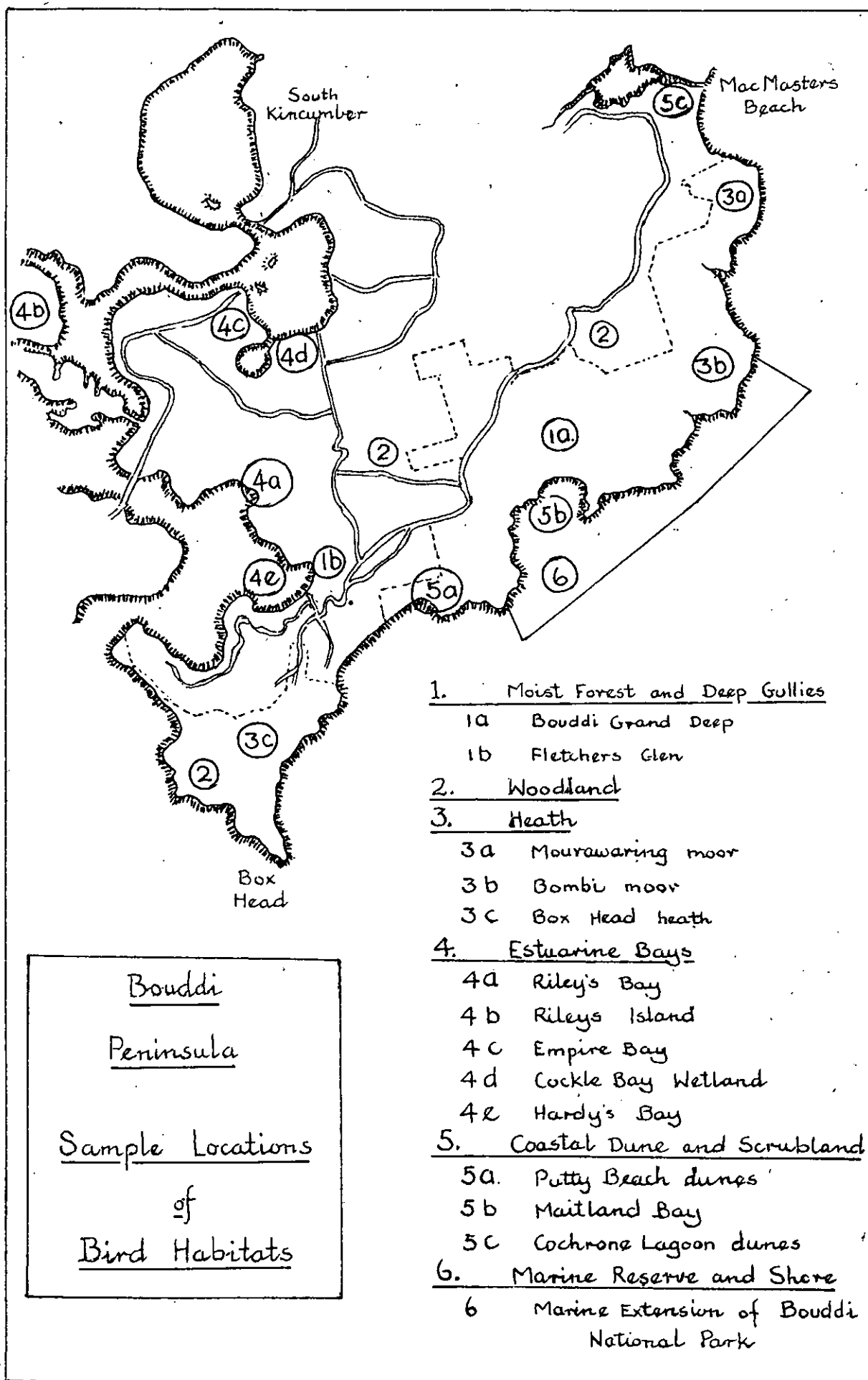
Hundreds of Shearwaters pass on migration around the Pacific, and seen occasionally in the Reserve are Penguins, Albatrosses, Sooty Oystercatchers and White-bellied Sea-Eagles.

7. RESIDENTIAL AREAS

More building with roads and clearing is bringing changes in the bird population. Some introduced birds - Starlings, Bulbuls, Turtledoves and Common Mynahs are extending their range to the southern part of the Peninsula to compete with the natives for food and nesting places.

Although losing their bush habitat, many of the Honeyeater group, Bowerbirds and Magpies are adapting to feed in domestic gardens. Grassed clearings bring more ground feeders, Wood Ducks, Finches and Galahs. Brown Pigeons and Regent Bowerbirds raid exotic fruit trees. There are roving bands of Lorikeets which visit houses for honey and Brush Turkeys come regularly for handouts.





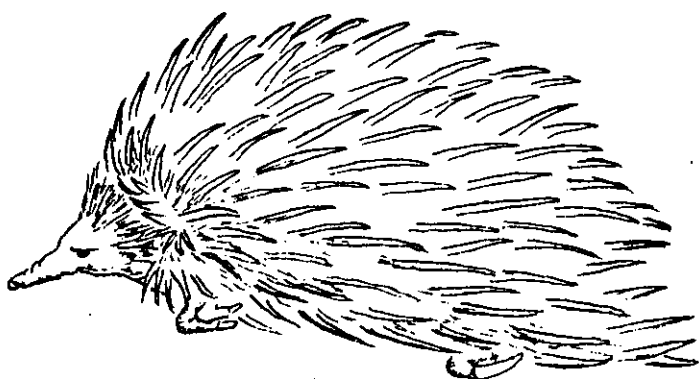
MAMMALS

Native mammals observed on the Bouddi Peninsula are largely those species which have limited territories, are nocturnal and cryptic. The large mammals such as kangaroos (Greys) and wallabies were not recorded during the study, and are thought to no longer occur on the peninsula. Large mammals require large territories, are active during the day to a much greater extent than the smaller species, and hence are far more vulnerable. This record of mammals has resulted from actual casual sightings and not from any trapping programmes. One value of this method is that if the mammal may be casually sighted it must be present in some numbers. However, only by trapping over a very long period can an accurate record be ensured.

All three groups of mammals occur on the Bouddi Peninsula: monotremes, marsupials and placentals.

MONOTREMES

The Spiny Anteater or Short-beaked Echidna (Tachyglossus aculeatus) is the monotreme or egg-laying mammal found on the Bouddi Peninsula. Mammals characteristically have hairs covering the body but in the case of the Echidna, the hairs are adapted to "spines". The Echidna has a slow, lumbering gait but can rapidly dig down and disappear into soft soil, leaving the spines up for protection. It can also roll into a spiny ball. The egg of the Echidna is carried in a special pouch developed by the female which suckles the young when hatched.



Spiny Anteater
Short-beaked Echidna

Head + body : 30-45 cm.

TACHYGLOSSUS ACULEATUS

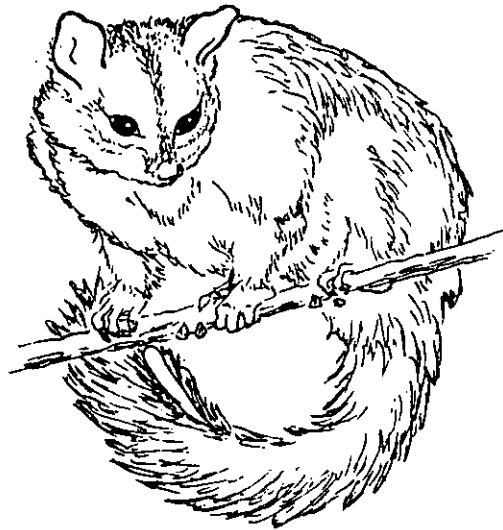
MARSUPIALS

The marsupials form the largest group of mammals in Australia, but in the study area only a few species are represented. The best known feature of a marsupial is that the young is born in a very immature condition but is capable of finding its way to the pouch. Here it becomes attached to the teat for some time before adopting an independent life.

On the Bouddi Peninsula, it is known that there are Possums, Bandicoots and mice-like creatures known as Marsupial Mice.

Most commonly observed is the Brush-tailed Possum (Trichosurus vulpecula) which will come around houses in the evening and is well adapted to living in house roofs and accepting regular feeding. With its bushy tail, it is readily distinguished from the Ring-tailed Possum (Pseudocheirus peregrinus). The latter is smaller, with a more dog-like head and a tail that curls at the end and is said to be prehensile. Brushtails hide in a tree hollow or dark corner during the day, but the Ringtail builds a platform and nest, sometimes in the fork of a thick shrub. Ringtails are far less likely to visit houses.

The Brush-tailed and Ring-tailed Possums protect themselves by agile locomotion along the ground, climbing trees and leaping from bough to bough through tree canopies. Their close relatives the Glider Possums have a flap of skin on both sides of the body, stretching from front to back legs. They glide (or volplane) from tree to tree like kites, spreading the skin flap and using the tail as a rudder.



Common Brushtail
Possum

H+B 35-55 cm.

T 25-40 cm.

TRICHOSURUS VULPECULA

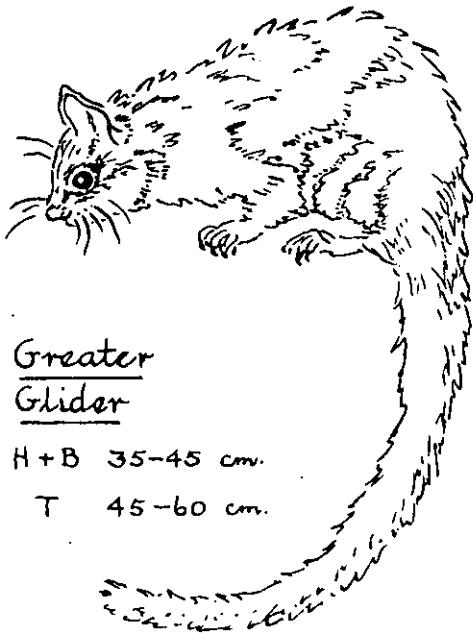


Common Ringtail
Possum

H+B 30-35 cm

T 30-35 cm

PSEUDOCHEIRUS PEREGRINUS



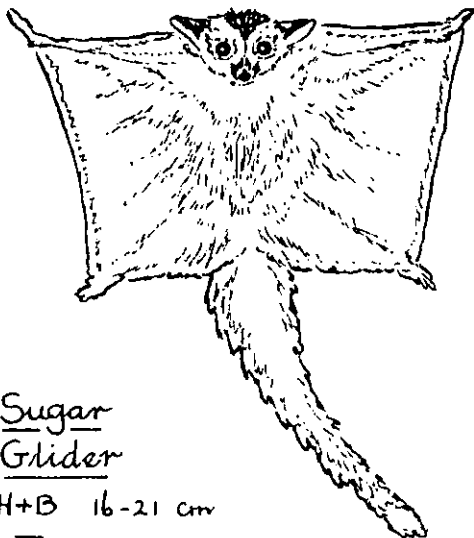
Greater
Glider

H+B 35-45 cm.

T 45-60 cm.

PETAUROIDES VOLANS

The largest of the gliders known to occur on the peninsula is the Greater Glider (Petauroides volans) which inhabits the Blackbutt Forests in the wetter areas. A much smaller relative in trees of lesser height, is the Sugar Glider (Petaurus breviceps) which is distinctively marked along the head and back. A still smaller, hand-sized animal is the Feather-tailed Glider (Acrobates pygmaeus).



Sugar
Glider

H+B 16-21 cm

T 16-21 cm

PETAURUS BREVICEPS

All the possums are nocturnal with large eyes and ears. They are mainly leaf eaters or honey eaters. They are often heard at night making "coughing" noises or little barking sounds.

Other marsupials recorded are ground dwellers.... the Long-nosed Bandicoot (Parameles nasuta) and the Brown Antechinus or Brown Marsupial Mouse (Antechinus stuartii). These animals are also nocturnal and are occasionally sighted by torchlight in the open areas around houses.

The bandicoot hobbles along in a peculiar fashion, somewhere between running and hopping like a small kangaroo. It digs its long nose into the ground in search of the grubs or larvae of beetles and is also said to hunt spiders including the Funnel Web.

Long-nosed Bandicoot

H+B 31-42 cm.

T 12-15 cm.

1 PARAMELES NASUTA



The Antechinus is often mistaken for the Common House Mouse, but is much larger, has a bigger head and face, and is brown in colour. Its practice of building a nest in corners of cupboards (if it can gain entrance to a shed or house), its long tail and gnawing habit, make the marsupial mouse similar to the House Mouse. The latter is a placental mammal which came to this country with the early Europeans.



Brown Antechinus

H+B c. 10 cm.

T c. 9 cm.

ANTECHINUS STUARTII

There has been a sighting of the Common Wombat (Vombatus ursinus) in the area, and one wombat was killed on the Scenic Road recently. It is not known whether this marsupial still occurs naturally in the area since wombats are occasionally "released" in the Park. There have been no reports of their large, characteristic burrows.

PLACENTALS

The remaining mammals in the study area are placentals which develop to a well advanced stage within the female, attached by a placenta or navel cord. When born, the young are already small replicas of the parent. They suckle for some time and are able to move about.

There are three main groups of placentals in the study area: the native rats which are confined to the ground and are true rodents; the bats which move through the air at night and live in caves, crevices and other secluded places; the Cetacea (whales and dolphins) which inhabit the marine environments.



Swamp Rat

H+B 16.4 cm

T 11.3 cm

RATTUS LUTREOLUS

Rats and bats are thought to have come to Australia rather than to have evolved here.... the rats on rafts of debris and the bats by flying. Whales and dolphins are, of course, free swimming and migratory.

There are two native rats in the area. Both are common and frequently sighted.



Bush Rat

H+B 11-19 cm.

T 11-19 cm

RATTUS FUSCIPES

One is the Bush or Allied Rat (Rattus fuscipes) and the other is the Swamp Rat (Rattus lutreolus). They inhabit much the same places despite their common names which suggest some feature of habitat. Native rats suffer badly because of the attitude that most people have towards the Ship Rat (Rattus rattus) and the Brown Rat (Rattus norvegicus).

Care has to be taken to distinguish between the native and introduced species since the native rats play an important part in the ecology of the natural systems on the Bouddi Peninsula. The introduced rats tend to favour the habitats produced by humans rather than the bushlands, but native rats are not adverse to accepting the "comforts of cover" in houses. A useful reference for identifying rats and other mammals is Australian Mammals - A Field Guide by Hyett & Shaw.

.

The bats are well adapted to a flapping flight as distinguished from the volplaning of the glider possums. A leathery flap of skin stretches from front to back legs and some species can move with remarkable speed. The bats are occasional visitors to the peninsula and the so-called Fruit Bats or Flying Foxes are sometimes sighted.

These bats feed on honey-bearing flowers, native fruits and, of course, introduced fruits. The two species seen are the Red Flying Fox (Pteropus scapulatus) and the Grey-headed Flying Fox (Pteropus poliocephalus), the latter being the most likely to attack orchard fruits. No "camps" of Flying Foxes are known to occur in the study area.

The lesser known bats are much smaller and more difficult to identify without the use of trapping techniques. Like the Flying Foxes they are nocturnal and are best seen (and heard) in the warmer months, "hawking" insects at great speed.

The species sighted are probably the Lesser Long-eared Bat (Nyctophilus geoffroyi) and the Bent-winged Bat (Miniopterus schreibersii). Others are mentioned in the Field Guide (see above) and are important in the ecosystems of the Bouddi Peninsula.

The most common of the marine mammals are the dolphins (mistakenly called porpoises). The Common Dolphin (Delphinus delphis) and the Bottle-nosed Dolphin (Tursiops truncatus) are the visitors to Brisbane Water reported from time to time. Occasionally an individual seal has come ashore on one of the ocean beaches, to rest. The most likely species is the Australian Fur Seal (Arcocephalus pusillus).

Sightings of various whales have been made, just off the coastline. Many whale species follow an amazing migratory pattern and those sighted are probably returning to Antarctica down the eastern coastline towards the end of the Antarctic winter. Stranded individuals have been seen on the beaches of the peninsula — exactly which species is not known.

NON-NATIVE (FERAL) MAMMALS

All of these mammals are placentals. They have been brought to the area on purpose or by accident, or have themselves migrated from sites where humans have established them. They are not part of the natural ecosystems and are a menace which must be eliminated. Species known to occur in the bushland on the peninsula are Fox, Rattus rattus, the House Mouse, the Domestic-cat-gone-feral, Rabbit, Goat and Pig. In addition, domestic cats and dogs which normally are household pets, undertake marauding trips into the bush.

GENERAL COMMENT

The mammals of the Bouddi Peninsula are remarkably widespread throughout the various habitats and have exploited all the environments from arboreal to the marine. It would seem that the species most adapted to widespread habitat and in possession of a suitable population, have been able to survive simply because the habitat continued to exist. It could be confidently declared that Koalas once existed on the peninsula whilst macropods (Wallabies and Kangaroos) were certainly here within living memory. Predation of various kinds has obviously contributed to their disappearance and it is suggested that herein lies a lesson for management. If we are to preserve our native animals, and hence the equilibrium of the natural systems, we must tailor human usage of those natural systems accordingly.

+ + + + +

MARINE ORGANISMS

This part of the study can only be very sketchy due to the enormous diversity and constantly changing nature of the collections of marine, estuarine and intertidal plants and animals. People often think of fish as the only marine life but these are at the tops of huge, very complicated food pyramids. They depend on myriads of not-so-obvious smaller plants and animals.

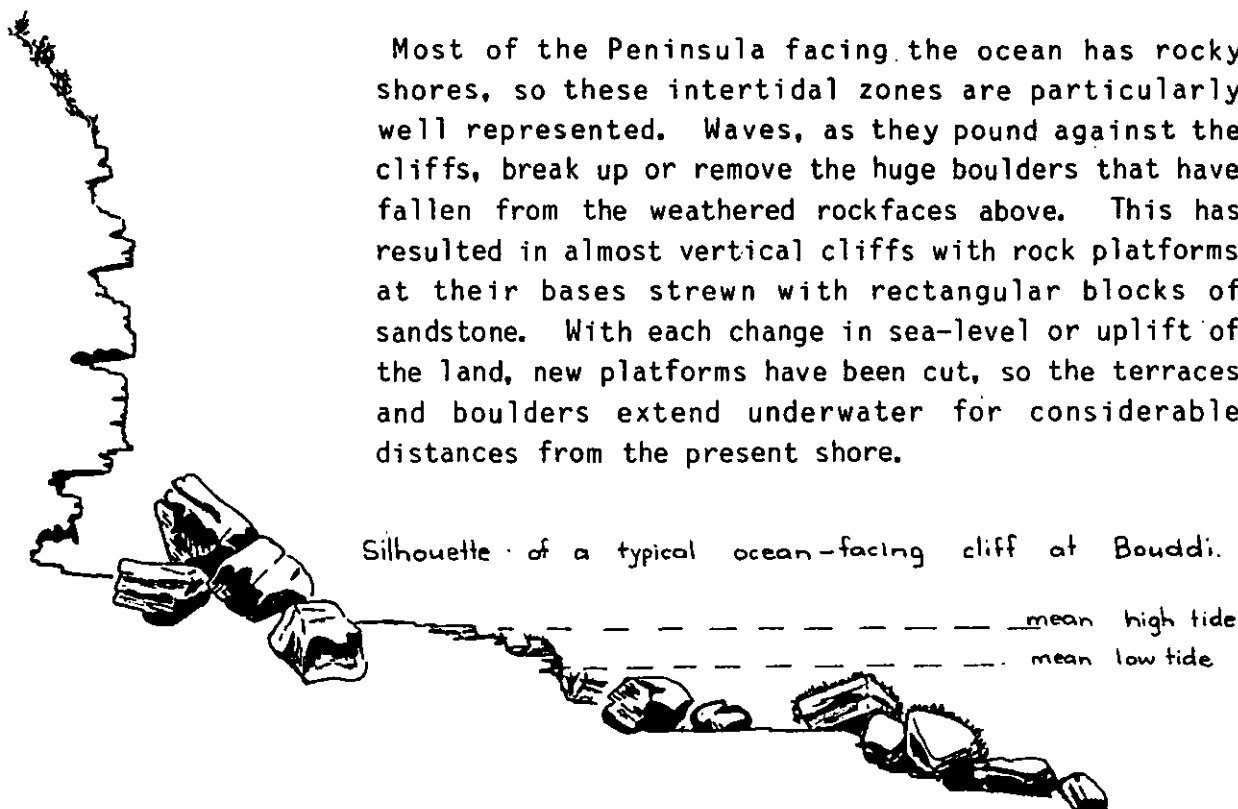
INTERTIDAL ORGANISMS

These plants and animals are adapted to a harsh environment where they are exposed and immersed twice daily. Nevertheless, the intertidal zone is one of the richest on earth. It supports an amazing variety and abundance of plants and animals. Since some organisms are more resistant to environmental extremes than others, distinct zones are visible, especially on rocky shores. Each zone is indicated by characteristic organisms or "marker species."

THE ROCKY INTERTIDAL ZONES

Most of the Peninsula facing the ocean has rocky shores, so these intertidal zones are particularly well represented. Waves, as they pound against the cliffs, break up or remove the huge boulders that have fallen from the weathered rockfaces above. This has resulted in almost vertical cliffs with rock platforms at their bases strewn with rectangular blocks of sandstone. With each change in sea-level or uplift of the land, new platforms have been cut, so the terraces and boulders extend underwater for considerable distances from the present shore.

Silhouette of a typical ocean-facing cliff at Bouddi.



The soft Narrabeen sandstones which form the platforms are easily eroded into deep pools and fissures. These, together with the boulders, give extra shelter to the organisms of the intertidal zones.

Listed below are some of the marker species which are most obvious in the rocky intertidal zones of our area.

1. The Splash Zone

Rocks here are normally dry and sunbaked. They are only covered by the highest of the spring tides. The main animals are small periwinkles such as Littorina and Nodilittorina. Red crabs (Leptograpsus) are the most active inhabitants.

The only algae are microscopic films on the rocks. Where shallow pools remain, green and brown filamentous alga occur (Enteromorpha and Ectocarpus).

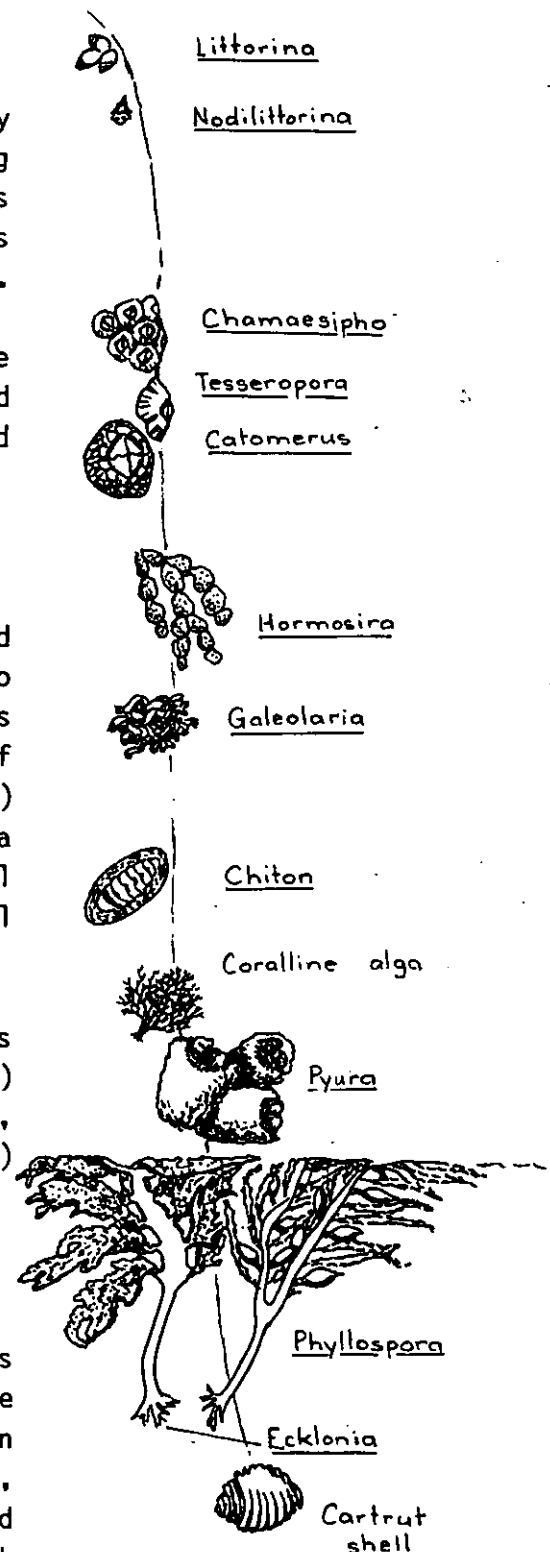
2. The Barnacle Zone

This is the zone covered by most high tides and is marked by small densely packed honeycomb barnacles (Chamaesipho) especially in sites where there is less wave action. Larger surf barnacles (Catomerus and Tesseropora rosea) are found lower in the zone. Tetraclitella purpurascens prefers shady areas. The small limpet (Notoacmea) is usually numerous in small depressions on large boulders.

Algal films cover the barnacles and the rocks between. Seaweeds such as popweed (Hormosira) are found in damp depressions in the rocks, particularly in the estuary. Sea lettuce (Ulva) prefers surfaces with greater wave action.

3. The Galeolara ("Sydney Coral") Zone

These worm tubes form dense bands on rocks between Box Head and Half Tide Rocks but are not obvious in more exposed conditions. In damp positions shellfish such as chitons, limpets and periwinkles are prolific, and coralline and small brown algae form thick mats.



4. The Cunjevoi Zone

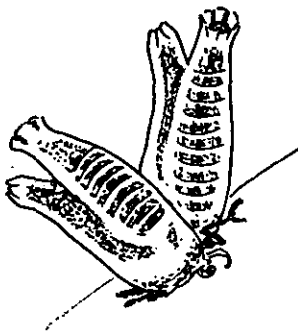
Cunjevoi (Pyura) is only exposed at very low tide and forms dense clumps on most rocky ocean shores and as far from the entrance as Half Tide Rocks. Like the Galeolaria it provides shelter for countless smaller animals and plants.

5. The Subtidal Zone

Large marine seaweeds such as Phyllospora comosa and Ecklonia radiata dominate the landward edge of this zone. They provide food and/or shelter for many animals that are often more easily observed in rock pools further above low tide level. Such things as sea anemones, starfish, sea urchins, feather-duster worms, shrimps, crabs, numerous molluscs and fish can be found in these pools.

Between Box Head and Wagstaff Point, clumps of the bright green grass-like alga, Caulerpa flagelliformis, are common.

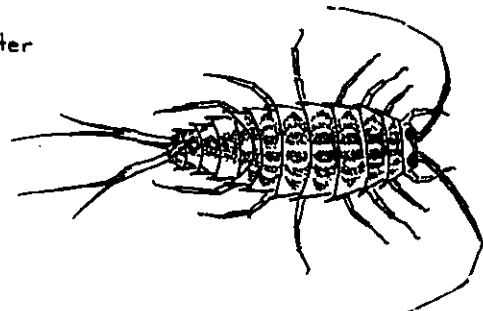
- Transition From Sea to Estuary -



The ascidian, Ciona

As the water gradually becomes calmer, murkier and less salty the marker species for the various intertidal zones change. Oysters replace the larger barnacles and are fringed below by popweed with bigger "beads". Mussels (Mytilus) and various brown and coralline algae form the lower band. Other species of ascidians supplant cunjevoi. If wave action is minimal, sea slaters (Ligia) are often seen scurrying on the rocks.

Sea slater

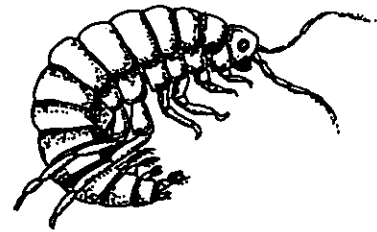


THE SANDY INTERTIDAL ZONES

1. Facing the Ocean

Zones on the surf beaches are hard to identify because seaweeds cannot anchor in the sand, and because the animals are usually buried.

Two animals which thrive above the high tide mark are the ghost crabs (Ocypode) and the sand hoppers (Talorchestia), both of which find food among the flotsam and jetsam. Most others remain buried in the damp sand nearer the sea and feed when the tide is in. They include many bivalve molluscs such as pipis (Donax), snail-like moonsnails (Polinices), beach worms (Australonuphis), and heart urchins (Echinocardium).

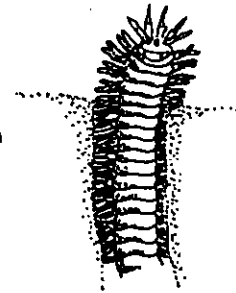


Sand hopper

Hermit crab



Head end
of a beach
worm

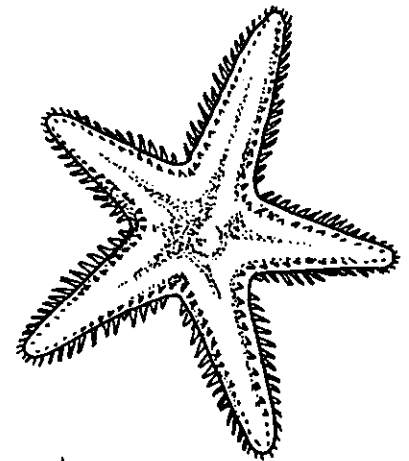


2. Inside the Estuary

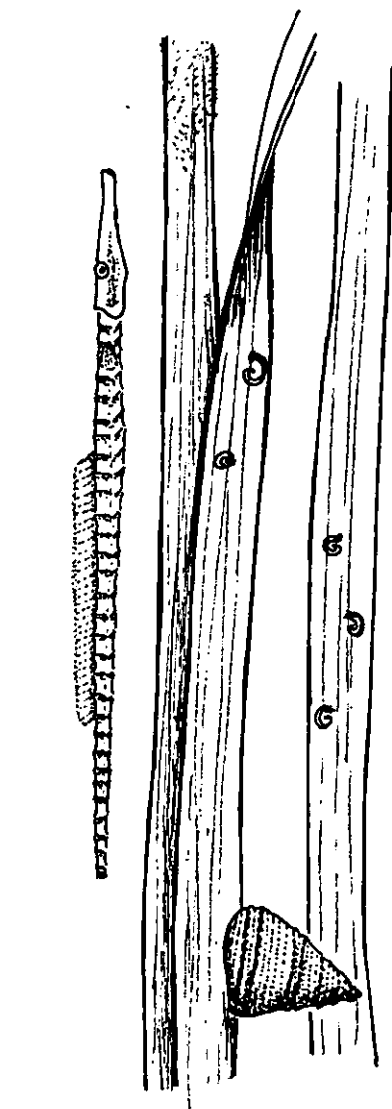
Mangroves and sea-grasses are among the most productive plants on earth and their living or decaying leaves form the bases of many food pyramids. The sheltered conditions and richer food supply of the estuary make life above the high tide mark more abundant.

Salt marshes still graduate into mangrove flats in Rileys Bay and parts of Hardys Bay, and are home to many species of crabs, molluscs and countless microscopic organisms.

In or on the exposed sand-mud flats live a wide variety of burrowing animals, such as soldier crabs (Mictyris), bait worms (Australonereis), starfish (Astropecten), cockles (Anadara and Tapes), fingernail shells (Neosolen), sand snails (Polinices) and whelks (Pyrazus). These organisms thrive by feeding on the organic material which is derived mainly from the seagrasses and is mixed with the mud.

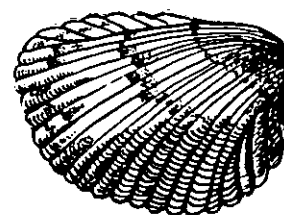


Astropecten



Pipefish

Thalotia



Cockle

Where the flats remain fairly wet at low tide the sea grass Zostera takes root. In slightly deeper water it is replaced by the wider-bladed Posidonia. Algal films grow on the grasses. These beds are food and shelter for numerous animals, most important economically being fish and prawns.

Hydroids, pipefish and seahorses attach themselves to the grass blades. Numerous molluscs (Thalotia, Bembicium, Austrocochlea) feed on the grass or its algal film, and cockles are found among its roots.

Shrimps, nippers, amphipods, isopods and compound ascidians are just a few of the other animals that thrive in the bountiful sea-grass beds.

SUB-TIDAL ORGANISMS

The underwater terrain echoes that above the water. At MacMasters Beach the sand slopes gently to a depth of 20m, punctuated with scattered rock outcrops. From Second Point to Little Beach the platform drops off about 4m to a dissected rock shelf which continues 30/ 50m underwater before dropping to another terrace covered with a veneer of coarse sand.

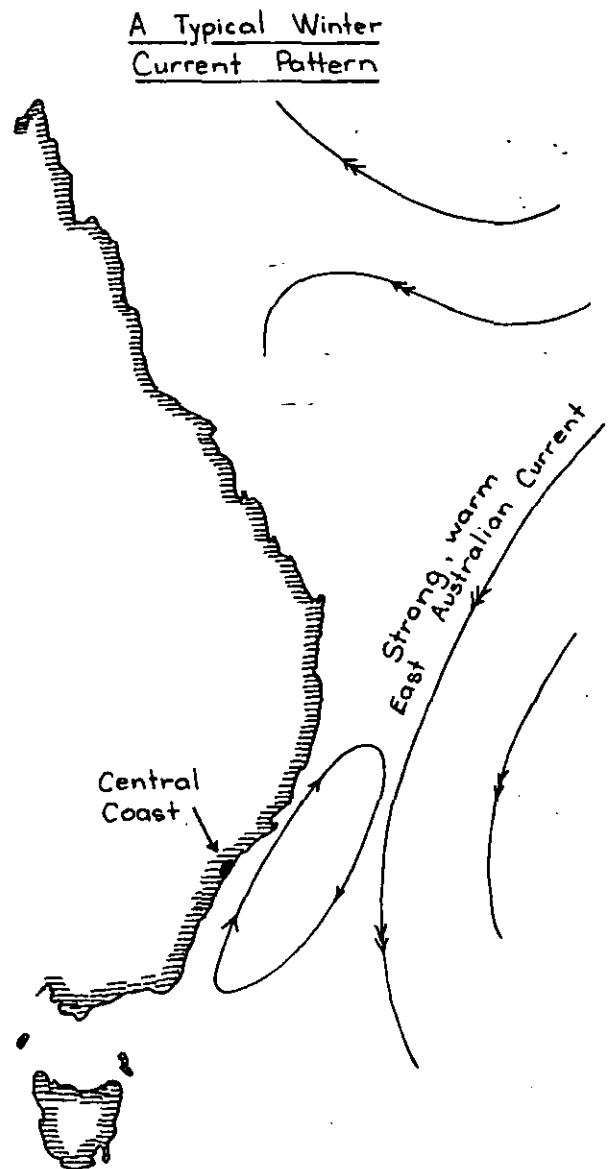
Large and small patches of reef rise 1.5m above the sand as this platform slopes to the 20m mark. Between Little Beach and Box Head the underwater coast is similar to that above the water, but there are extensive rocky reefs and foul ground to seaward (West and East Reefs).

Although it is always underwater, the subtidal region is not a stable environment. Animals and plants have to adapt to many variables such as changes in water temperature, freshwater inputs and the degree of pollution.

1. The Ocean Waters.

On the ocean side of the Peninsula the water temperature is greatly influenced by the warm, southerly-flowing East Australia Current. For much of the year it is far from the coast and creates a huge eddy which flows along the Peninsula from south to north. In summer the East Australia Current swings in closer to the coast and, depending on the wind, can produce a strong north-south flow near Maitland Bay. Many warm water pelagic species, such as Spanish Mackerel, follow the current close inshore.

Spectacular underwater cliffs, clothed in kelp, ascidians, encrusting sponges and soft corals attract great numbers of fish. Some are residents, such as the groper, rock cods, bream, blennies, and many colourful species of leather-jacket and wrasse. Others visit seasonally. Tunas and mackerel are common from October to May, tailor and a few salmon arrive in late summer followed by kingfish. Schools of sea mullet, bream and luderick come out of the estuaries in February for their spawning migrations northwards.



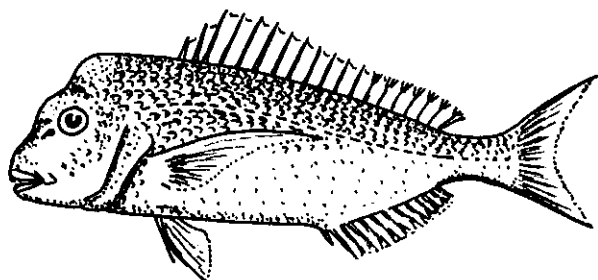
Within the Marine Reserve at Maitland Bay, many of these fish can be observed by snorkellers in sheltered shallow waters. Whiting and rays can often be spotted over the sand. Maori wrasse, butterfish and damselfish are colourful residents among the algae and kelp of the southern side of the bay. The coralline painted rocks of the northern end provide excellent camouflage for wirrahs and rock flathead, and are a favourite haunt for a variety of colourful leatherjackets. Anyone prepared to look carefully can find thousands of other animals, from soft-corals to crustaceans, hidden among the weeds and in the crevices.

Like Maitland Bay the sheltered end of Putty Beach is also a haven for schools of small fish such as marine hardyheads and toads. Underwater boulders provide attachment for coralline algae, kelps, sea-tulips and colourful encrusting sponges. Many species of territorial fish, such as the red morwong, hide in the crevices.

Nearer the mouth of the Hawkesbury the ocean bottom is largely sand and mud, and the water less salty with run out tides. Flathead are fairly common and are commercially trawled here.

2. Estuarine Waters

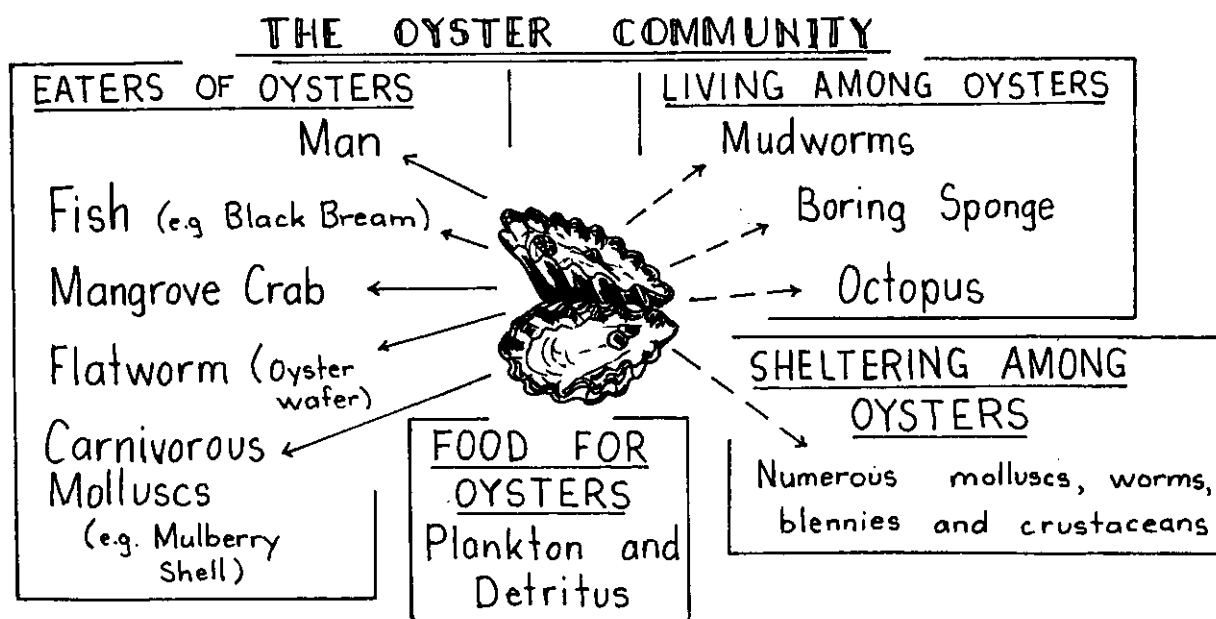
Many commercially valuable fish species spawn near the entrance to the estuary and their larvae drift in with the tides to settle and grow.



Snapper, yellow-finned bream, flathead, jewfish, tailor, blackfish and mullet are just a few of the fish which use the estuary as a nursery or feeding ground. Other edible species such as sand whiting and flounder are common over sand flats.

Another prized marine organism which is prolific in the Brisbane Water is the rock oyster. Prawns, blue-swimmer and mud crabs also use the estuary as a breeding ground.

All these commercial animals are dependent on smaller food organisms living in the rich organic mud and the plankton filled water. Many small crustaceans and fish are intermediate links in the food chains. For example, among the non-commercial fish caught in the channels of St. Huberts Island are estuarine hardyheads, trumpeters, sprats and many species of gobies, pipefish and leatherjackets.

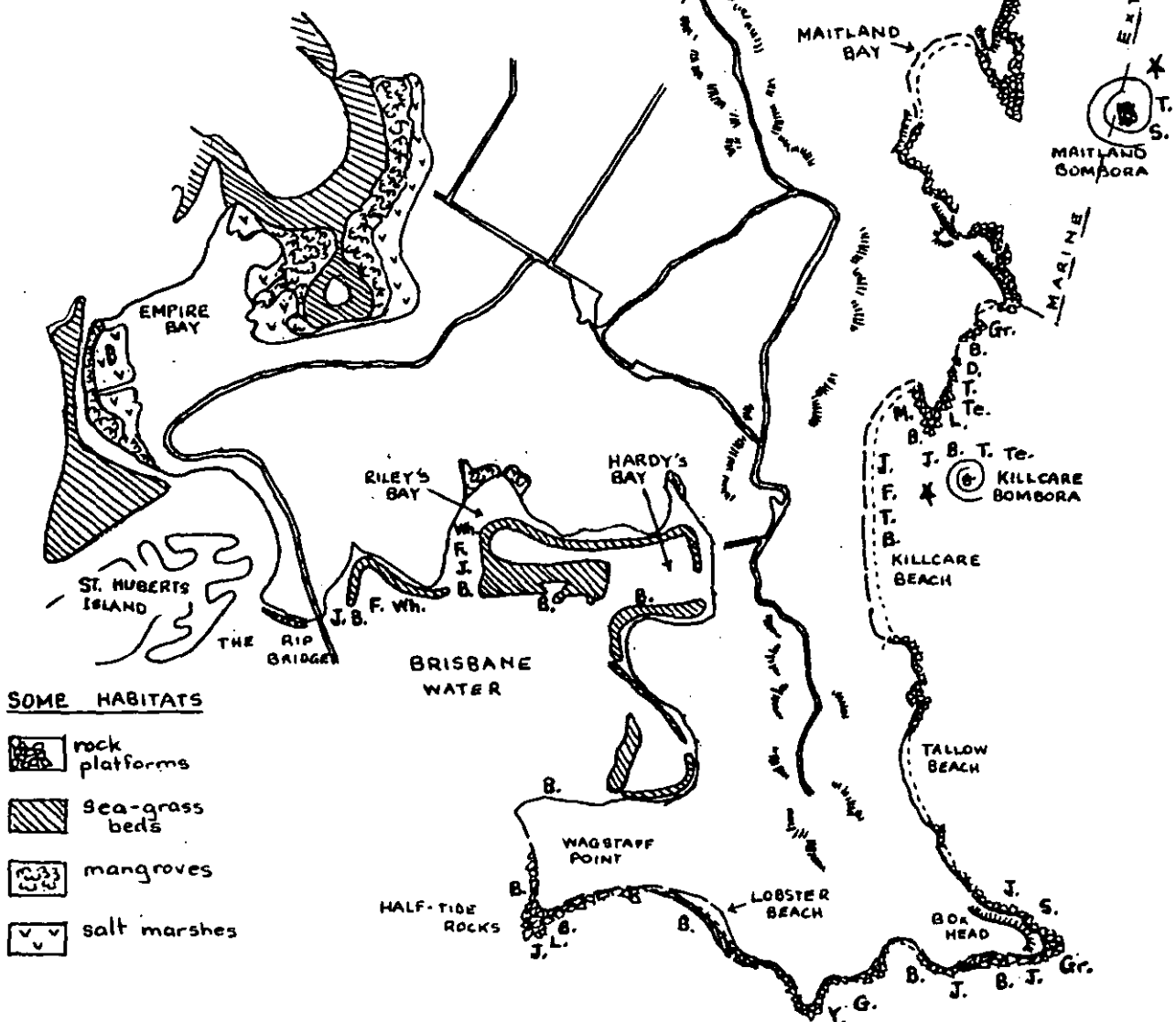


SOME COMMONLY CAUGHT

FISH

B.	bream
D.	drummer
F.	flathead
G.	sea garfish
Gr.	groper
J.	jewfish
L.	luderick
M.	mullet
S.	snapper
T.	tailor
Te.	teraglin
Y.	yellowtail
*	pelagics (e.g. kingfish, tuna, salmon.)

MARINE ORGANISMS



THE ABORIGINES

The Aborigines were the first people living in this area, as elsewhere in Australia, and it is argued by some historians that Europeans are more correctly described as "invaders" than "discoverers" or "first settlers". ⁽¹⁾

We are uncertain about the tribal boundaries of the local Aborigines and about the languages spoken. One source indicates the people were of the Daruk group but another says the Daruk language never reached the coast and that the Guringai (Kuringgai) language was spoken from the north side of Port Jackson to the Tuggerah Lakes.

It seems the local Aborigines were friendly with the Darkinjan people who lived in the Wyong area and further west, and there were tribal visits and intermarriages. In addition to tribal and language areas there were descent groups or clans and smaller food collecting groups made up of different families. ^{(2)&(3)}

Numbers may not have been high by our standards but the area was well occupied by Aborigines judging by the large numbers of "sites" and the comments of the first European visitors.

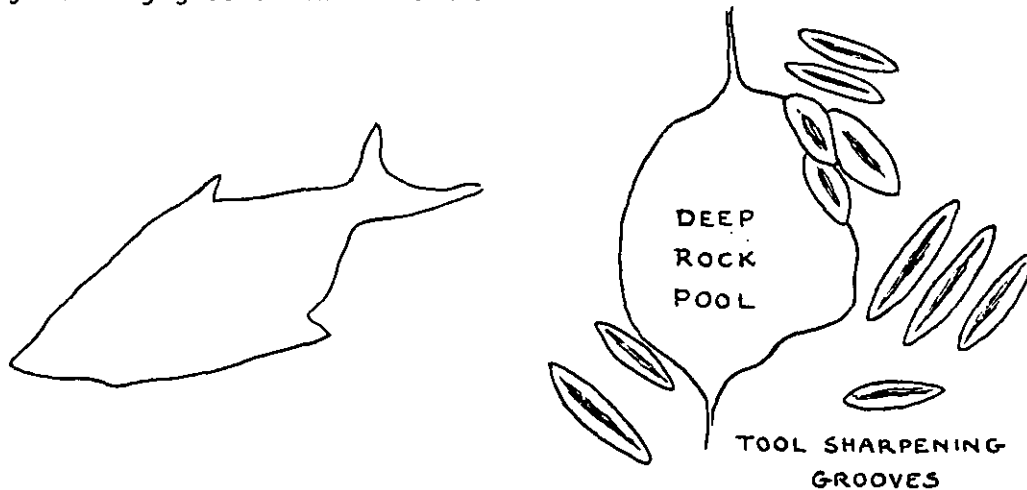
ABORIGINES AND THE LAND

Aborigines have lived in the Gosford/Wyong region for thousands of years according to carbon-dating at a site at Mangrove Creek, which goes back 11,000 years. They had a special relationship with the land where they had lived for so long, sometimes described by anthropologists as not so much the people owning the land as the land owning the people. The social groups, which we call tribes, claimed hunting rights and religious sanction for the occupation of areas with loosely defined boundaries -- often defined by natural features with mythological significance.

Because Aborigines did not practise agriculture or live in permanent dwellings, Europeans thought they were not fully using the land and so felt justified in settling it. However, Aborigines made considerable use of the land and they did so without upsetting the "balance of nature."

Patricia Vinnicombe, in "A Study of Aboriginal Sites in the Gosford Wyong Area" for the National Parks and Wildlife Service in 1980, notes numerous "sites" on the Bouddi Peninsula, including eighty two just in the Putty Beach, Hardys Bay and Rileys Bay area. It was clearly a favoured place for Aboriginal life. ⁽⁴⁾

The landforms and associated rock materials were very favourable. The flat rocks of the Hawkesbury Sandstones were used for ceremonial engravings, and the caves for shelter from the wind, rain and cold. Pools in rock held water for various purposes and were sometimes deepened to retain water for dry weather. Accumulations of clay in the Narrabeen formations (ranging from white through yellow to red) were used for body decoration, whilst pebbles of quartz and other hard rocks were made into tools and fish hooks. Larger tools were shaped from basalt found in places around the district including the Peats Ridge area. These tools needed to be sharpened, as evidenced by the many rubbing grooves in the area.



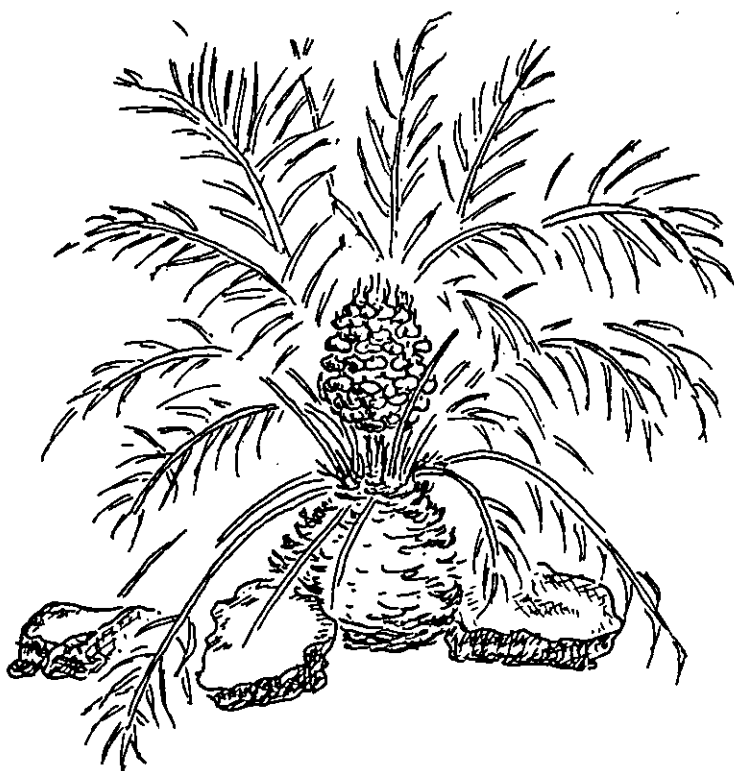
The coastal and estuarine waters provided an abundance of marine life. Patricia Vinnicombe lists some forty kinds of fish identified from middens. (Middens are piles of shells, fishbones, remains of vegetable matter and discarded tools left by Aboriginal people at a camp site.) Aborigines were expert at fishing, by line and spear, as well as at gathering crabs, lobsters, prawns, yabbies, worms and many kinds of molluscs.

Molluscs were important because they could be carried to rock shelters far from their source. Large amounts of shells are found in middens, including oysters, mussels, limpets, pipis, cockles, whelks and triton shells, some of which came from sea rock platforms and some from mud flats of the estuary.

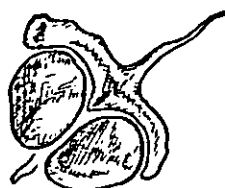
Australian fur seals must have occurred on the Central Coast as middens show they were sometimes eaten by Aborigines.

Patricia Vinnicombe, in her study, lists one hundred and thirteen plants in the Central Coast region which were sources of food, medicine, fish poisons, weapons and utensils.

The Xanthorrhoea, or Grass Tree, had varied uses. The young centre shoots are edible, the flowers contain nectar, the long flower stem could be made into a spear, and the resin extracted for shafting stone and shell implements and for mending leaking canoes and wooden vessels. Segments of the trunk when rubbed together readily produce fire.



The Macrozamia or Burrawang, one of our most prolific plants, is known to have been gathered by the Aborigines for its kernels. These were removed from the hard outer covering, crushed, soaked in water for some days to remove poisonous substances and then roasted in the fire.



Other plants used by the Aborigines include:

Banksia -- nectar sucked from flowers; dried cones burnt for a long time in the fire.

Kurrajong tree -- twine made from the bark; seeds eaten; roots eaten; water obtained from roots in dry season.

Orchids -- "tubers" eaten raw (to combat dysentery) or roasted after husks removed.

Stringybark -- bark used for canoe hulls and for "roofing" on primitive huts; smaller pieces used for torches.

Grevillea -- nectar obtained from flowers.

Cabbage Tree Palm -- young leaf bases and hearts eaten; gum sucked; bark fibres used for fishing lines; leaves used for temporary shelters.

Bracken Fern -- staple diet; underground stems (rhizomes) roasted in ashes.

The lumpy growths common on *Angophora costata* (Sydney Red Gum) could be used for bowls or even cradles, whilst weapons and digging sticks were made from hardwood trees. Timber was of course burnt in fires for warmth at night, cooking, and hardening and gluing weapons. Grass, reeds, vines, leaves and bark provided string, utensils and materials for shelters.

The birds and mammals of our area balanced the diet of the Aborigines and there is ample evidence in middens of kangaroos, wallabies and possums. Archaeological and ethnographic accounts suggest that koalas and wombats were not very often eaten.

Aborigines speared kangaroos and wallabies by pursuing them or surrounding them when they grazed. Snares for catching animals and birds were observed by early Europeans in the Hawkesbury area. Kangaroos and wallabies figure prominently in drawings and engravings, and must have been of ritual as well as economic importance.

Remains of various water birds have been found in middens. Fairy penguins may have been eaten. Parrots were certainly eaten as were crows. Brush turkeys would have been an easy prey, and birds' eggs were gathered.

Snakes, lizards and goannas were an important food since they could easily be caught when inactive in winter. Bees nests provided honey. Ants and ants' eggs provided fat as did the larvae of various insects (including those known to us as "witchetty grubs").

THE COMING OF THE EUROPEANS

Written history of this area is inevitably from a European perspective and we can only try to imagine what a shock it must have been to the Aborigines to see the first sailing ships and make contact with the first Europeans. The Aborigines appear to have been quite friendly towards Phillip and Hunter when they explored Broken Bay in 1788 and 1789.

William Bradley, who accompanied Governor Phillip, describes in his Journal how they were met by "a great number of natives, men, women and children. The men were all armed with spears, clubs, stone hatchets and wooden swords." However, when the party landed on the north side of the Bay, the natives were friendly and without arms. They had several huts "which were merely small sticks placed against each other and covered over with bark."

In these huts were several women, old and young, who were terrified at first but soon became composed and friendly on receiving presents. On 4th March 1788, the party explored the "extensive piece of water" known today as Brisbane Water and they "found natives all the way up." (5)

In 1789, a smallpox epidemic broke out amongst the Sydney Aborigines and when David Collins visited the south side of Broken Bay he found that in "many places our path was covered with skeletons."

Details of the depopulation of the north side of Broken Bay are not known, since few Europeans visited the area, but it is possible that smallpox reduced the Aboriginal numbers considerably. In June 1789, after further explorations of the "north branch" (Brisbane Water), Captain John Hunter recorded that "in this harbour we did not see more than twenty natives." (6)&(7)

An important article in The Australian in 1826, soon after European settlement of the area began, describes a walk from Bensville, across to Cockrone Lake and on to Avoca, Terrigal, Erina and Narara. There is no mention of encountering any Aborigines except at Erina where the writer met a "group", some of them afflicted with sickness. Speaking of the "inexhaustible body of sea-shells" in the area of Brisbane Water, he says "it is difficult to believe the common opinion that these shells have been deposited by former natives, because it implies a populousness which the present state of the blacks would hardly warrant." (8)

- - - - -

We have few written accounts of relationships between Aborigines and Europeans in our study area, and none of any substance. The very lack of information suggests that here, as in other areas of the Central Coast, the Aborigines soon lost their language, culture and tribal identity. Any direct descendants would be difficult to trace.

ABORIGINAL SITES

Apart from the very meagre historical records, our knowledge of the Aborigines of our area comes from Aboriginal sites. These include occupation and ceremonial sites: rock shelters, middens, "carvings" and so on.

The Daleys Point site is an important one, with extensive flat areas of rock suited for rock engravings and ceremonial activities. The site is within a Public Reserve adjoining the national park.

The engravings include fish, whales, kangaroos and birds. There are grinding grooves beside a small pool and, below the rock shelf, caves with deep middens which have yielded carbon date readings from about 600 Before the Present (B.P.) to 5,500 B.P. The caves contain charcoal drawings of kangaroos, echidnas, fish and human figures.



COULD THAT BE A EUROPEAN BOAT,
ON THE LEFT?

The importance of the site has been recognised by individuals and institutions over the years, and a proposed road from The Rip Bridge was re-aligned by the D.M.R. in 1974 to avoid any damage.

Guided visits to the Daleys Point site are a feature of the Holiday Programmes conducted by the National Parks & Wildlife Service, but the site has no special protection under their Act. (It is of course protected in the same way as all other Aboriginal remains.)

People have driven cars across the engravings and defaced the cave, in past years, and a certain amount of vandalism continues today. In addition, the rocks are "flaking" and an officer of the N.P. & W.S. has estimated that the engravings are eroding at 0.2mm per annum.

This important site and others like it, remind us of the precarious nature of Aboriginal archaeological remains; of our neglect of this heritage in the past and the need to step up preservation measures if it is to be kept for future generations.

CONCLUSION

The Aborigines were part of a complex chain of life. They were able to live most successfully in the study area by making effective use of the natural resources available.

Their lives were not just controlled by physical conditions, however. They were "governed by strict codes of social behaviour and guided by mythological and associated ritual ceremonies." ⁽⁹⁾

Australians today can learn a good deal from the balanced and meaningful relationship between nature and people, which our Aboriginal heritage reveals. We must ensure that this heritage on the Bouddi Peninsula, in the form of Aboriginal "sites", is cherished and preserved.

+ + + + +

REFERENCES

- (1) See, for example, Reynolds, H. The Other Side of the Frontier: Aboriginal Resistance to the European Invasion of Australia. Penguin, 1982.
- (2) Tindale, N. B. Aboriginal Tribes of Australia. Canberra, ANU Press, 1974.
- (3) "Aboriginal Languages in the South Central Coast, N.S.W.: Fresh Discoveries". Oceania, 41, 1. Sept., 1970.
- (4) Vinnicombe, Patricia. Prediliction and Prediction - A Study of Aboriginal Sites in the Gosford Wyong Area. N.S.W. National Parks and Wildlife Service, July, 1980.
- (5) Bradley, W. A Voyage to New South Wales. Sydney: Public Library of N.S.W. 1969.
- (6) Collins, D. An Account of the English Colony in New South Wales, London. Cadell and Davies, 1910.
- (7) Hunter, J. Historical Journal of Events at Sydney and at Sea 1787-1792. Angus & Robertson, 1968.
- (8) "X.Y.Z." in an article in The Australian, 20 December 1826.
- (9) See Vinnicombe p.xiv:6.

WATERS AND SHORES

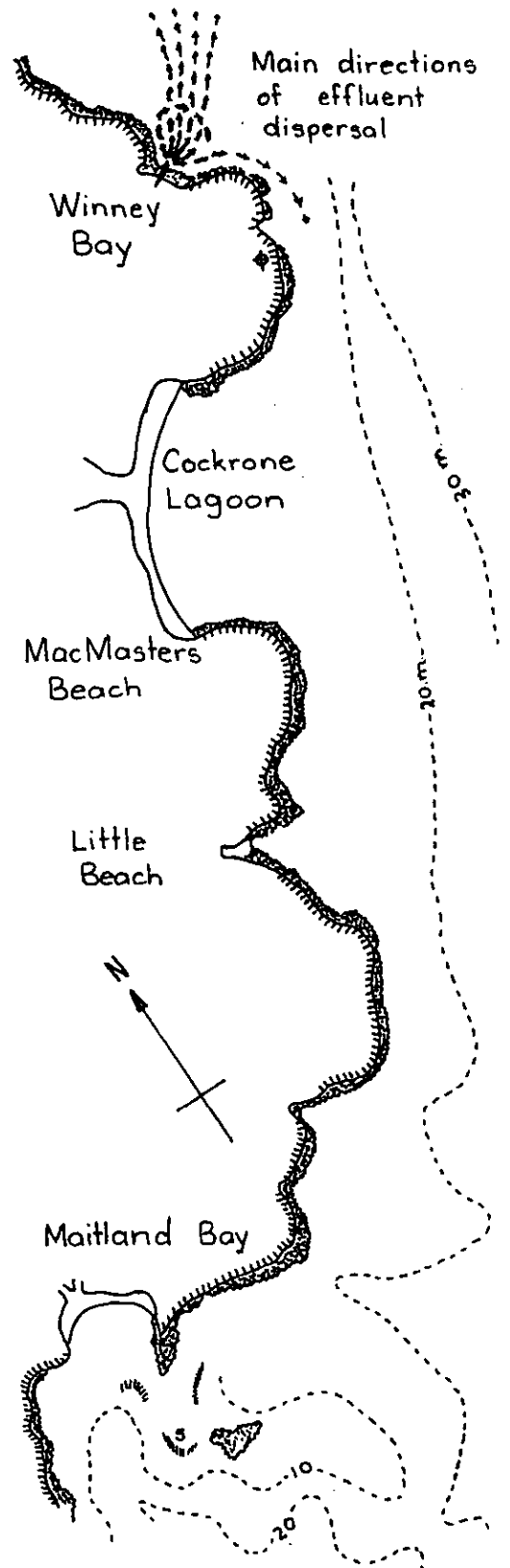
THE WATER

Crucial to the well being of the Bouddi Peninsula is the quality of the water which surrounds it. The ocean is large but not indestructible, especially on the local level.

Public pressure prevented the discharge of Gosford's sewerage effluent at Little Beach in the National Park and at the same time saved Cockrone Lagoon from acting as a pond for emergency overflows.

The sewerage outlet, now at Winney Bay, disposes of the effluent from the Kincumber treatment works. At present the works are grossly underloaded because much of the Gosford area remains unconnected, and as a result the effluent is not as dilute as desired. It varies between 10/10 (10 mg/l dissolved materials such as nitrates and 10 mg/l suspended solids) and 20/30, but the Council has an interim licence to release effluent as concentrated as 50/50. When the plant is fully operational it is hoped that the effluent will not exceed 10/10.

Dissolved nitrates etc. lower the dissolved oxygen in the water where they are released. Suspended solids increase the turbidity, thus reducing light penetration and favouring a growth in the populations of bottom dwelling and filter feeding animals at the expense of algae.



Environmental studies suggested that effluent of 10/10 quality will be quickly dispersed from the Winney Bay area, mainly to the north and east. It should have a negligible effect on the marine communities, although releases of primary effluent in times of emergency could lead to temporary destruction of habitats in some areas. The consultants stressed that every six months the marine communities 50m and 200m from the outfall should be monitored. However, the least damage will be done to the ocean if users of the scheme can be educated not to contaminate the effluent with hazardous domestic and industrial substances.

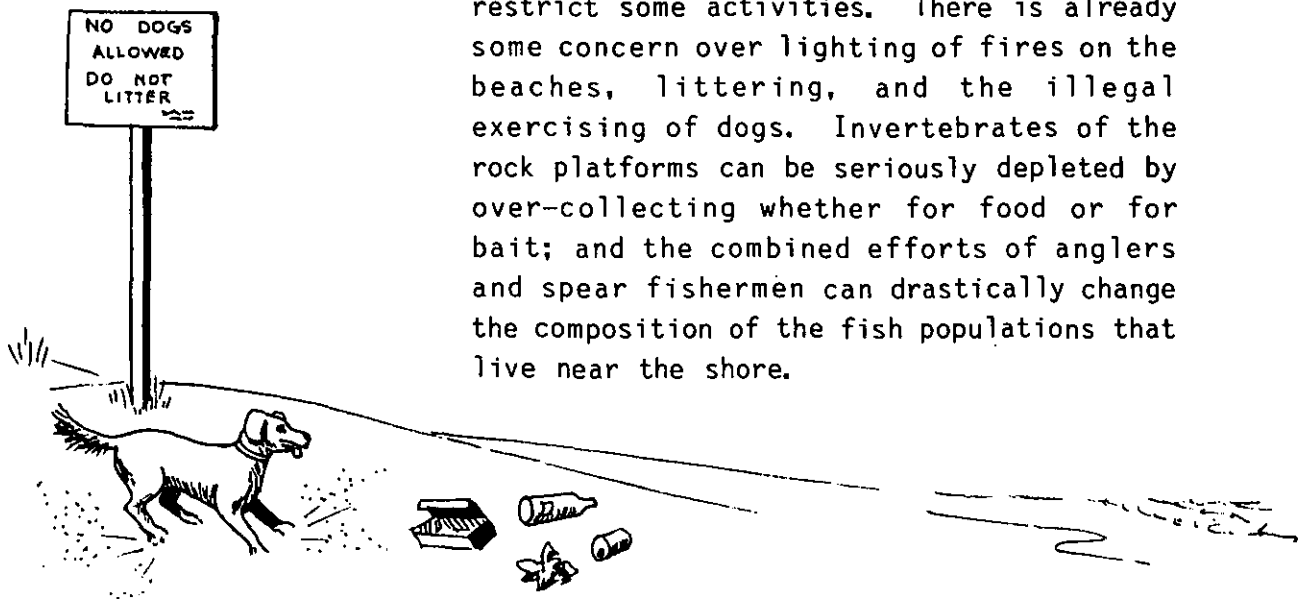
Stormwater drains and streams carry urban run-off and silt along with their water. A few vital catchments, such as part of Cockrone Lagoon's, have some protection by Open Space and Conservation zonings but most catchments pose a threat to the health of the estuary and lagoon.

Brisbane Water and Broken Bay have also to contend with pollution from afar, since the Hawkesbury River which drains so much of western Sydney, greatly influences the quality of the estuary and inshore waters. Obviously many authorities over a wide area of New South Wales will need to be persuaded to act together in the interests of preserving and improving the water which surrounds us.

THE SEASHORE

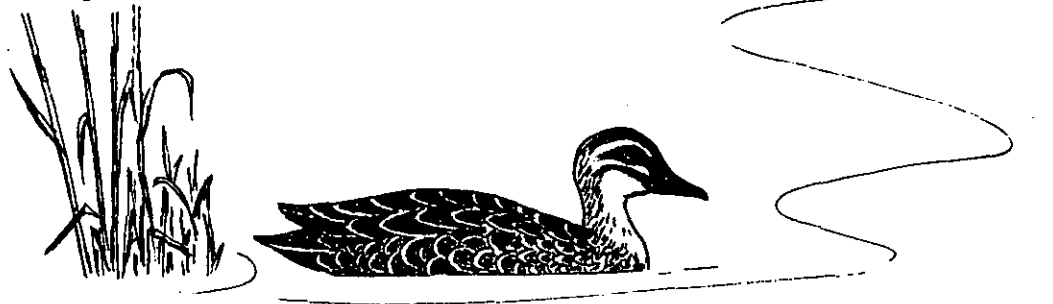
Naturally, as the number of residents and tourists grows, the pressure on the shores becomes more intense. While the public theoretically owns the land between the tidemarks, it may become necessary to

restrict some activities. There is already some concern over lighting of fires on the beaches, littering, and the illegal exercising of dogs. Invertebrates of the rock platforms can be seriously depleted by over-collecting whether for food or for bait; and the combined efforts of anglers and spear fishermen can drastically change the composition of the fish populations that live near the shore.



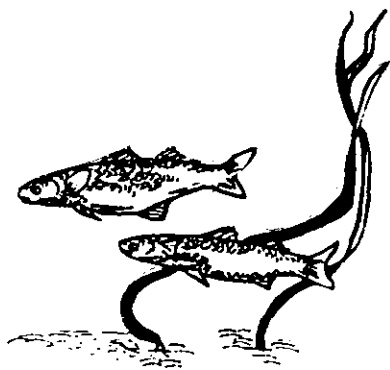
THE LAGOON

Conflicts of interest also threaten Cockrone Lagoon, one of the few relatively undisturbed coastal lagoons. It is a haven for wildlife, but is increasingly used for recreation by swimmers, canoeists and sail-board riders. It is doubtful that this small body of water can continue to satisfy all the demands that are placed upon it and a Plan of Management is urgently required for both the lagoon and its catchment.



THE ESTUARY

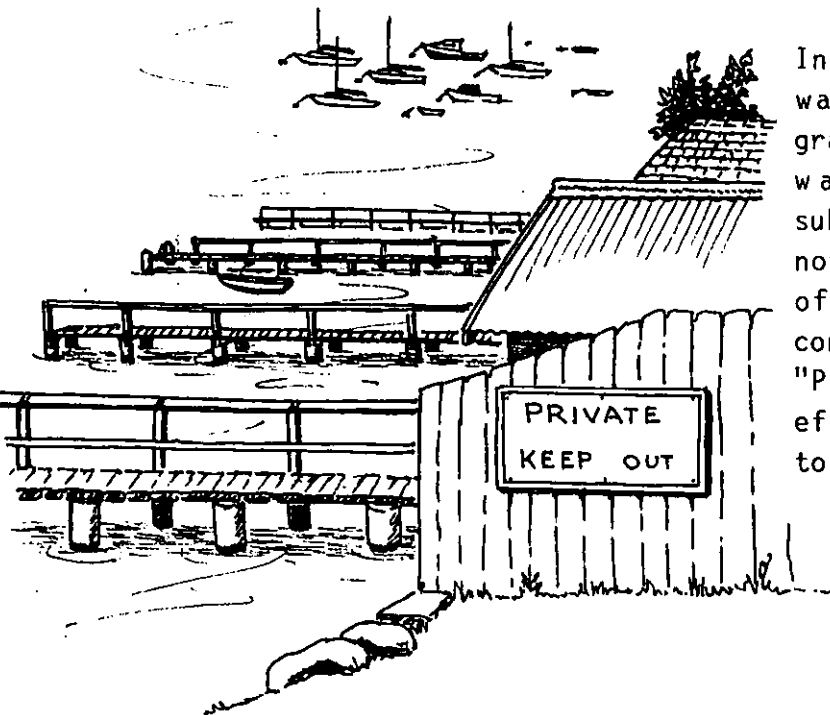
The Brisbane Water has been a rich source of food since the time of the aboriginals and is still important today to the oyster farmer for his livelihood and the amateur fisherman for his sport. Both of these activities are vitally dependent on the water quality of the estuary; and the productive wetlands, mangroves and sea grass beds.



Brisbane Water is closed to commercial fishing and has the usual regulations against the use of set nets or traps. Small seine trawlers operate in Broken Bay and the Hawkesbury River, catching mainly prawns, but some netting for bream and mullet is carried out. Since nearly seventy percent of the commercial fishing catch in coastal waters is of estuary dependent fish, crabs and prawns, the incomes of many people are linked to the conservation of Brisbane Water and its wetlands.

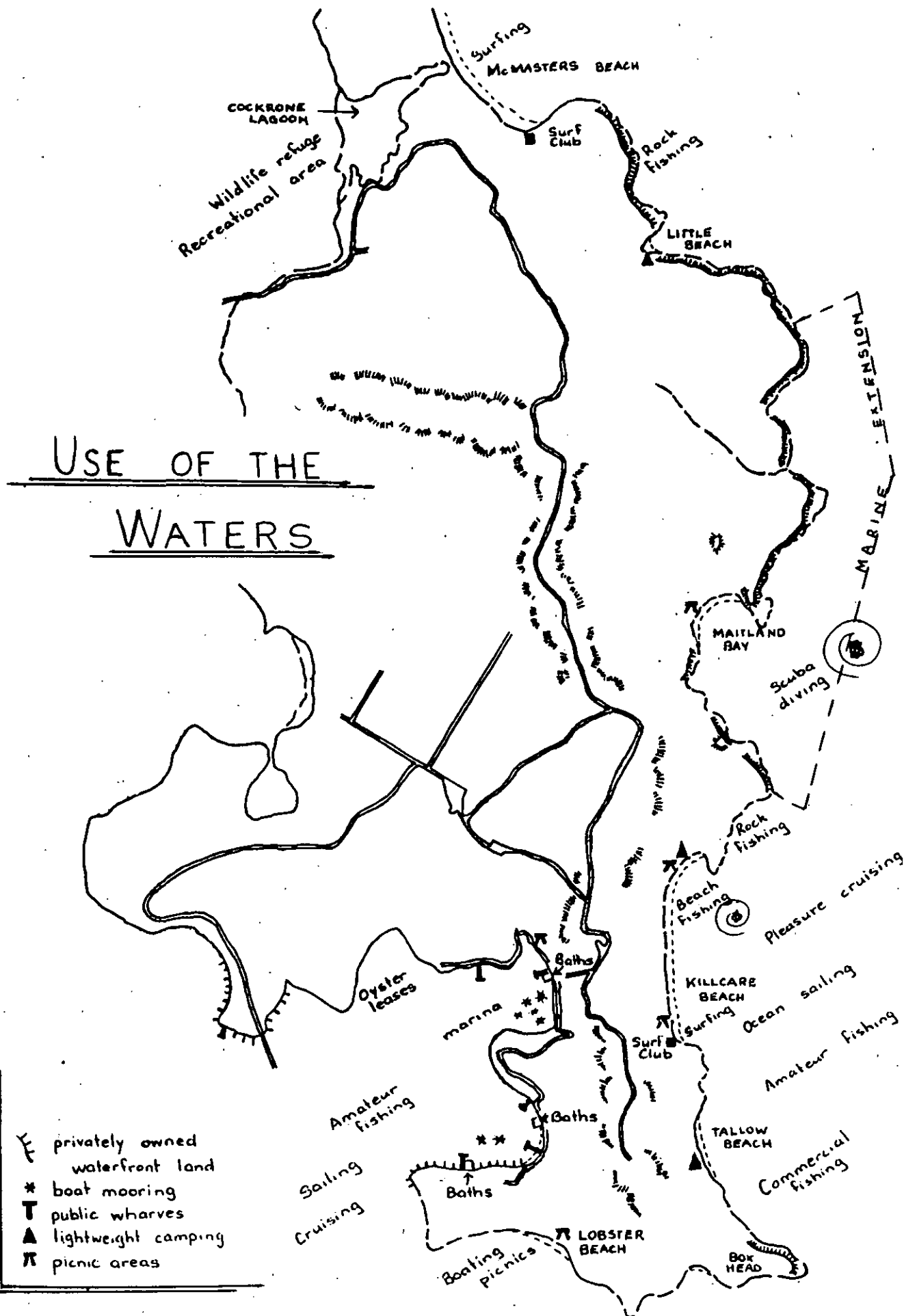
Oyster farming is carried out in Hardys Bay and Rileys Bay where spats are collected and the final fattening done. They are removed to Nelsons Bay for most of their growth to avoid doubling up of spats which stunts growth. Oyster purification plants had to be built when polluted water contaminated the crop of oysters. Oyster farming is controlled by the Division of Fisheries, Department of Agriculture, which says that all available leases between the Rip Bridge and the entrance have been taken up. The leases run for a 15 year period with an option to extend for another 15 years, but existing leases can be bought and sold.

Although no longer used extensively for commercial transport, the estuary is always crowded with motor and sailing boats, especially on weekends and holidays. There is a growing demand for moorings and marinas, but many of the potential users are not residents of the area. Public pressure will decide whether large areas of the waters should be alienated from public use.



In the past, some of the shoreline was made private property, by grants of land which did not leave waterfront reserves and subdivisions of that land which did not correct the position. In parts of Wagstaff and Hardys Bay, the construction of private wharves on "Permissive Occupancies" has effectively blocked public access to inter-tidal areas as well.

Most local residents have expressed the wish that Bouddi Peninsula should remain "as it is now", but it is obvious that this will not happen of its own accord. To conserve our valuable waters and shores for instance, everybody -- from resident to government authority -- will need to consciously address the task.



CURRENT LANDUSE

Upon settlement of New South Wales by Europeans, all land was held by the Crown. The section on the history of settlement has indicated that pieces or parcels of the Crown land on the Peninsula, were "alienated" or sold off in some fashion to various persons. As the process of alienation continued, it became apparent that the Crown should reserve certain lands for various "public purposes". These lands would not then be possessed by any individual who could exercise a right to prevent access.

Following World War II, the Government of New South Wales began to constrain people with a freehold title from using land or carrying out developments on land, which were believed to be prejudicial to the interests of others in the community. This procedure is part of Town and Country Planning.

By the 1950s, the Shire of Gosford was preparing a Town Plan for the Shire which would determine what kinds of uses landholders would be permitted to have on their land. This scheme has gradually been refined over the years and has been one of the most important factors in directing landuse on the Peninsula and therefore the ambience which people enjoy.

The planning scheme has complemented the growth of the Bouddi National Park, so that the Park, the Crown Reserves and the constraints of the Town Plan have been responsible for the development of a unique environment based on a combination of natural systems, impressive landforms and limited landuse. The factor which can alter that environment is a change in landuse.

THE BOUDDI NATIONAL PARK

The Park began as "Bouddi Natural Park" containing about 650 acres (290 ha) in 1935. In the last fifty years several areas of Crown and purchased land have been added, bringing the Park to approximately 3,000 acres or 1,200 hectares. Small parcels of land are still being negotiated for addition. The history of the Park's development is provided elsewhere in this booklet.

Landuse maps usually show national parks as open space but they should be carefully distinguished from other areas of open space so classified under town planning ordinances. In the first place, national parks are managed by a specific authority set up for the purpose in 1967 under the National Parks and Wildlife Act. The authority is known as the National Parks and Wildlife Service. Whilst national parks do provide for public enjoyment of landscape, wildlife and naturalness, they must also contribute to the preservation of natural systems as a means of conserving resources of native plants and animals within naturally produced landforms.

National Parks are not "Crown land" and may be revoked only by Act of Parliament. The community has to accept a strict code for usage of national parks in order to ensure their viability.

CROWN RESERVES

Areas of Crown land may be reserved under the Crown Lands Consolidation Act for a wide range of public purposes. In most cases, such reserves remain Crown land and may be revoked by the simple means of a Ministerial decision followed by publication in the Government Gazette.

There are two major areas of Crown reserve on the Bouddi Peninsula ... one at Putty Beach (which is for public recreation) and the other between Rileys Bay and Daleys Point (for water reserve and public recreation). It is usual for any Crown reserve for public recreation to come under the local Council for "care, control and management" — but the Minister for Lands has an overriding authority.

In addition to these two areas (above), there are several other smaller Crown reserves on the Bouddi Peninsula. They may not be shown on the map in this booklet because of the small scale, but can be seen on larger maps that are available.

OPEN SPACE

This term covers areas of land of diverse tenure and purpose, as follows...

- land acquired by Council over the years, zoned open space and held in fee simple, i.e. literally owned by Council.
- land acquired by Council for open space purposes and dedicated as public reserve under the Local Government Act.

- land purchased by Council since 1978 for open space purposes but not dedicated as public reserve.
- land zoned regional open space, being purchased progressively by the Department of Environment and Planning and (usually) handed to Council for management.

.

There are some problematic aspects of land zoned open space, including the following:

- . security of tenure is often very dubious;
- . land for which Council has unencumbered title may be seen by Council, in the future, as being suitable for development.
- . the use to which the land may be put is often undetermined, e.g. for playing fields or as natural areas.
- . management procedures for an area of open space may be non-existent or in conflict with the real value of the site. e.g. clearing of the understorey in areas designated as "natural".
- . there is no common administrative requirements and no overall legislation to cover the wide divergence of tenures and possible uses.

Whilst open space may be assumed by the community to be synonymous with public property, such a generalisation is often wide of the truth; some land held by Council in fee simple is to all intents and purposes, private property.

Maps on current landuse shows some significant areas of open space along Daleys Point Ridge and the MacMaster Ridge but the details should be studied on the larger scale reference maps available. These two ridgelines are part of the Coastal Open Space System which the Gosford City Council sponsored; the details are available in a special publication.

There are four broad zonings of land in the study area:-

"CONSERVATION" LAND [Zoned 7(a)]

The primary purpose of 7(a) land is described as preservation of existing vegetation and character. It is usually freehold and may be used for agriculture, dwelling houses, home occupations and roads. It may be subdivided into 40 ha lots. Subdivision of 7(a) land on the Bouddi Peninsula took place before the present landuse requirements became operative, and many small parcels of land were created, serving to threaten the primary purpose stated above.

"TOURIST ACCOMMODATION" LAND [Zoned 7(c3)]

Primary purpose is tourist uses with a minimum lot size of 4 ha. Tourist uses include caravan parks, tourist units, clubs, recreation establishments and refreshment rooms, but in addition the land may be used for agriculture (larger hobby farms), convalescent hospitals, dwelling houses, educational establishments, home industries, hotels, lawn cemeteries, places of public worship, plant nurseries; and stock homes (for breeding cats, dogs and horses).

"RURAL SMALL HOLDINGS" [Land zoned 7(c2)]

Primary purpose is rural residentials or small "hobby" farms. Also permitted are convalescent hospitals, dwelling houses, educational establishments, home industries, home occupations, places of public worship, plant nurseries and stock homes. The land may be subdivided to 2-hectare lots or down to 1-hectare lots with "bonus provisions" (i.e. land or finance must be given to help with the provision of "open space" or the management of "open space"). Land zoned as 7(c2) is also known as Scenic Protection.

"RESIDENTIAL" OR URBAN LAND

The map on current landuse does not distinguish between the various zonings for residential land on the Bouddi Peninsula, nor does it attempt to show the small areas provided for commercial and other purposes within the urban areas. This detail is available on the larger-scaled Planning Sheets.

The zonings in the Killcare-Wagstaff segment of urban development are as follows:

- 2(a1) - Dwellings and dual occupancies on land having an area of 1850 square metres, common in the steeper parts.
- 2(a2) - Dwellings and dual occupancies on land having an area of 750 square metres, applying to most of the subdivided land.
- 2(a3) - Dwellings and dual occupancies on land having an area of 550 sq. metres with up to 10% of the lots in any subdivision having a minimum area of 450 square metres.
There are restricted sites where this zoning is permissible at this time.

The zoning in the MacMasters Beach segment of urban development is restricted to 2(a2).

+ + + + +

REFERENCES:

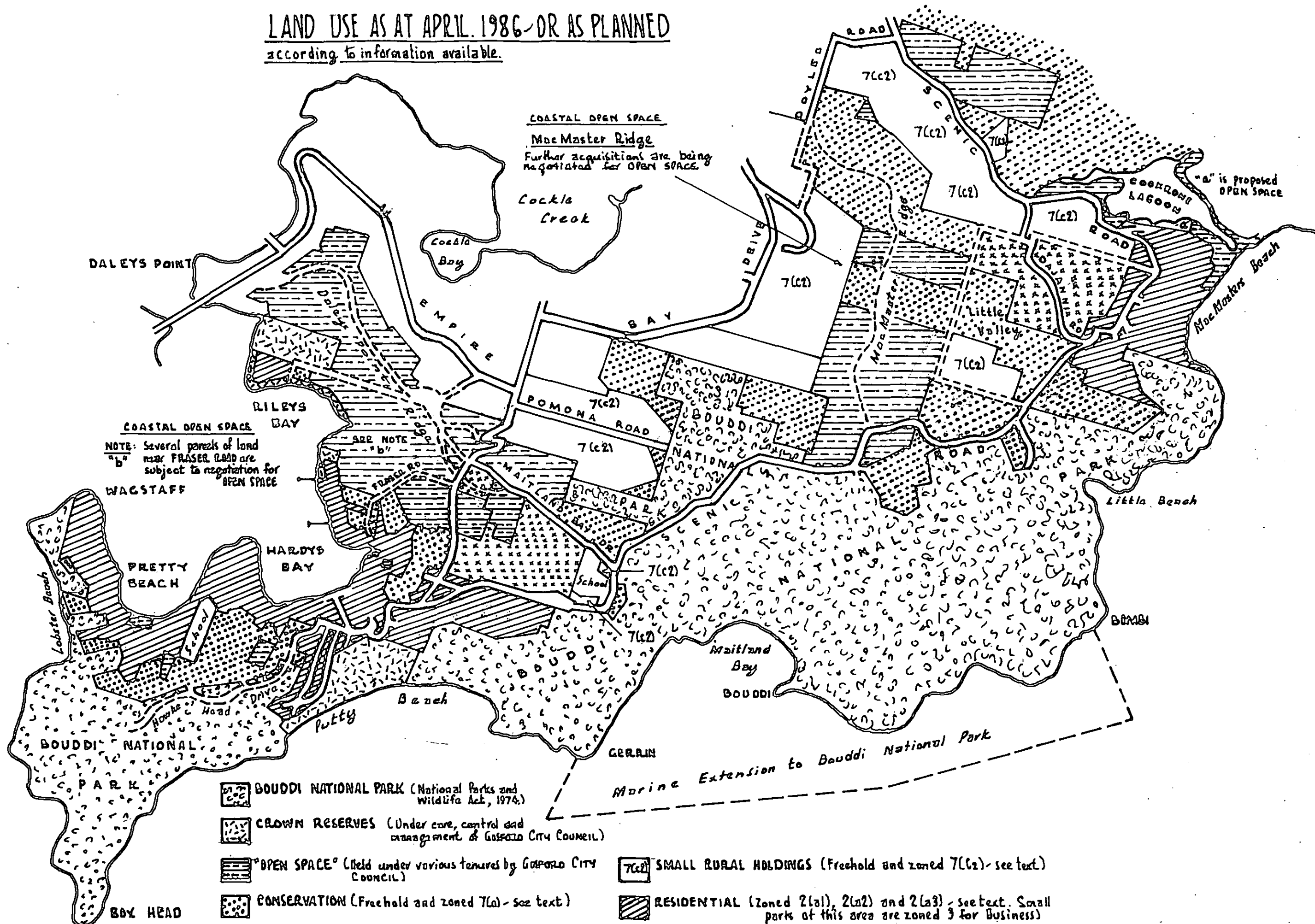
Gosford City Council has published a 17-page paper entitled "Planning Instruments and Zones" which is recommended reading for a summary of current landuse practices. For greater detail, there are maps and booklets covering the Gosford Planning Scheme and Interim Development Order No. 122, all of which are available for purchase or inspection at the Town Planning Department of Council.

IMPORTANT COMMENT:

Amendments to the Planning Scheme and I.D.O. 122 may be undertaken through the provisions of the Environmental Planning and Assessment Act. These amendments require the preparation of either Regional Environmental Plans or Local Environmental Plans. In both cases, the legislation provides for publication of the detail and comment by any member of the community.

LAND USE AS AT APRIL 1986 OR AS PLANNED

according to information available.



THE LANDSCAPE

The landscape of the Bouddi Peninsula is a major resource of the region, combining both natural and cultural elements. It is a "perceived" resource. Other sections of the booklet give details of the landforms, geology, plants and animals of the area, and human usage of such resources. This section will identify the qualities that make the peninsula attractive visually, and the important need to preserve these qualities.

LANDSCAPE ASSESSMENT

In order to plan for the future, it is necessary to find out what people consider attractive in terms of landscape. This is quite a difficult thing to do, but it has been attempted in various studies, both in Australia and overseas. A recent Landscape Perception Study by Lamb and Purcell (Department of Architecture, University of Sydney) on the neighbouring Waringah Peninsula, is a good example of such an attempt.

This report draws heavily on the findings of the Lamb/Purcell Study as they apply to the Bouddi Peninsula. It also draws upon our own "Coast-watch" survey, conducted in the study area in 1984.

FACTORS WHICH DETERMINE THE LANDSCAPE QUALITY

In the Lamb/Purcell Study, a number of people assessed the landscape quality of 180 selected sites by looking at colour slides of each place. The results were statistically analysed and, for a landscape to have a high scenic quality in the eye of the beholder, the following factors were found to be the most important :-

1. extensive views from high points
2. significant topographic features
3. water, particularly interacting with land
4. natural vegetation in the foreground
5. overall predominance of natural vegetation
6. minimal man-made intrusions.

Low quality scenery was associated with areas of high density development in housing and commercial areas, particularly where no vegetation was present, or where buildings intruded significantly into the view. Some of the low quality scenery did include water, but there was also high density or intrusive buildings. Water of itself did not make for attractiveness. It had to be associated with other factors.

The highest ratings were given to scenes which contained water, particularly when viewed towards the land or across the water to land; when the land was in a natural state or contained small groups of houses or individual houses in a setting of natural vegetation.

.

In the Coastwatch survey, a group attempted a "landscape analysis" by visiting a number of sites and making an assessment according to certain guidelines. Each site was rated on a scale (0-5) and any detrimental or very attractive features were noted. The guidelines used were these:

1. Landforms Effect - variety of physical features: hills, gullies, beaches, waterways etc.
2. Vegetation Effect - amount of natural cover: trees, shrubs etc.
3. Quality of Ridgeline/Escarpment - affected by intrusive houses, poles. water towers etc.
4. Quality of Waterline - sandy, rocky, vegetated OR artificially walled, piped, etc.
5. Outstanding Features - natural (eg cliffs, headland, large area of naturalness, individual trees); man-made (historic buildings, wharves etc).
6. Harmony Effect - blending of development (=structure/use) and natural elements.
7. Emotional Impact - yuk! mmm! wow!

On the Bouddi Peninsula, certain factors can be clearly identified as affecting the landscape quality:

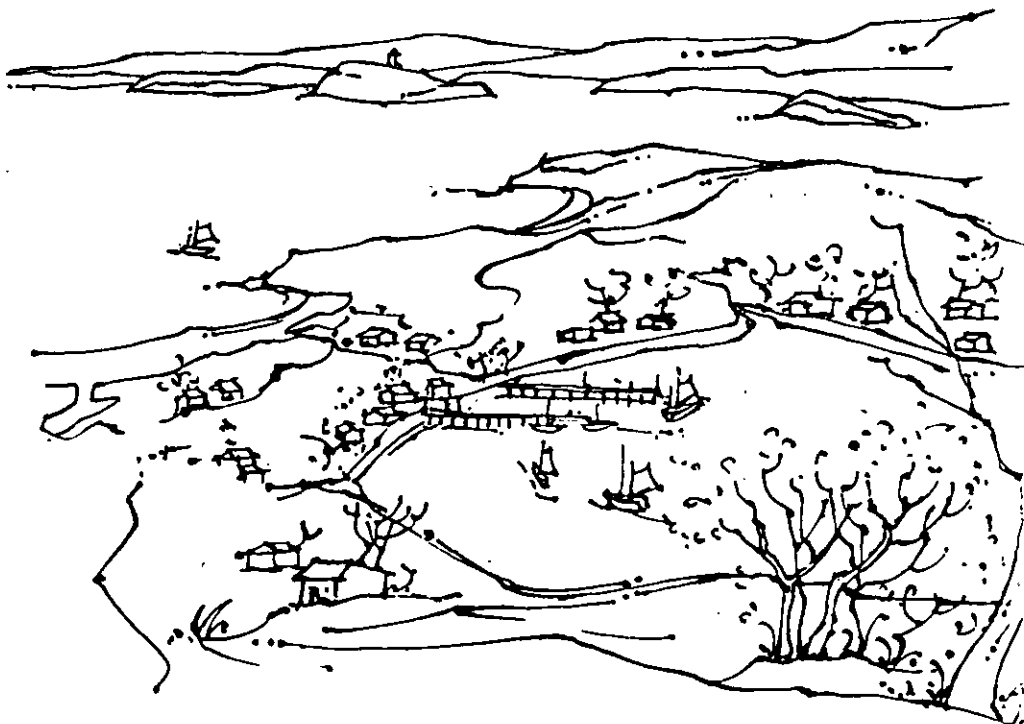
1. Topography/Landform

The hilly nature of the area (with its high cliffs, steep gullies and many places from where extensive views can be seen) makes for a landscape of high scenic quality.

Views to the area from places like Blackwall Mountain, Barrenjoey, Umina and Ettalong, and views from the area at very many places along the ridges of the Bouddi Peninsula, contain most if not all of the elements listed in the Waringah study. They are considered by the Coastwatch group to be as attractive as any in the world.

2. Water

With the Pacific Ocean to the east and Brisbane Water to the west, the Peninsula is in a unique position. Having the shorelines in such close proximity to high ground makes for outstanding views both to and from the water. And with Bouddi National Park along most of the ocean perimeter, the natural vegetation element is added.



The still-water landscapes of Hardys Bay, Pretty Beach and Wagstaff have special appeal to many people. They will require careful management if their present quality is to be retained.

3. Vegetation

The almost-continuous vegetation on the ridgelines forms a background to many landscapes and contributes greatly to the scenic quality of the place. This is another area under pressure, however, and a number of buildings and bright roofs already intrude.

The maintenance of natural vegetation along many of the roads, around the small rural properties and in residential gardens, adds quality to the landscape.

Bouddi National Park provides a variety of vegetation with bonsaid heathlands, dry sclerophyll forests and pockets of gully rainforest all contributing. The wildflowers in Spring are a recurring delight.

Around the bays, remnant mangroves give contrast to the sandy and muddy foreshores and there is currently some local effort to expand this feature.

4. Historical Village Areas

Killcare, Hardys Bay, Pretty Beach and Wagstaff (on the shores of Brisbane Water and with their background of bushland ridges) rate highly as scenic places. The lack of foreground vegetation in some places is a negative factor, but small houses with trees, moored boats and foreground water provide elements which rate highly in landscape perception. Some recent developments intrude obviously into this picture and reduce the scenic quality, but others are in harmony and do not affect the charm.

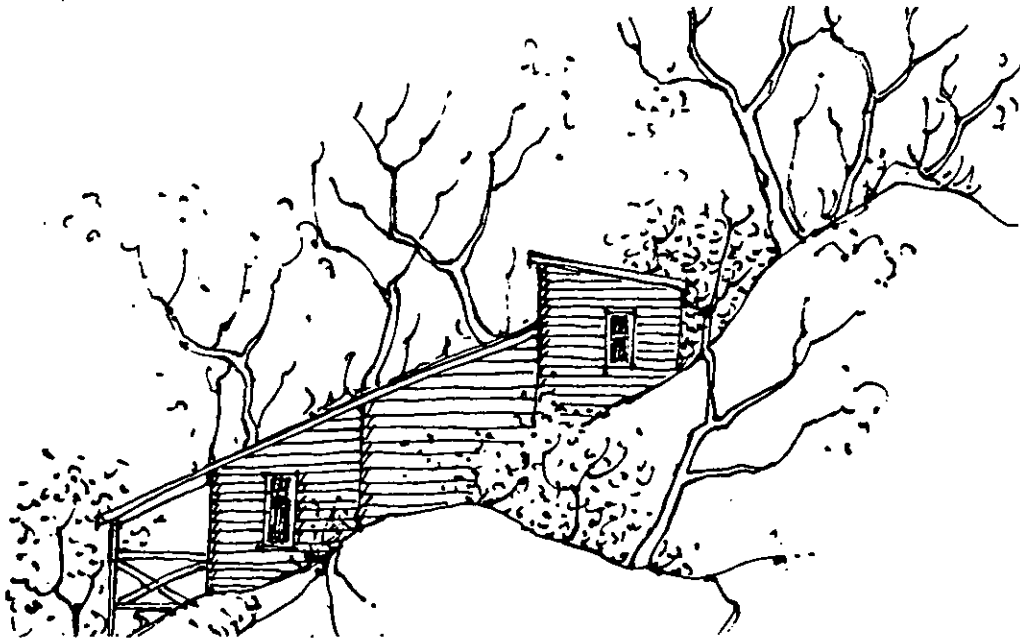
Some of the early buildings, including the corner stores, have been identified as "heritage items" for inclusion in a special planning instrument which will control demolition and alteration.

5. Housing and Similar Landuse

New houses in the Grandview Crescent area, in the "saddle" between Box Head and Killcare Heights, and on Killcare Heights proper, have had considerable impact on the landscape in recent years. They can be seen from the waterways, beaches and roads ... and from the national park. According to landscape studies, houses have a negative impact on the quality of the scenery, particularly where they are intrusive. This effect can be minimised by suitable design, by "setbacks" and by retention of as much as possible of the natural vegetation.

Infill of empty blocks in the village areas has frequently had a negative effect on the landscape, and renovations and extensions to early buildings are not always done sympathetically.

Shiny roofs, buildings above the ridgeline and light coloured buildings in natural areas all stand out clearly and reduce the overall harmony of the landscape. By contrast, earthy colours, natural building materials and suitable designs blend in with their surroundings and have minimal visual effect.



The Bouddi Peninsula has been fortunate in having no "high rise" and only minimal commercial development. These rate very poorly as landscape features, according to recent studies.

Future landuse on the area known as the Triangle (between Wards Hill Road, The Scenic Road and Maitland Bay Drive) could dramatically affect the landscape quality of the area. The small rural holdings enhance the scenery and it is most important that they be retained.

6. Roads

Roads which are kerbed and guttered, and/or fully sealed, rate very low on the scenic scale according to the Waringah study and this was confirmed by "Coastwatch". Unformed roads, particularly where natural vegetation is present on the verges, attract a high rating.

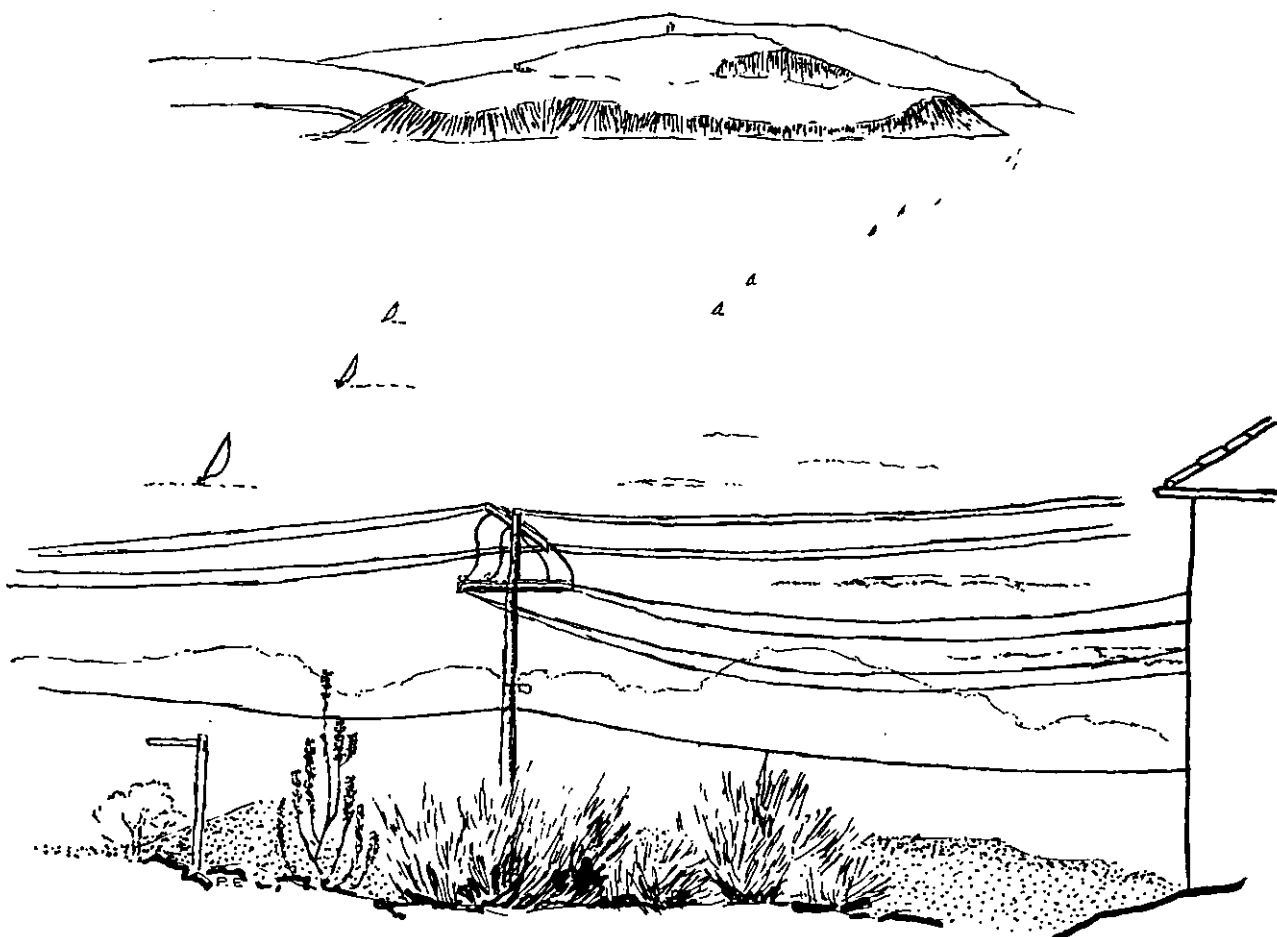
The Peninsula has only two main roads, The Scenic Road and Wards Hill Road, which have no kerbing for much of their length and natural vegetation is the order of the day along the edges. In addition,

these roads are winding and have some dramatic and extensive viewpoints. Many of the roadside dwellers in MacMasters Beach and Killcare have kept some natural vegetation and the Scenic Road in this area can still be said to live up to its name.

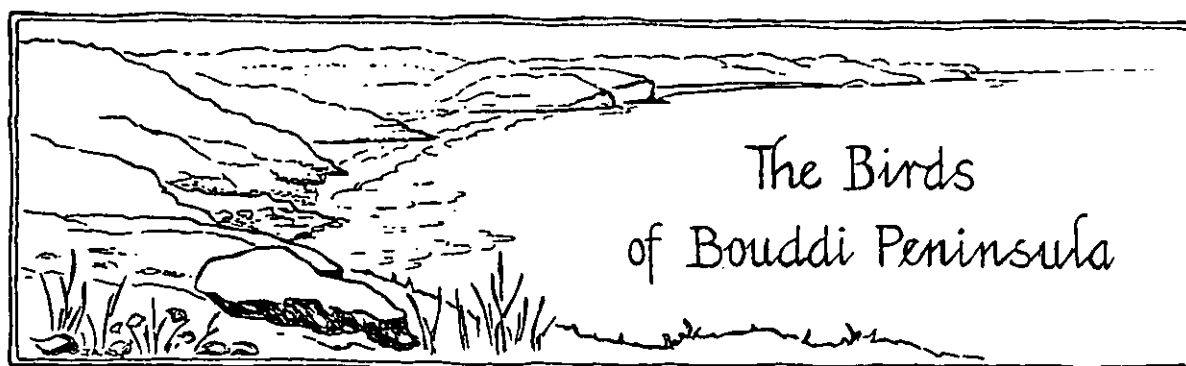
GENERAL COMMENT

The Bouddi Peninsula, at the present time, is a delightful mix of natural areas, historic villages dating from the turn of the century, small rural properties and (some) new housing. Because it is such an attractive area in terms of landscape, there is likely to be pressure for further residential and tourist development. A major problem with such development is that unless very carefully controlled, it can damage a landscape to the extent that the initial attractiveness disappears... to the great disappointment of the resident and tourist today, and with infinite loss for the similar people of tomorrow.


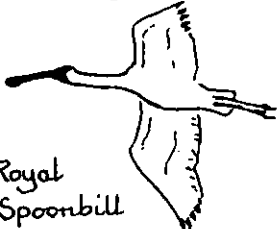


The need for careful management of the landscape quality of Bouddi Peninsula, cannot be over-emphasised.


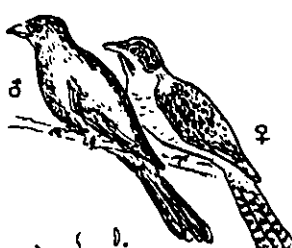

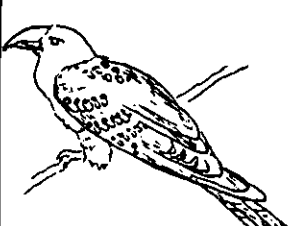













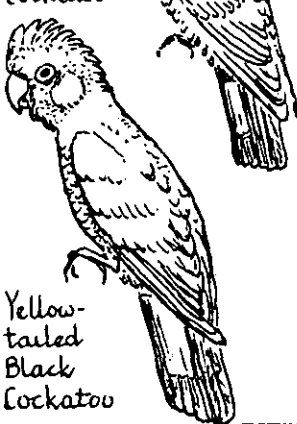
APPENDIX 1
























C Common
 U Uncommon
 X Rare
 M Migrant
 N Nomad
 V Visitor
 I Introduced

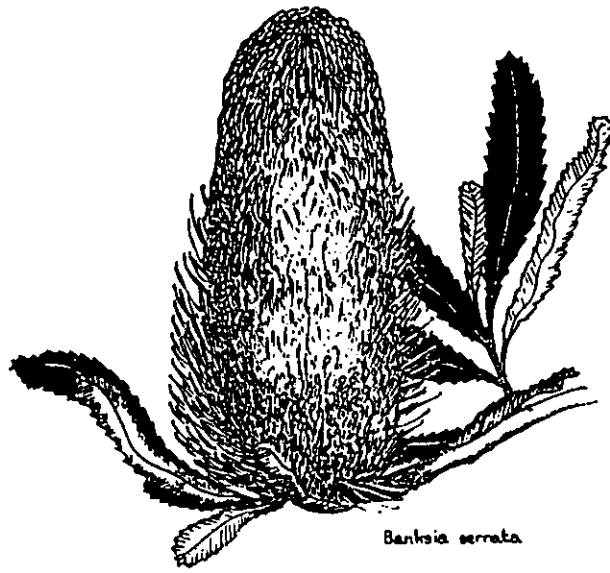
	Moist Forest	Woodland	Heath	Estuarine Bays	Coastal Dune	Marine	Residential	Water Birds
Little Penguin						X		 Striated Heron
Black-browed Albatross						XV		
Wedge-tailed Shearwater						X		
Short-tailed Shearwater						CM		 Royal Spoonbill
Fluttering Shearwater						UV		
Australian Pelican				CN				
Australasian Gannet						CV		
Great Cormorant				CN		CN		
Pied Cormorant				CN				
Little Black Cormorant				CN				
Little Pied Cormorant				CN				
Pacific Heron							U	 Great Egret
White-faced Heron				C				
Cattle Egret							C	
Great Egret				C				
Little Egret				U				
Plumed Egret (Intermediate Egret)				U				 Black Swan

	Moist Forest	Woodland	Heath	Estuarine Bays	Coastal Dune	Marine	Residential	Migrants
Eastern Reef Egret						X		 <p>Short-tailed Shearwater</p>
Mangrove Heron (Striated Heron)				C				
Sacred Ibis				C				
Royal Spoonbill				C				
Black Swan				CN				
Pacific Black Duck				C				
Mallard				UI				
Grey Teal				CN				
Chestnut Teal				CN				
Maned Duck (Wood Duck)		C					C	
Black-shouldered Kite		XN						
Whistling Kite		C		C				
Brown Goshawk		U	U					
Grey Goshawk		X						
White-bellied Sea-Eagle		U		U		U		
Australian Kestrel		U	U					 <p>Common Koel and Channel-billed Cuckoo</p>
Australian Brush-turkey	C	C					C	
Buff-banded Rail				U				
Brown Quail			U					
Eurasian Coot					UN			
Bush Stone-Curlew				X				
Pied Oystercatcher				U				
Sooty Oystercatcher						U		
Masked Lapwing				C				
Lesser Golden Plover				UM				
Black-fronted Plover				UN				 <p>Dollarbird</p>
Eastern Curlew				CM				
Whimbrel				UM				
Grey-tailed Tattler				UM				
Bar-tailed Godwit				UM				
Arctic Jaeger						U		
Silver Gull				CN		CN		
Caspian Tern				XV				
Common Tern				UN				

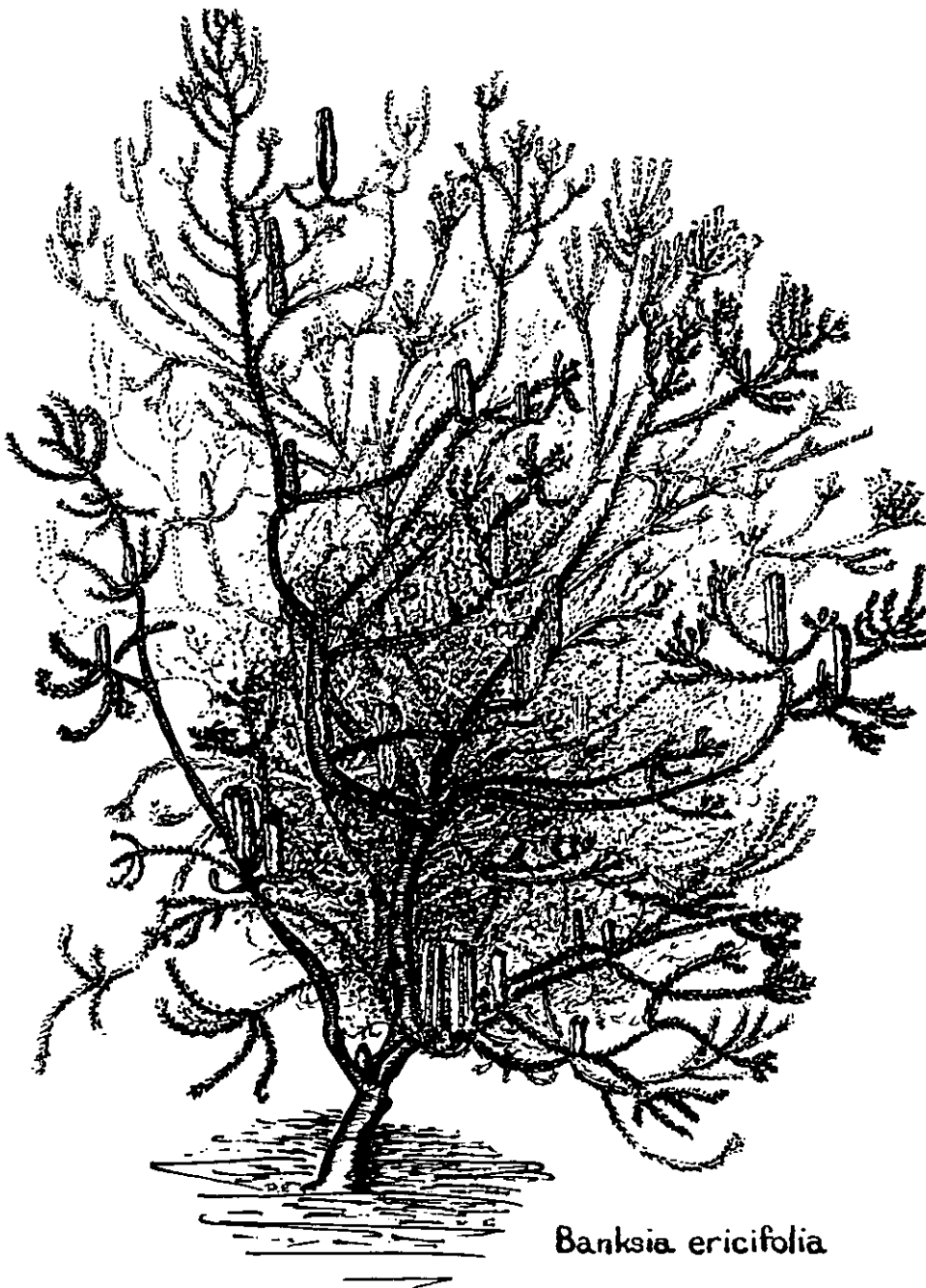
	Moist Forest	Woodland	Heath	Estuarine Bays	Coastal Dune	Marine	Residential	Cockatoos Rosellas	Parrots Lorikeets
Crested Tern				CN		CN		Musk Lorikeet	
Feral Pigeon							UI	Scaly-breasted Lorikeet	
Spotted Turtle-Dove		UI			UI		CI	Rainbow Lorikeet	
Brown Cuckoo-Dove	U	U					U		
Brush Bronzewing		U							
Crested Pigeon		C					C	Eastern Rosella	
Wonga Pigeon	U								
Glossy Black-Cockatoo		UN		UN				Crimson Rosella	
Yellow-tailed Black-Cockatoo		UN							
Galah		U		C	C		C	Galah	
Long-billed Corella		U							
Little Corella		U						Little and Long-billed Corella	
Sulphur-crested Cockatoo		C					C		
Rainbow Lorikeet		C		C	C		C		
Scaly-breasted Lorikeet		C					C		
Musk Lorikeet		X							
Australian King-Parrot		C					U	King Parrot	
Crimson Rosella		U					U		
Eastern Rosella		C					C		
Pallid Cuckoo		UM							
Brush Cuckoo		UM							
Fan-tailed Cuckoo	UN	CN			UN			Sulphur-crested Cockatoo	
Horsfield's Bronze-Cuckoo				UN					
Common Koel		CM			UM		UM		
Channel-billed Cuckoo		UM						Glossy Black Cockatoo	
Pheasant Coucal		U							
Southern Boobook		C							
Barking Owl		X							
Tawny Frogmouth		U							
Spine-tailed Swift		CM							
Azure Kingfisher		X							
Laughing Kookaburra		C		C	C		C		
Sacred Kingfisher		UM		UM				Yellow-tailed Black Cockatoo	
Dollarbird		CM		CM			CM		

	Moist Forest	Woodland	Heath	Estuarine Bays	Coastal Dune	Marine	Residential	Bush Birds
Superb Lyrebird	U	U						Variegated Fairy-wren 
Welcome Swallow		C	C	C			C	
Australian Pipit (Richard's Pipit)					U			Superb Fairy-wren 
Black-faced Cuckoo-shrike		C					C	
Cicadabird		XM						
Red-whiskered Bulbul					CI		CI	
Eastern Yellow Robin		C			C			Rufous Fantail 
Shrike-tit (Crested Shrike-tit)		U						
Golden Whistler		CN						
Rufous Whistler		CM						
Grey Shrike-thrush		C	C		C			Golden Whistler 
Leaden Flycatcher		UM						
Rufous Fantail		UM						
Grey Fantail	C	C			C			
Willie-wagtail		U		C	U		U	Striated Thornbill 
Eastern Whipbird	C	C	U		U			
Little Grassbird				U				
Superb Fairy-wren					C			Eastern Whipbird 
Variegated Fairy-wren		C	C					
Southern Emu-wren			C					
Large-billed Scrubwren	X							
Yellow-throated Scrubwren	X							Green Catbird 
White-browed Scrubwren		C	U		C			
Brown Warbler (Brown Gerygone)	C	C						
Brown Thornbill	C	C						
Yellow Thornbill					C			
Striated Thornbill		C			C			
White-throated Treecreeper		U						
Red Wattlebird		C						
Little Wattlebird		C	C		C		C	
Noisy Friarbird		C						
Regent Honeyeater		X						Brown Cuckoo-Dove 

	Moist Forest	Woodland	Heath	Estuarine Bays	Coastal Dune	Marine	Residential	Honeyeaters
Bell Miner	C	C						Scarlet 
Noisy Miner		U					C	Eastern Spinebill 
Lewin's Honeyeater	C	C	U		C		U	Tawny- crowned 
Yellow-faced Honeyeater		CN	UN	CN	UN			Yellow -faced 
White-naped Honeyeater		CN						White- cheeked 
New Holland Honeyeater		U	C		C		U	New Holland 
White-cheeked Honeyeater		U	C		C			Lewin's 
Tawny-crowned Honeyeater			C					Regent 
Eastern Spinebill		CN	CN				CN	Noisy Miner 
Scarlet Honeyeater		UN					XN	Little Wattle -bird 
White-fronted Chat				XN				Red Wattle -bird 
Mistletoebird		CN						Noisy Friar -bird 
Spotted Pardalote		C					U	Bell Miner 
Silvereye		C			C		C	
House Sparrow							UI	
Red-browed Firetail		U	C		C		C	
Double-barred Finch		U					U	
Common Starling							UI	
Common Mynah							UI	
Olive-backed Oriole		CN						
Spangled Drongo		UN						
Satin Bowerbird	C	C					U	
Regent Bowerbird	U	U					X	
Green Catbird	U							
Magpie-lark					U		C	
Grey Butcherbird		C					C	
Australian Magpie		C			C		C	
Pied Currawong	C	C					C	
Australian Raven		C	U	U	C		U	



Banksia serrata



Banksia ericifolia

VEGETATION COMMUNITIES

QUATERNARY ALLUVIAL FLATS

Community 1:1 TALL OPEN FOREST (*Eucalyptus saligna*, *E.amplifolia*, *E.robusta*)

Structure: Trees more than 30 metres high with an open to mid dense canopy cover. Understorey wet, with a mid-dense canopy cover of smaller trees, shrubs, monocotyledons and herbs.

Distribution: Remnant pockets are found at Ward and Karuk Roads, Bensville and at Pomona Road, Empire Bay.

Habitat: Poorly drained wet sites around bases of escarpments. High water table present.

Main Species Present: *Eucalyptus saligna*, *E.amplifolia*, *E.robusta*. *E.botryoides* and *Angophora floribunda* are occasionally present. Smaller trees include *Melaleuca styphelioides* and *Glochidion ferdinandi*.

Community 1:2:1 OPEN FOREST (*Eucalyptus robusta*, *Angophora floribunda*)

Structure: Trees up to 25 metres high with a mid-dense canopy cover. Understorey wet, comprised mainly of smaller trees and monocotyledons.

Distribution: Located around the southern shore of Cockrone Lake only.

Habitat: Estuarine flats subject to tidal inundation. High water table always present.

Main Species Present: *E.robusta* and *A.floribunda*. Smaller trees include *Glochidion ferdinandi* and *Rapanea howittiana*. Shrub layer dominated by *Ghania* sp.

Community 1:2:2: OPEN FOREST (*Eucalyptus botryoides*)

Structure: Trees up to 20 metres high with a sparse to mid-dense canopy cover. Understorey wet, mid-dense comprising smaller trees and shrubs.

Distribution: Remnant pockets are found at Hardys Bay and a relatively undisturbed pocket at Rileys Bay.

Habitat: Restricted to alluviums adjacent to the water's edge and sometimes subject to tidal inundation. High water table always present.

Main species Present: *E.botryoides* and *Allocasuarina glauca*.

Community 1:3:1 WOODLAND with REEDLAND/RUSHLAND (*casuarina glauca*)

Structure: Trees about 20 metres high with a sparse canopy cover. Understorey wet with pockets of reedland/rushland about 3 metres high, and usually seaward of the woodland community.

Distribution: Around the southern shore of Cockrone Lake.

Habitat: Flats subject to tidal inundation. Saline environment.

Main Species Present: (*Casuarina glauca*, *Melaleuca quinquenervia*, *M. spyphelioides* and *M. ericifolia*.)

Reedland/rushland comprises members of the Poaceae and Cyperaceae families particularly *Phragmites australis* and *Eleocharis* sp.

Community 1:3:2: WOODLAND with WETLAND (*Melaleuca quinquenervia*)

Structure: Trees up to 20 metres high with a sparse to mid-dense canopy cover, surrounding a body of water. Understorey wet and comprising mainly smaller trees.

Distribution: Small communities are located south-west of Cockroone Lake and at McMasters Beach.

Habitat: Alluvial flats which are continually inundated. High water table always present.

Main Species Present: *Melaleuca quinquenervia*. Smaller trees include *Acmena smithii* and *Glochidion ferdinandi*.

Community 1:4 LOW OPEN SCRUB - MANGROVES (*Avicennia marina*)

Structure: Low shrubs of Mangroves about 3 metres high.

Distribution: Along foreshores of Rileys Bay, Pretty Beach and Hardys Bay.

Habitat: Tidal mud flats where no wave action is present.

Main Species Present: *Avicennia marina* var. *australasica*.

PERCHED SAND DUNES

Community 2:1:1 LOW WOODLAND (*Eucalyptus gummifera*)

Structure: Low stunted trees up to 7 metres high with an open to mid-dense canopy cover. Understorey dry, with a cover of shrubs, monocotyledons and herbs.

Distribution: Restricted to a small community on the north-western periphery of the Mourawaring Moor.

Habitat: Dry north and north-eastern slopes.

Main Species Present: *E. gummifera* dominates. A few specimens of *Angophora costata* occur on lower slopes.

Community 2:1:2 LOW WOODLAND (*Eucalyptus gummifera*, *E. umbra*, *Angophora costata*)

Structure: Trees up to 7 metres high, stunted with an open canopy cover. Understorey dry with a cover of shrubs, monocotyledons and herbs.

Distribution: South-west slopes of the Mourawaring Moor and north-west slopes of the Bombi Moor.

Habitat: On dune side slopes sheltered from the wind.

Main Species Present: *E. gummifera*, *E. umbra* ssp *umbra* and *A. costata*

Community 2:2:1 CLOSED HEATH (*Allocasuarina distyla*)

Structure: Dense to mid-dense heath up to 2 metres high.

Distribution: Restricted to the Mourawaring Moor.

Habitat: Adjacent to the sea above cliff tops and extending to near the cliff edge. Subject to onshore winds and salt spray.

Main Species Present: Dominated by *Allocasuarina distyla* as the tallest stratum. Smaller shrubs include *Epacris microphylla* and *Hakea teretifolia*.

Community 2:2:2 CLOSED HEATH with pockets of LOW WOODLAND (*Banksia aemula*, *Allocasuarina distyla*)

Structure: Dense cover of heath about 1 metre high with pockets of low woodland up to 7 metres high.
Distribution: Restricted to the Bombi Moor.
Habitat: Adjacent to the sea above cliff tops and extending down to near the cliff edge. Subject to onshore winds and salt spray.
Main Species Present: Heath is dominated by *B.aenula* and *A.distyla*. Woodland comprises *E.umbra* ssp *umbra*, *E.gummifera* and *Angophora costata*.

**Community 2:3 OPEN SCRUB (*Allocasuarina distyla*,
Banksia integrifolia)**

Structure: Open heath up to 3 metres high with a herbaceous understorey.
Distribution: Restricted to a small pocket on the south-western edge of the Mourarwaring Moor.
Habitat: Adjacent to the cliff edge. Subject to onshore winds and salt spray.
Main Species Present: Dominated by *A.distyla* and *B.integrifolia*. The herb stratum is dominated by *Themeda australis*.

RECENT COASTAL DUNES

**Community 3:1 LOW OPEN FOREST (*Eucalyptus umbra*,
Angophora costata, *Syncarpia glomulifera*)**

Structure: Trees up to 4 metres high with a mid-dense canopy cover. Understorey dry with a sparse cover of shrubs, monocotyledons and herbs.
Distribution: Restricted to the western end of Putty Beach.
Habitat: Adjacent to the sea at the rear of dunes. Subject to onshore winds and salt spray.
Main Species Present: *E.umbra* ssp *umbra*, *A.costata*, *S.glomulifera* and *Banksia serrata*. *E.resinifera* and *E.pellita* are also present.

Community 3:2 OPEN SCRUB (*Leptospermum laevigatum*)

Structure: Shrubs and small trees up to 4 metres high with a dry understorey of smaller shrubs and herbs.
Distribution: Along the shore at Putty Beach.
Habitat: Adjacent to the sea on hind dunes. Subject to onshore winds and salt spray.
Main Species present: Dominated by *L.laevigatum*

GOSFORD FORMATIONS OF THE NARRABEEN GROUP

**Community 4:1 CLOSED FOREST (*Acmena smithii*,
Ceratopetalum apetalum)**

Structure: Palms and other dominant trees up to 30 metres high and smaller trees up to 15 metres high. Canopy cover dense and understorey moist with small trees, shrubs, lianes, ferns and herbs. Epiphytes abundant in southerly aspects.
Distribution: Most watercourses mainly in the eastern section of the study area.
Habitat: Deep moist sheltered gullies where continual moisture supply is available. Aspect is variable.
Main Species Present: Taller trees include *Syncarpia glomulifera* and the palm *Archontophoenix cunninghamiana*. Smaller

trees include rainforest species such as *Acmena smithii*, *Ceratopetalum apetalum*, *Ficus coronata*, *Ficus rubiginosa*, *Pittosporum undulatum* and *Endiandra sieberi*. Small shrubs include *Eupomatia laurina*, *Trochocarpa laurina* and *Guioa semiglauca*.

Community 4:2 TALL OPEN FOREST (*Eucalyptus saligna*)

Structure: Emergent trees greater than 30 metres high and smaller trees up to 15 metres high. Canopy cover mid-dense and understorey moist comprising smaller trees, shrubs, lianes, ferns and herbs.

Distribution: Restricted to watercourses around Pomona Road, Empire Bay, Ward and Karuk Roads, Bensville and Little Valley Road, McMasters Beach.

Habitat: Moist sheltered gullies at valley bottoms with northerly and westerly aspects. Prone to wildfire.

Main Species Present: *E.saligna* is the main emergent. *E.deanii* may also be present. Understorey trees include *Acmena smithii*, *Ceratopetalum apetalum*, *Endiandra sieberi*, *Trochocarpa laurina*, *Melaleuca styphelioides* and the palm *Archontophoenix cunninghamiana*.

Community 4:3:1 OPEN FOREST (*Eucalyptus pilularis*, *E.punctata*, *E.paniculata*)

Structure: Trees up to 30 metres high with a semi-closed canopy cover. Understorey moist but sparse consisting of smaller trees, twiners, and shrubs.

Distribution: Constitutes the main vegetation community throughout the north-eastern part of the study area.

Habitat: Sheltered valley slopes on all aspects.

Main Species Present: *E.pilularis*, *E.punctata* and *E.paniculata*. *Angophora floribunda* and *E.botryoides* are also present. Deep in the gullies *E.pilularis* becomes the sole dominant. Smaller trees include *Allocasuarina torulosa*, *Glochidion ferdinandi* and *Pittosporum undulatum*.

Community 4:3:2 OPEN FOREST (*Eucalyptus maculata*, *E.paniculata*)

Structure: Trees up to 30 metres high with a mid-dense to open canopy cover. Understorey dry, mid-dense with a cover of shrubs, herbs and monocotyledons.

Distribution: Restricted to the area between Hardys Bay and Kourang Gourang Point.

Habitat: Dry north facing slopes adjacent to waterways.

Main Species Present: *E.maculata*, *E.paniculata* and *Allocasuarina torulosa*.

Community 4:3:3 OPEN FOREST (*Eucalyptus botryoides*, *Syncarpia glomulifera*)

Structure: Trees up to 20 metres high with a semi-closed canopy cover. Understorey moist, dense and comprised of shrubs, monocotyledons and herbs.

Distribution: Restricted to the Bouddi Grand Deep.

Habitat: Cool south facing slopes, adjacent to the sea. Very moist habitat.

Main Species Present: *E.botryoides*, *E.pellita*, *Angophora floribunda* and *S.glomulifera*. *E.resinifera* is at times present and on higher points between re-entrants *E.umbra* ssp *umbra* occurs.

**Community 4:3:4 OPEN FOREST (*Eucalyptus paniculata*,
E.piperita)**

Structure: Trees up to 20 metres high with an open canopy but with a dense dry understorey of shrubs, monocotyledons and herbs.

Distribution: On western, eastern and southern slopes around Mount Bouddi.

Habitat: Dry valley slopes adjacent to the sea. Slopes not so sheltered and subject to onshore winds.

Main Species Present: *E.paniculata*, *E.piperita*, *E.botryoides*, *Angophora floribunda* and *Syncarpia glomulifera*.

**Community 4:3:5 OPEN FOREST (*Eucalyptus punctata*,
E.paniculata)**

Structure: Trees up to 20 metres high with an open to mid-dense canopy cover. Understorey dry, sparse to mid-dense comprising shrubs, monocotyledons and herbs.

Distribution: Restricted to western slopes above Hardys Bay and Killcare Extension.

Habitat: Dry western slopes adjacent to waterways. Subject to cold winter and hot summer dessicating westerly winds.

Main Species Present: *E.punctata*, *E.paniculata*, *E.umbra* ssp *umbra*, *E.piperita* and *Angophora floribunda*.

**Community 4:3:6 OPEN FOREST to LOW OPEN FOREST
(*Eucalyptus gummifera*, *E.umbra*, *Angophora costata*)**

Structure: Trees up to 20 metres high, at times stunted, with an open to mid-dense canopy cover. Understorey dry to slightly moist, mid-dense, with a cover of monocotyledons, shrubs and herbs.

Distribution: On coastal slopes between Putty Beach and Maitland Bay.

Habitat: Mainly exposed slopes adjacent to the sea. Slopes between Gerrin and Maitland Bay are more moist and sheltered. Subject to onshore winds and salt spray.

Main Species Present: *E.paniculata*, *E.umbra* ssp *umbra*, *E.gummifera*, *Syncarpia glomulifera* and *Angophora costata*. *E.capitellata*, *E.pellita* and *E.resinifera* are occasionally present. Where moist gullies occur *E.botryoides* and *A.floribunda* are present.

Community 4:4:1 LOW OPEN FOREST (*Eucalyptus pilularis*)

Structure: Trees up to 7 metres high, stunted, with an open to mid-dense canopy cover. Understorey moist, but sparse comprising shrubs and smaller trees.

Distribution: Restricted to a small area at McMasters Beach below the Mourawaring Moor.

Habitat: North-eastern slopes adjacent to the sea, subject to onshore winds and salt spray.

Main Species Present: *E.pilularis*

**Community 4:4:2 LOW OPEN FOREST (*Eucalyptus paniculata*,
Allocasuarina torulosa)**

Structure: Trees up to 10 metres high with a sparse to mid-dense canopy cover. Understorey dry, sparse consisting of shrubs, monocotyledons and herbs.

Distribution: Restricted to an area above Iron Ladder Beach.
Habitat: Western slopes adjacent to the sea. Extends down to cliff edges. Subject to cold winter and hot summer westerly winds.
Main Species Present: *E.paniculata*, *Angophora floribunda*, and *Allocasuarina torulosa*. The ground cover is dominated by *Themeda australis*.

Community 4:5 WOODLAND (*Angophora costata*, *Eucalyptus umbra*)
Structure: Trees up to 15 metres high, at times stunted, with an open canopy cover. Understorey dry, mid-dense, consisting of smaller trees, shrubs, monocotyledons and herbs.
Distribution: Between Wagstaffe Point and Iron Ladder Beach.
Habitat: Western slopes adjacent to the sea. Subject to onshore winds and salt spray.
Main Species Present: *A.costata*, *A.floribunda*, *E.umbra* ssp *umbra*. Occasionally *E.gummifera*, *E.piperita* and *E.botryoides* occur. Smaller trees are mainly *Allocasuarina torulosa*.

Community 4:6 OPEN SCRUB (*Allocasuarina distyla*, *Banksia integrifolia*, *Leptospermum laevigatum*)
Structure: Shrubs up to 4 metres high with a dry understorey of smaller shrubs and herbs.
Distribution: A small pocket at the western end of Putty Beach.
Habitat: Adjacent to the sea behind coastal dunes. Subject to onshore winds and salt spray.
Main Species Present: *A.distyla*, *B.integrifolia* and *L.laevigatum*

Community 4:7:1 CLOSED HEATH (*Banksia aemula*, *Allocasuarina distyla*)
Structure: Dense cover of heath up to 1 metre high.
Distribution: Restricted to the cliff edges of the Bombi Moor.
Habitat: Adjacent to the sea on cliff edges. Very exposed situation and subject to onshore winds and salt spray.
Main Species Present: *B.aemula* and *A.distyla*.

Community 4:7:2 CLOSED HEATH (*Allocasuarina distyla*)
Structure: Dense cover of heath up to 2 metres high.
Distribution: Along the southern coastal fringe of the study area.
Habitat: On slopes and cliff edges adjacent to the sea. Very exposed situations. Subject to onshore winds and salt spray.
Main Species Present: Dominated by *A.distyla*.

Community 4:8:1 OPEN HEATH (*Allocasuarina distyla*, *Lomandra longifolia*)
Structure: Sparse to mid-dense cover of heath up to 0.5 metre high.
Distribution: Found only at the eastern end of Tallow Beach.
Habitat: Restricted to lower slopes and extending down to cliff edges. Exposed situation and subject to onshore winds and salt spray.
Main Species Present: Dominated by *A.distyla* and *L.longifolia*.

Community 4:9 GRASSLAND (*Phragmites australis*)
Structure: Wetland dominated by herbs, sedges, reeds and grasses

from the Restionaceae, Juncaceae and Poaceae families. No trees are present.

Distribution: Restricted to an isolated community above Bullimah Beach.

Habitat: Waterlogged site or perched wetland where underlying stata is impermeable.

Main Species Present: *P.australis* and *Ghania* sp.

HAWKESBURY SANDSTONES

Community 5:1:1: WOODLAND (*Eucalyptus piperita*, *E.gummifera*, *Angophora costata*)

Structure: Trees up to 20 metres high with an open canopy cover. Understorey dry but sparse, comprising few shrubs and a mid-dense cover of grasses and shrubs.

Distribution: Wards Hill only.

Habitat: Dry plateau tops and slopes extending down to cliff edges.

Main Species Present: *E.gummifera*, *E.umbra* ssp *umbra*, *E.piperita* and *A.costata*. *Allocasuarina torulosa* is the dominant understorey tree.

Community 5:1:2 WOODLAND (*Eucalyptus gummifera*, *E.umbra*, *Angophora costata*)

Structure: Trees up to 20 metres high with an open canopy cover. Understorey dry, mid-dense, comprising shrubs, monocotyledons and herbs.

Distribution: Ridgetops throughout eastern part of the Peninsula.

Habitat: Dry habitats on plateau tops.

Main Species Present: *E.gummifera*, *E.umbra* ssp *umbra* and *A.costata*. At times *A.floribunda*, *E.botryoides* and *E.pellita* are present. Smaller trees are mainly *Allocasuarina torulosa*.

Community 5:1:3 WOODLAND (*Angophora floribunda*, *Eucalyptus gummifera*)

Structure: Trees up to 20 metres high with an open canopy cover. Understorey dry with a sparse cover of shrubs and monocotyledons and a mid-dense cover of grasses and herbs.

Distribution: Restricted to the head of the north-west ridge.

Habitat: Dry western slopes. Subject to cold winter and hot summer westerly winds.

Main Species Present: *A.floribunda* and *E.gummifera*. Small trees dominated by *Allocasuarina torulosa*.

Community 5:2:1 LOW WOODLAND (*Eucalyptus gummifera*, *E.umbra*, *Angophora costata*)

Structure: Trees up to 7 metres high, stunted, with an open to mid-dense canopy cover. Understorey dry, comprising shrubs, monocotyledons and herbs.

Distribution: Restricted to western parts of the Peninsula around Putty Beach and on Box Head.

Habitat: Mainly rocky peaks on plateau tops. Exposed windy sites.

Main Species Present: *E.umbra* ssp *umbra*, *E.gummifera*, *Syncarpia glomulifera* and *A.costata*. On very exposed sites only *E.umbra* and *S.glomulifera* occur.

**Community 5:2:2 LOW WOODLAND (*Eucalyptus capitellata*,
E.umbra, *Angophora costata*)**

Structure: Trees up to 6 metres high, stunted, with an open canopy cover. Understorey, dry and mid-dense, comprising shrubs, monocotyledons and herbs.

Distribution: Located on the slopes of Hawkes Head.

Habitat: Exposed southern and northern slopes. Subject to onshore winds and salt spray.

Main Species Present: *E.umbra* ssp *umbra*, *E.capitellata* and *A.costata*.

**Community 5:2:3 LOW WOODLAND (*Eucalyptus capitellata*,
E.gummifera, *Angophora costata*)**

Structure: Trees up to 10 metres high with an open canopy cover. Understorey dry, with a mid-dense cover of shrubs and monocotyledons.

Distribution: Restricted to the top of the ridge at Wards Hill.

Habitat: Very high plateau tops. Exposed windy sites.

Main Species Present: *E.gummifera*, *E.capitellata* and *A.costata*.

Community 5:3:1 OPEN HEATH (*Allocasuarina distyla*)

Structure: Mid-dense cover of heath about 1 metre high at times amongst rocky outcrops.

Distribution: Confined to the Box Head area.

Habitat: Adjacent to the sea in exposed situations. Found on slopes down to cliff edges and subject to onshore winds and salt spray.

Main Species Present: Dominated by *A.distyla*.

**Community 5:3:2: OPEN HEATH with pockets of LOW WOODLAND
(*Allocasuarina distyla*, *Banksia ericifolia*)**

Structure: Heath up to to 2 metres high interspersed with patches of low woodland up to 6 metres high.

Distribution: Western parts of the Peninsula along Hawkes Head and at Box Head.

Habitat: Confined to exposed ridge tops and slopes. Subject to onshore winds and salt spray.

Main Species Present: *A.distyla*, *B.ericifolia*, *Persoonia laevis* dominate the heath whilst *E.umbra* ssp *umbra*, *E.capitellata*, *E.haemastoma* var. *haemastoma* and *A.distyla* comprise the woodland.

HAWKESBURY SANDSTONES WITH LATERITE TOPS

Community 6:1:1 LOW WOODLAND (*Eucalyptus umbra*, *E.paniculata*)

Structure: Trees up to 7 metres high, stunted, with and open to mid-dense canopy cover. Understorey sparse and dry, comprising smaller trees and shrubs.

Distribution: Restricted to a small pocket at McMasters Beach.

Habitat: On cliff tops adjacent to the sea. subject to onshore winds and salt spray.

Main Species Present: *E.umbra* ssp *umbra* and *E.paniculata*. Smaller trees include *Rapanea variabilis* and *Pittosporum undulatum*.

Community 6:1:2 LOW WOODLAND (*Eucalyptus capitellata*,
E.gummifera, *E.haemastoma*)
Structure: Trees up to 7 metres high, stunted, with an open canopy cover. Understorey dry with a dense to mid-dense cover of shrubs, monocotyledons and herbs.
Distribution: Two isolated pockets occur; north of Hawkes Head Drive and north of Scenic Drive.
Habitat: Plateau tops in exposed situations. Subject to onshore winds.
Main Species Present: *E.capitellata*, *E.gummifera* and *E.haemastoma* var. *haemastoma*.

Community 6:2 LOW OPEN WOODLAND (*Eucalyptus gummifera*,
Angophora costata)
Structure: Trees up to 7 metres high, stunted, with a very open canopy. Understorey very sparse and at times non-existent. Where present it is dry and consists of shrubs and herbs.
Distribution: Wards Hill only.
Habitat: Plateau tops in exposed situations.
Main Species Present: *E.gummifera*, *A.costata* and *Allocasuarina torulosa*. *E.pellita* is sometimes present.

NOTE: A comprehensive list of Rainforest species is available as a separate paper.

APPENDIX 3

UNDERSTOREY SPECIES

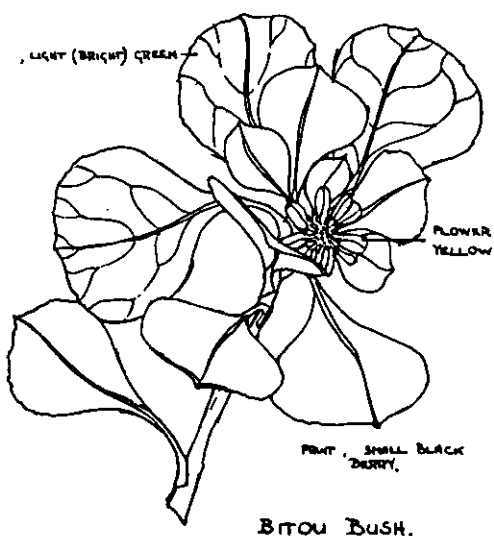
The plant lists in this Appendix are representative of the species in the understorey. It should be noted that there are plants occurring on the Bouddi Peninsula which, because of the sampling nature of the survey, were not encountered in any quadrats and therefore are not included in the lists. Well known examples include Libertia paniculata, Kunzea ambigua and Acacia linifolia.

Introduced plants also occurred in quadrats but were not counted. For example, Ligustrum sinense and Ligustrum lucidum (Small/Large-leaf Privet), Lantana camara, and Chrysanthemoides monilifera (Bitou Bush) are widespread.

The lists contain several species of eucalypts and angophoras which were found growing in juvenile form. They were identified by examining nearby trees and consulting Beadle.

The following codes are used in the lists to indicate the quantity of plants counted:

A	Abundant	-	100+
C	Common	-	21/99
NC	Not Common	-	5/20
R	Rare	-	less than 5

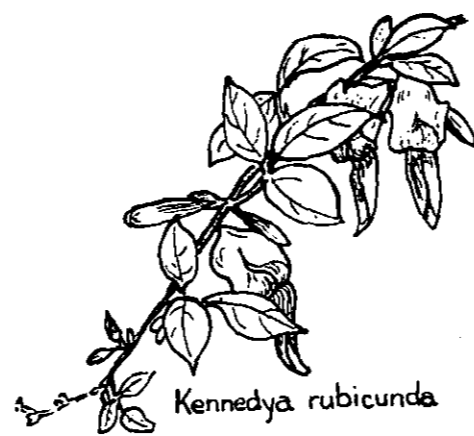




Epacris longiflora



Actinotis helianthi



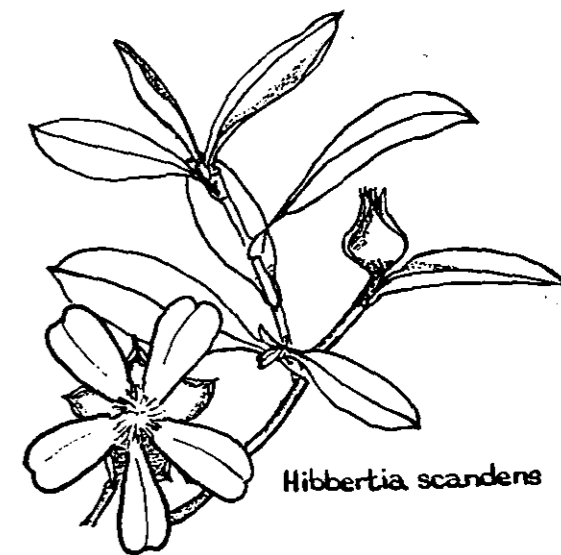
Kennedyya rubicunda



Hibbertia nitida



Leptospermum scoparium



Hibbertia scandens



Eriostemon australasius



Persoonia lanceolata



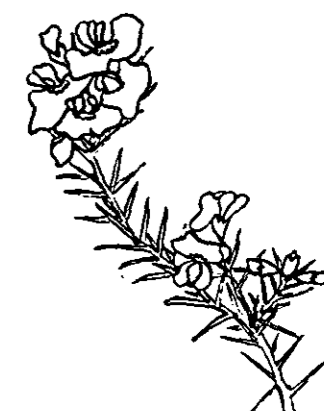
Blandfordia nobilis



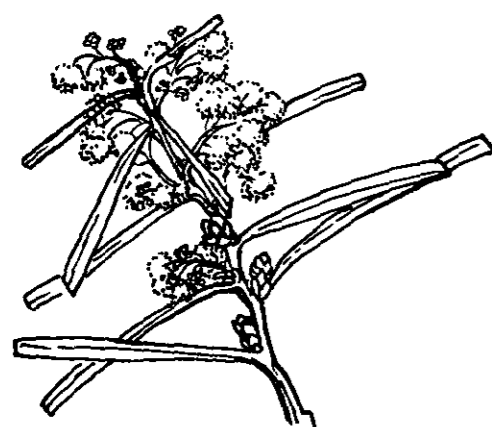
Bossia scolopendria



Casuarina distyla



Dillwynia ericifolia



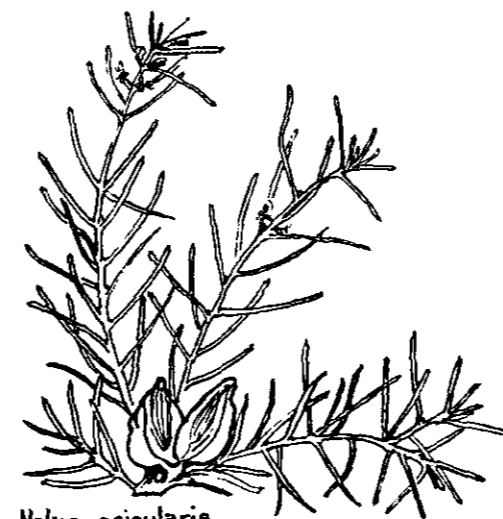
Acacia suaveolens



Callistemon citrinus



Scaevola ramosissima



Hakea acicularis



Dampiera stricta



Epacris pulchella



Isopogon anemonifolius



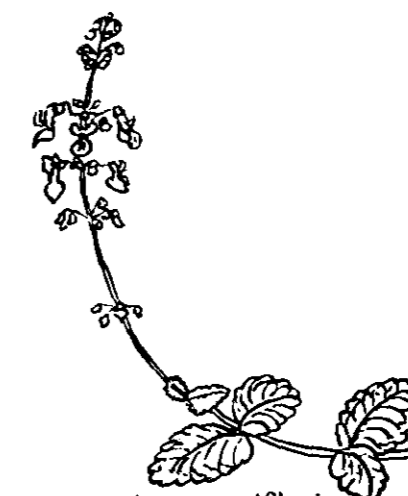
Gompholobium latifolium



Libertia paniculata



Pimelia linifolia



Plectranthus parvifloris



Leptospermum flavescens

FAMILY	SPECIES	WOODLAND	FOREST	HEATH	RAINFOREST	MANGROVES
<i>Acanthaceae</i>	<i>Bruoniella pumilio</i> <i>Pseuderanthmum varibile</i>		R	N		
<i>Adiantaceae</i>	<i>Adiantum aethiopium</i> Maiden Hair Fern		A			
<i>Aizoceae</i>	<i>Carpobrotus aequilaterus</i>					R
<i>Araceae</i>	<i>Gynostachys anceps</i> Settlers Flax				R	
<i>Bignoniaceae</i>	<i>Pandorea pandorana</i> Wonga Wonga Vine	R	R		R	
<i>Blechnaceae</i>	<i>Doodia aspera</i> Prickly Rasp Fern		N			
<i>Cassythaceae</i>	<i>Cassytha paniculata</i>		R			
<i>Casuarinaceae</i>	<i>Casuarina distyla</i> <i>Casuarina glauca</i> <i>Casuarina littoralis</i> Black She Oak <i>Casuarina torulosa</i> Forest Oak	N C C	 N N	A		R N
<i>Compositae</i>	<i>Cassinia aculeata</i>	N	R			
<i>Cunoniaceae</i>	<i>Ceratopetalum apetalum</i> Coachwood				N	
<i>Cyatheaceae</i>	<i>Culcita dubia</i> Rainbow Fern				N	
<i>Cyperaceae</i>	<i>Caustis flexuosa</i> <i>Cyperus rotundis</i> Nut Grass <i>Schoenus paludosis</i> <i>Scleria mackaviensis</i>		R			R A
<i>Dennstaedtiaceae</i>	<i>Lindsaea trichomanoides</i> <i>Pteridium esculentum</i> Austral Bracken	A	A	N	R A	C
<i>Dilleniaceae</i>	<i>Hibbertia acicularis</i> <i>Hibbertia dentata</i> <i>Hibbertia diffusa</i> <i>Hibbertia fasciculata</i> <i>Hibbertia nitida</i> <i>Hibbertia riparia</i> <i>Hibbertia stricta</i> <i>Styphelia longifolia</i>	C R N R	A N	N A R N		

FAMILY	SPECIES	WOODLAND	FOREST	HEATH	RAINFOREST	MANGROVES
<i>Dioscoreaceae</i>	<i>Dioscorea transversa</i>		R			
<i>Droseraceae</i>	<i>Drosera peltata</i>			R		
<i>Elaeocarpaceae</i>	<i>Elaeocarpus reticulatus</i> Blue Berry Ash				N	
<i>Epacridaceae</i>	<i>Astroloma pinifolium</i>	R				
	<i>Epacris microphylla</i>	C	N	C		
	<i>Epacris pulchella</i>	C	N	A		
	<i>Leucopogon deformis</i>			C		
	<i>Leucopogon ericoides</i>	N				
	<i>Lissanthe strigosa</i>	N	R	C		
	<i>Monotoca elliptica</i>		N	R		
	<i>Monotoca scoparia</i>			R		
	<i>Woolisia pungens</i>	R		A		
<i>Euphorbiaceae</i>	<i>Breynia oblongifolia</i>	R	C			
	<i>Glochidion fernandi</i>	R				
	<i>Monotaxis linifolia</i>	C				
	<i>Omolanthus populifolius</i> Bleeding Heart				R	
	<i>Ricinocarpus pinifolius</i> Wedding Bush	R		N		
<i>Geraniaceae</i>	<i>Pelargonium inodorum</i>		N			
<i>Gleicheniaceae</i>	<i>Sticherus flabellatus</i> Umbrella Fern				R	
<i>Goodeniaceae</i>	<i>Dampiera stricta</i>	C		C		
	<i>Goodenia bellidifolia</i>			N		
	<i>Goodenia decurrens</i>	C				
	<i>Goodenia hederacea</i>		N			
	<i>Goodenia heterophylla</i>		C			
	<i>Goodenia ovata</i>			R		
	<i>Goodenia stelligera</i>	C				
	<i>Scaevola ramosissima</i>	R				
<i>Gramineae</i>	<i>Imperata cylindrica</i>	C				
	<i>Microlaena stipoides</i>	R				
	<i>Themeda australis</i>	R				
<i>Haloragaceae</i>	<i>Haloragis tetragyna</i>			R		
<i>Iridaceae</i>	<i>Patersonia glabrata</i> Native Iris	R		C		
	<i>Patersonia sericea</i>			N		
<i>Juncaceae</i>	<i>Juncus microcephalus</i>					A

FAMILY	SPECIES	WOODLAND	FOREST	HEATH	RAINFOREST	MANGROVES
<i>Labiatae</i>	<i>Plectranthus parviflorus</i> <i>Westringia fruticosa</i>	R	R	C	N	
<i>Liliaceae</i>	<i>Dianella laevis</i> <i>Stypandra caespitosa</i> <i>Thysanotus tuberosus</i> Fringed Lily	R	C	N C		
<i>Lobeliaceae</i>	<i>Pratia pedunculata</i> <i>Pratia purpurascens</i> White Root	C C	N C		A	
<i>Loganiaceae</i>	<i>Mitrasacme polymorpha</i>			N		
<i>Meliaceae</i>	<i>Synoum glandulosum</i>		R			
<i>Menispermaceae</i>	<i>Sarcopetalum harveyanum</i> <i>Stephania japonica</i> var. <i>discolor</i>	R			N	
<i>Mimosaceae</i>	<i>Acacia longifolia</i> var. <i>longifolia</i> Sydney Golden Wattle <i>Acacia melanoxylon</i> <i>Acacia myrtifolia</i> <i>Acacia suaveolens</i> Sweet-scented Wattle <i>Acacia ulicifolia</i> Prickly Moses		N R NC	N R	N	R
<i>Monimiaceae</i>	<i>Wilkea huegiana</i>				N	
<i>Moraceae</i>	<i>Ficus coronata</i> Sandpaper Fig				R	
<i>Myrsinaceae</i>	<i>Rapanea variabilis</i>		N			
<i>Myrtaceae</i>	<i>Acmena smithii</i> Lillypilly <i>Angophora costata</i> Smooth-barked Apple <i>Angophora hispida</i> Dwarf Apple <i>Austromyrtus tenuifolia</i> <i>Baekkea brevifolia</i> <i>Callistemon linearis</i> Narrow-leaved Bottle Brush <i>Eucalyptus botryoides</i> Bangalay <i>Eucalyptus gummifera</i> Red Bloodwood		R R R R		N C N	

FAMILY	SPECIES	WOODLAND	FOREST	HEATH	RAINFOREST	MANGROVES
Myrtaceae (contd.)	<i>Eucalyptus pellita</i>					
	Large-fruited Red Mahogany				R	
	<i>Eucalyptus pilularis</i>					
	Blackbutt		N			
	<i>Eucalyptus umbra</i>					
	Bastard Mahogany	R	R			
	<i>Glycine clandestina</i>	C	A			
	<i>Leptospermum arachnoides</i>			R		
	<i>Leptospermum attenuatum</i>	R				
	<i>Leptospermum flavescens</i>					
	Yellow tea-tree	C	A		R	
	<i>Leptospermum laevigatum</i>					
	Coastal tea-tree	C		R		
	<i>Rhodamnia rubescens</i>		R			
	<i>Syncarpia glomulifera</i>					
	Turpentine	R			C	
Orchidaceae	<i>Cymbidium canaliculatum</i>	R				
	<i>Dendrobium speciosum</i>					
	Rock Orchid		R			
	<i>Dendrobium tetragonum</i>		R			
Oxalidaceae	<i>Oxalis corniculata</i>		R			
Palmae	<i>Archontophoenix cunninghamiana</i>					
	Bangalow Palm				R	
	<i>Livistona australis</i>					
	Cabbage Tree				A	
Papilionaceae	<i>Bossiaea scolopendria</i>			C		
	<i>Dillwynia ericifolia</i>		A			
	<i>Dillwynia floribunda</i>					
	var. <i>floribunda</i>	C		C		
	<i>Dillwynia floribunda</i>					
	var. <i>teretifolia</i>			N		
	<i>Gompholobium latifolium</i>					
	Golden Glory Wedge-pea	N	A	R		
	<i>Hardenbergia violacea</i>					
	False Sarsaparilla		N			
	<i>Hovea linearis</i>					
	Blue or Purple Pea		R			
	<i>Kennedia rubicunda</i>					N
	<i>Mirbelia rubifolia</i>	R		R		
	<i>Platylobium formosum</i>					
	Handsome Flat-pea	C				
	<i>Pultanea flexilis</i>		R			
	<i>Pultanea retusa</i>	A				
	<i>Pultanea scabra</i> var. <i>scabra</i>		C	C		
Philesiaceae	<i>Eustrephus latifolius</i>	N	N		R	
	<i>Geitonoplesium cymosum</i>		R		R	

FAMILY	SPECIES	WOODLAND	FOREST	HEATH	RAINFOREST	MANGROVES
<i>Pittosporaceae</i>	<i>Billardiera scandens</i> Apple Berry	N	N			
<i>Polygalaceae</i>	<i>Comesperma ericinum</i> Heath Milk Wort		C	R		
<i>Proteaceae</i>	<i>Banksia aemula</i>			C		
	<i>Banksia collina</i> Hill Banksia	N	N			
	<i>Banksia ericifolia</i> Heath-leaved Banksia		R	C		
	<i>Banksia integrifolia</i> White Honeysuckle		N			
	<i>Banksia marginata</i>		R			
	<i>Banksia oblongifolia</i>	N		N		
	<i>Banksia serrata</i> Red Honeysuckle	R				
	<i>Banksia spinulosa</i>		R	N		
	<i>Grevillea linearifolia</i>		R			
	<i>Grevillea sericea</i> Pink Spider flower	N				
	<i>Hakea gibbosa</i>		R		R	
	<i>Hakea salicifolia</i>			N		
	<i>Hakea sericea</i>			R		
	<i>Hakea teretifolia</i> Dagger Hakea			C		
	<i>Isopogon anemonifolius</i> Drumsticks	R		C		
	<i>Isopogon anethifolius</i>			R		
	<i>Lambertia formosa</i> Mountain Devil		R	N		
	<i>Lomatia silaifolia</i> Wild Parsley	R				
	<i>Persoonia lanceolata</i>		R			
	<i>Persoonia levis</i>		R	N		
	<i>Petrophile pulchella</i>	N		R		
	<i>Petrophile sessilis</i>	R		C		
<i>Ranunculaceae</i>	<i>Clematis aristata</i> Old Man's Beard	R				
<i>Rutaceae</i>	<i>Correa alba</i>		R	R		
	<i>Eriostemon australasius</i> Pink Wax Flower	C	R	A		
	<i>Eriostemon buxifolius</i> ssp obovatus			C		
<i>Sapindaceae</i>	<i>Dodonea triquetra</i> Hop Bush		C			

FAMILY	SPECIES	WOODLAND	FOREST	HEATH	RAINFOREST	MANGROVES
<i>Smilacaceae</i>	<i>Ripogonum album</i> White Supplejack <i>Smilax glyciophylla</i> <i>Sarsaparilla</i>				N N	
<i>Sterculiaceae</i>	<i>Lasiopetalum ferrugineum</i> <i>Lasiopetalum rufum</i>	R	R			
<i>Thymelaeaceae</i>	<i>Pimelia linifolia</i> Rice Flower	A	C	A		
<i>Tremandraceae</i>	<i>Tethratheca shiresii</i>			N		
<i>Umbelliferae</i>	<i>Actinotus helianthi</i> Flannel Flower <i>Actinotus minor</i> <i>Hydrocotyle vulgaris</i> Penny Wort <i>Platysace lanceolata</i> <i>Platysace linearifolia</i> <i>Xanthosia pilosa</i>	C C A C	A A R N	C N C A		A
<i>Verbenaceae</i>	<i>Clerodendrum tomentosum</i>		A			
<i>Violaceae</i>	<i>Viola hederacea</i> Ivy-leaved Violet		A	A		
<i>Vitaceae</i>	<i>Cissus hypoglauca</i> Native Grape		R		N	
<i>Xanthorrhoeaceae</i>	<i>Lomandra filiformis</i> <i>Lomandra longifolia</i> <i>Lomandra multiflora</i> <i>Lomandra obliqua</i> <i>Xanthorrhoea media</i> ssp <i>media</i> Black boy	R C R N	 N N	 C R		
<i>Zamiaceae</i>	<i>Macrozamia communis</i> Burrawang	N			N	