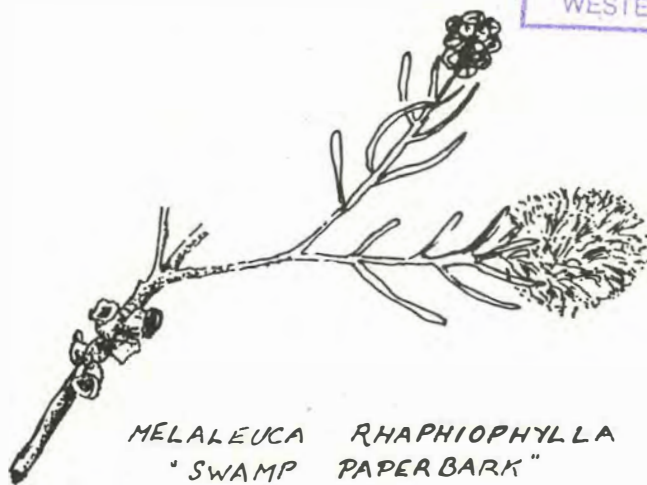


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# LESCHENAULT INLET MANAGEMENT AUTHORITY

## Fringing vegetation of the Lower Collie and Brunswick Rivers 1992

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MELALEUCA RHAPHIOPHYLLA  
"SWAMP PAPERBARK"

Waterways Commission  
Report No 37  
1993



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**FRINGING VEGETATION  
OF THE LOWER COLLIE  
AND BRUNSWICK  
RIVERS 1992**

Report to the Leschenault Inlet  
Management Authority  
**Dr L J Pen**

Waterways Commission  
184 St Georges Terrace  
Perth WA 6000

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# FOREWORD

The fringing vegetation of the Collie and Brunswick Rivers between the Collie Bridge and the South West Highway was classified and the resultant vegetation types mapped.

Twenty-two vegetation types were described of which 16 were recognised as plant communities and one as a complex of undescribed plant communities. They were divided into salt-marsh (3), fringing vegetation (1), estuarine fringing forest (6), freshwater riverine fringing forest (1 complex and 1 community), sandy rise vegetation (1), other plant communities and vegetation types (5) and pastured woodlands (4).

Downstream estuarine areas support much healthier fringing vegetation than the freshwater upstream areas and over most of the study area the native understorey of forest communities has been almost completely replaced by introduced weeds, with only a few native species remaining. Three species, a small tree, *Melaleuca lateritia*, and two tall sedges, *Baumea articulata* and *B. riparia*, are considered to have suffered major contractions in distribution. Native tree regeneration is particularly strong along the lower Brunswick River.

The main management considerations include foreshore erosion, especially upstream of the Bunbury Bypass, the conservation and rehabilitation of associated wetlands, landscape conservation, the control of weed species and native vegetation rehabilitation.

## **TERMS OF REFERENCE**

This report is the second in a series of studies that the Leschenault Inlet Management Authority is undertaking to determine the status of vegetation abutting the waterways. The first report Fringing Estuarine Vegetation of the Leschenault Estuary was release in 1992. Other proposed studies will look at the vegetation of the Wellesley River, the vegetation of the Preston and Ferguson and the vegetation of the Upper Collie and Brunswick Rivers.

## **ACKNOWLEDGEMENTS**

The author expresses his gratitude to Scott Woodcock, Bev Thurlow and Eric Wright and other officers of the Waterways Commission. Thanks also to Greg Baxter for the preparation of maps and figures in the document.

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# **1. INTRODUCTION**

The Collie and Brunswick Rivers drain an area to the east of the Darling Scarp and a small section of the Swan Coastal Plain. Below the Scarp and west of the South West Highway, both rivers generally meander across the coastal plain in an western direction for about 9 km before taking a sharp turn to the south. In this region the rivers cut moderately deep into flood plain alluvial soils which support agriculture based on livestock grazing; especially irrigated dairy farming on the Brunswick. The flood plains are mainly cleared for pasture and for the most part only remnant scattered trees remain to represent the native vegetation. There are few properly maintained fences to protect the rivers and as a consequence livestock have caused severe erosion of the river channel embankments. Fringing vegetation along the river banks mainly consists of trees, many of which are undermined through erosion. Small wetlands, most of which have permanent or seasonal standing water, are often found on the flood plain in this region.

The Wellesley River, which receives water from an artificial drainage system near Harvey, joins the Brunswick about 1 km above the Bunbury Bypass.

After turning to the south, the Brunswick River flows for about 4 km and becomes increasingly estuarine as it approaches the Leschenault Estuary. Similarly, the Collie River flows south for about 2 km, before turning west again and flowing 2.5 km to empty into the Leschenault Estuary. The Collie becomes increasingly estuarine downstream of the Bunbury Bypass. Tidal lagoons, deltaic islands, salt-marshes and broad healthy stands of fringing vegetation are features of this estuarine region of the two rivers.

## **2. THE STUDY AREA AND AIMS OF THE STUDY**

The study area consists of the land along the Collie and Brunswick Rivers between the South West Highway and the Collie River bridge near the Leschenault Estuary (Fig. 2.1). It includes the river channel embankments, the floodways and flood plains of the rivers and the river valley embankments which rise immediately above them (see Fig. 2.2 for an explanation of the terms used to describe river valley form).

The aims of the study were as follows:

1. To classify and map the fringing vegetation of the Collie and Brunswick Rivers between South West Highway and the Collie Bridge,
2. To identify the major management issues concerning the conservation of fringing vegetation in the study area, and
3. To consider the general quality of the vegetation and to make recommendations for its conservation and rehabilitation.

## **3. VEGETATION DESCRIPTION AND MAPPING**

Colour aerial photographs of the study area taken in 1989 at 1:10 000 scale were obtained from the Department of Land Administration (see Appendix 1) and sketchmaps to a 1: 5 000 scale were produced using a Ziess Aerosketchmaster. These sketchmaps were drawn up to convey information on the distribution of vegetation and vegetation type, standing water and landuse (eg. pasture or urban).

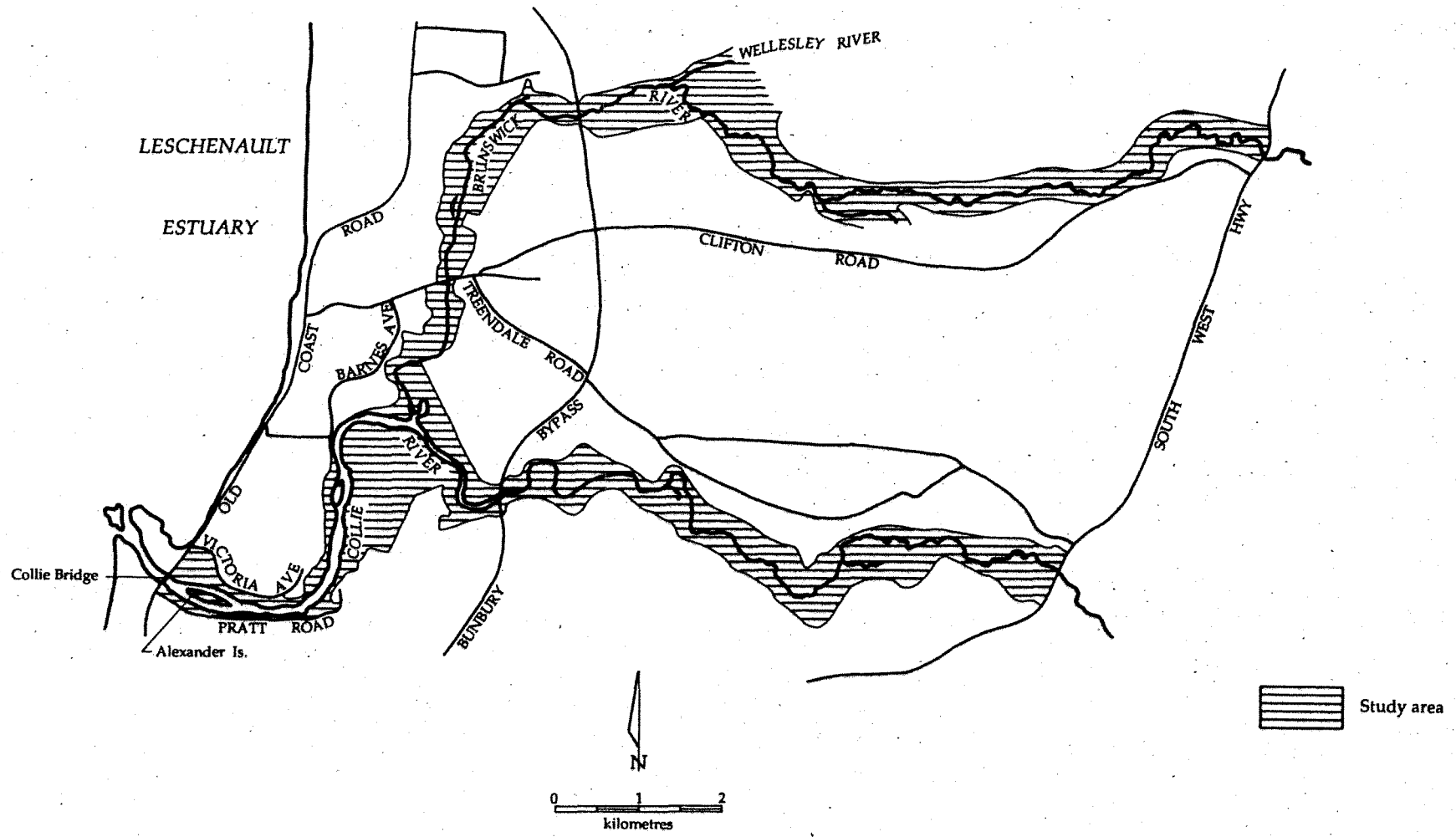


Figure 2.1: Collie and Brunswick Rivers study area.

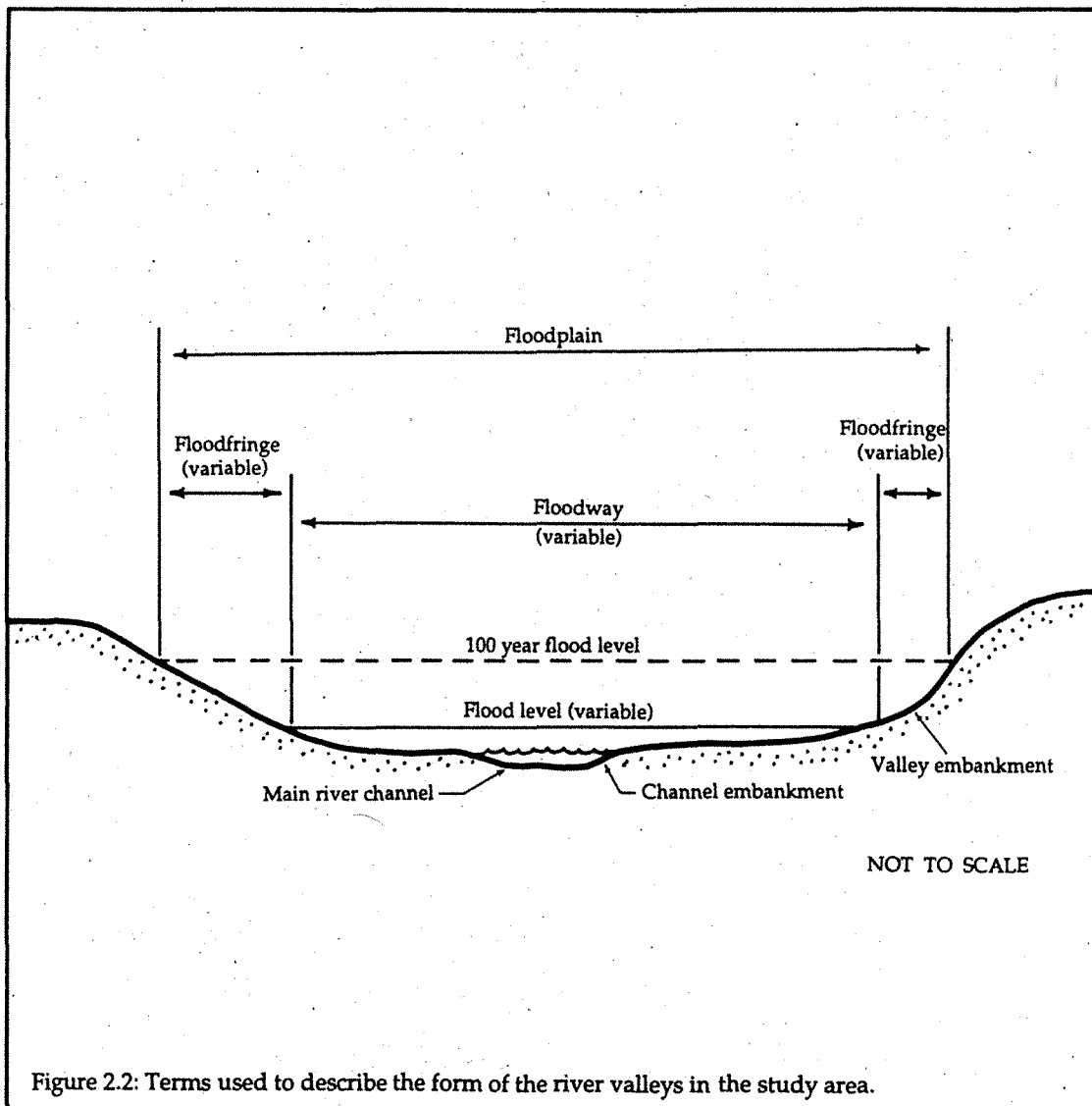


Figure 2.2: Terms used to describe the form of the river valleys in the study area.

The sketchmaps were taken into the field over the period 7 - 9 June 1992 and annotated with relevant information on plant community composition and structure and weed infestations.

Unknown species were submitted to the WA Herbarium for identification.

Plant communities were identified and described on the same structural and dominant species basis as that used by Trudgen (1984) and Pen (1992) for the Leschenault Peninsula and Estuary, respectively. This was done to create a continuity of the description of the vegetation of the region.

## 4. VEGETATION OF THE COLLIE AND BRUNSWICK RIVERS BELOW THE SOUTH WEST HIGHWAY

The fringing vegetation of the Collie and Brunswick Rivers in the study area can be divided into six categories: salt-marsh, fringing vegetation, estuarine fringing forest, freshwater (riverine) fringing forest, sandy rise vegetation and other plant communities and vegetation types.

### 4.1 Salt-marsh vegetation

*Sarcocornia quinqueflora* closed herbland

This community is dominated by the low samphire *Sarcocornia quinqueflora* which commonly forms mat like meadows over broad areas. It is very common along the periphery of the main basin of the Leschenault Estuary, but in the study area it is restricted to an extensive saline flood plain north east of the Collie Bridge (Map 1) and a tiny area near the mouth of the Brunswick River, where it forms the most upstream example of the community on the estuary. Associated species include seablite (*Suaeda australis*) and *Sarcocornia blackiana*; the latter species is very similar to *S. quinqueflora* but is more shrub-like in appearance. Shorerush (*Juncus kraussii*) can be found fringing in areas.

*Halosarcia indica bidens* low open heath

The shrubby glasswort (*Halosarcia indica bidens*) is a large shrub, reaching 2 m in height, which forms an open heath in relatively high but saline regions of the salt-marsh (Pen, 1981). As with the above community, it is only found in the area north-east of the Collie Bridge in the study area (Map 1). Here the community also consists of *S. quinqueflora* and saltwater couch (*Sporobolus virginicus*) and a species of introduced annual rye grass (*Lolium* sp.). The small trees *Melaleuca viminea* and the swamp sheoak (*Casuarina obesa*) are very occasional in the community. Unfortunately, this particular salt-marsh is highly disturbed and the community has become infested with annual weeds.

*Juncus kraussii* closed sedgeland

Shore-rush (*Juncus kraussii*) forms small bands along the river channel near the Collie Bridge and extensive broad stands on or about tidal lagoons along the lower sections of the Collie and Brunswick Rivers. Usually it backs onto low closed forest dominated by freshwater paperbarks (*Melaleuca raphiophylla* and *M. viminea*) and saltwater sheoak (*Casuarina obesa*). The largest stands are located around the tidal lagoons near the junction of the Collie and Brunswick Rivers (see Maps 3 and 8).

## 4.2 Fringing vegetation

### *Bolboschoenus caldwellii* closed sedgeland

The club-rush *Bolboschoenus caldwellii* forms very narrow bands, of no more than a metre or two in width, along that section of the Brunswick River lying between the Clifton Road Bridge and the Bunbury Bypass Bridge. The species is annual in nature, dying off over the dryer part of the year, and regrowing from underground rhizomes during winter and spring.

*Bolboschoenus caldwellii* is known to be invasive on salt-marshes and at one stage was thought to be introduced (Brock and Pen, 1984; Green, 1982). However, it is now considered by some plant taxonomists to be a native species which behaves very much like a weed (Marchant *et al.*, 1987; Marchant pers. comm.).

## 4.3 Fringing estuarine forest vegetation

### *Casuarina obesa* - *Melaleuca raphiophylla* - *Eucalyptus rudis* low open - closed forest

In the lower reaches of the Collie River, the fringing vegetation immediately adjacent to the river is dominated by the small trees saltwater sheoak (*Casuarina obesa*) and swamp paperbark (*Melaleuca raphiophylla*) and the medium to tall tree flooded gum (*Eucalyptus rudis*). The saltwater sheoak reflects the saline conditions of the estuary, as does the dominant understorey species, which is shorerush (*Juncus kraussii*) (Pen, 1981). The best stands of this community are found on Alexander and Snake Islands (see Maps 1 and 2).

### *Casuarina obesa* - *Eucalyptus rudis* open - closed forest

A community, consisting basically of saltwater sheoak (*C. obesa*) and flooded gum (*E. rudis*) over shorerush (*J. kraussii*), lines most of the Collie River between the Bunbury Bypass Bridge and the Collie Bridge (see Maps 1 to 3). Swamp paperbark (*M. raphiophylla*) is present only occasionally. This community usually exists as a thin band along the river, either backing onto fringing forests or pasture. Seldom does it extend more than a few metres in from the immediate foreshore and as such it probably reflects the more saline conditions of the river periphery. If it does, then the estuary would appear to extend only a few hundred metres upstream of the Bunbury Bypass, where the sheoak is replaced by swamp paperbark, and shorerush by twig rush (*Baumea juncea*) and the large shrub *Astartea fascicularis*, as well as by many introduced weeds (see Section 5.1).

### *Casuarina obesa* - *Melaleuca raphiophylla* low closed forest

At the entrance of a large tidal lagoon on the Collie River, saltwater sheoak (*C. obesa*) and swamp paperbark (*M. raphiophylla*) form a low closed forest (see Map 2). The understorey is comprised mainly of shorerush (*J. kraussii*), which also forms a closed sedgeland on adjacent lower, and probably more saline, ground.

### *Casuarina obesa* low open - closed forest

A few small stands of saltwater sheoak (*C. obesa*) over mainly shorerush (*J. kraussii*) are found at the downstream end of Alexander Island (Map 1). The community is typical of the delta regions of rivers entering Swan coastal plain inlets.

#### *Melaleuca viminea* low open - closed forest

On the saline tidal flat area north-east of the Collie Bridge the small paperbark (*Melaleuca viminea*) forms a community with a number of salt-marsh species which occupy the understorey. They include shrubby glasswort (*H. indica bidens*), samphire (*S. quinqueflora*), seablite (*S. australis*) and rye grass (*Lolium* sp.) (see Map 1).

#### *Melaleuca raphiophylla* low closed forest

The swamp paperbark (*Melaleuca raphiophylla*) forms a closed forest over shore-rush in the lower estuarine regions of the Collie River, probably as a result moderate freshwater flushing arising from the groundwater table (see Map 1). The small paperbark, *Melaleuca viminea*, is sometimes present in patches in this community and the flooded gum (*E. rudis*) and the tufted sedge *Gahnia trifida* may be present in fresher areas fringing freshwater forest. The sheoak is often found fringing in more saline areas.

### 4.4 Fringing freshwater (riverine) forest vegetation

#### *Eucalyptus rudis* - *Melaleuca raphiophylla* forest complex

By far the more dominant plant species in the study area are the medium tree flooded gum (*E. rudis*) and the small tree swamp paperbark (*M. raphiophylla*). Both are found throughout the study area and in a range of situations, including flood plain, wet depressions and along the river bank.

Variation in the distribution of native understorey species suggests that these two tree species, together with a range of native trees, shrubs and sedges, once characterised a number of distinct plant communities. Unfortunately, the study area today is so greatly disturbed through frequent burning and livestock damage that recognition of these plant communities is no longer possible. This is because, in most areas, the native understorey has been almost entirely replaced by a huge range of introduced weeds, with only a few sparsely distributed native species remaining. Furthermore, the seemingly chaotic distribution and variation in composition of weed species in the understorey prevents any recognition of pattern using the simple descriptive method of this study. For this reason, vegetation dominated by flooded gum and swamp paperbark has been described as a complex of, as yet, undescribed plant communities.

The most pristine stands of this complex are found in the lower section of the Collie River below Snake Island (see Map 2). Here, except in small areas cleared for parkland, the understorey is largely intact. However, upstream the understorey becomes progressively replaced by weeds until by the junction of the Collie and Brunswick Rivers only a few native species remain.

A number of trees are occasional members of this complex. In the estuarine lower section of the Collie River, the saltwater sheoak (*C. obesa*) is often found fringing near the water, while the small paperbark *Melaleuca viminea* is occasionally present in patches. Elsewhere, the medium to tall tree marri (*Eucalyptus calophylla*) fringes on the landward side and the small tree peppermint or native willow (*Agonis flexuosa*) is occasionally to commonly present throughout the study area. The small paperbarks *Melaleuca incana* and *M. lateritia* are only rarely found upstream of Snake Island along both rivers.



In the healthier stands, the middle storey is dominated by the tall shrub golden spray (*Viminaria juncea*). Other shrubs include *Oxylobium lineare*, *Acacia saligna*, *A. pulchella* and *Astartea fascicularis*. The native understorey is largely comprised of a number of sedge and rush species including coastal saw sedge (*Gahnia trifida*), shore-rush, *Juncus pallidus*, *Juncus* sp. 1, twig rush (*Baumea juncea*) and common sword sedge (*Lepidosperma longitudinale*). *Lepidosperma gladiatum* and *L. tetraquetrum* are more occasional, while the twig rushes *Baumea articulata* and *B. riparia*, are found in the more water logged sites. Native ground covers include mat grass (*Hemarthria uncinata*) and small pennywort (*Centella cordifolia*).

The main weeds of the understorey include watsonia (*Watsonia bulbilifera*), swans down (*Asclepias* sp.), kikuyu (*Pennisetum clandestinum*), couch (*Cynodon dactylon*), buffalo grass (*Stenotaphrum secundatum*), pampas grass (*Cortaderia selloana*), rye grass (*Lolium* spp.), paspalum (*Paspalum dilatatum*), clubnut rush (*Cyperus* sp.), blackberry brambles (*Rubus* spp.), dock (*Rumex crispus*) and wild aster (*Aster subulatus*). Arum lily (*Zantedeschia aethiopica*) is common in wetter spots, while persicaria (*Polygonum minus*) and watercouch (*Paspalum distichum*) are common along the immediate riverbank upstream of the junction of the rivers.

On the Brunswick River below its junction with the Wellesley River and on the Collie below the Bunbury Bypass, the *E. rudis* - *M. rhapsiophylla* forest complex forms broad stands on river flood plain. However, upstream of these points the rivers begin to cut more deeply into the surrounding land and broad flood plain is largely absent or is present on higher ground. In this situation, both rivers support only a narrow and often broken fringe of flooded gum and swamp paperbark, with fringing marri and peppermint, over pasture, which, in the absence of properly maintained fences, often extends to the riverbank. In fenced off sections the understorey consists mainly of weeds. On the Collie River, the main weeds include kikuyu, couch, paspalum, club-rush and watercouch, while on the Brunswick River they include these species as well as buffalo grass, brambles, soursob (*Oxalis pes-caprae*), pink oxalis (*O. articulata*), bridle creeper (*Myrsiphyllum asparagoides*) and clubnut rush. Some particularly large weeds are to be found on the Brunswick River in this region, including giant reed (*Arundo donax*), willow tree (*Salix* sp.) and very occasionally fig tree (*Ficus carica*). Despite severe physical disturbance by livestock and the abundance of weeds, a few sparsely distributed relic species remain, including *Astartea fascicularis*, on both rivers, twig rush, shore-rush and the small tree *Melaleuca incana*, on the Collie River and *Carex appressa*, *Juncus pauciflorus* and *J. subsecundatus* on the Brunswick River.

#### *Eucalyptus calophylla* open - closed forest

Narrow stands of this community are found on moist soils along the edge of the Collie River valley below Snake Island (see Map 2). The dominant species is marri (*E. calophylla*) which is present as medium to tall trees. Peppermint (*Agonis flexuosa*) is common in the community, whereas flooded gum (*E. rudis*) and swamp paperbark (*M. rhapsiophylla*) are present only occasionally. The most common understorey species is common sword sedge (*L. longitudinale*). The co-occurrence of relic marri and peppermints over pasture, fringing the *E. rudis* - *M. rhapsiophylla* forest complex in many moist sites throughout the study area, suggests that this community was very widespread in the past (see Section 4.6.5).

## 4.5 Sandy rise vegetation

*Eucalyptus calophylla* - *Agonis flexuosa* open forest - tall open forest - woodland

Some sections of the lower Collie and Brunswick Rivers are flanked by moderately sloped or steep sandy rises. They support a fairly open forest or woodland of often tall marri (*E. calophylla*) and small to medium size trees of peppermint (*A. flexuosa*) (see Maps 1,2,9 and 10). Tall tuarts (*Eucalyptus gomphocephala*) and medium to tall jarrah (*E. marginata*) are present occasionally. More common are small banksia trees (*Banksia attenuata* and *B. grandis*) and the Christmas tree (*Nuytsia floribunda*). In most stands, the native understorey has been depleted by frequent burning and has largely been replaced by abundant weeds. The more common native species include the tall shrubs harsh hakea (*Hakea prostrata*), grey stinkwood (*Jacksonia furcellata*) and prickly moses (*Acacia pulchella*). Blackboy (*Xanthorrhoea preissii*) and zamia palm (*Macrozamia riedlei*) are also common. The main weeds include veldt grass (*Ehrharta calycina*), lupins (*Lupinus* spp.), wild oats (*Avena* spp.) and blowfly grass (*Briza maxima*).

## 4.6 Other plant communities and vegetation types

### 4.6.1 *Melaleuca raphiophylla* low open - closed (swamp) forest

Swamp paperbark (*M. raphiophylla*) forms stands of low closed forest over small seasonal lakes along the Collie River between the Bunbury Bypass and the South West Highway (see Maps 5, 6, 7 and 11). In other areas, where *M. raphiophylla* is regenerating in wet depressions or seasonal lakes, it forms a low open forest. In time, as the trees grow, the canopy will widen to form the closed forest form.

### 4.6.2 *Baumea articulata* closed sedgeland

In a few localities on the Brunswick River below the Bunbury Bypass the tall sedge jointed twig rush (*Baumea articulata*) forms a closed sedgeland, often near or in standing water (see Maps 8 to 10).

### 4.6.3 *Juncus pauciflorus* open sedgeland

A rush (*Juncus pauciflorus*), somewhat similar to shore-rush (*J. kraussii*), forms scattered clumps on extensive areas of pasture along the Brunswick River below the Wellesley River (see Maps 9 to 11). It is not known at this stage whether the community is natural or represents an infestation of pasture by this native species.

### 4.6.4 *Typha orientalis* closed sedgeland

The introduced bulrush, *Typha orientalis*, infests a number of very wet or inundated freshwater sites, particularly along the Brunswick River (see Maps 8, 9 and 11).

### 4.6.5 Pastured woodlands

Much of the study area has been cleared for the establishment of pasture or the creation of parkland. In most cases all that remains of the old native forest and woodland communities which once lined the rivers are their larger trees. These trees now form pastured woodlands which impart a unique landscape and character to much of the study area. A stand of ageing *E. rudis* woodland is found adjacent to salt-marsh, north-east of the Collie Bridge and smaller

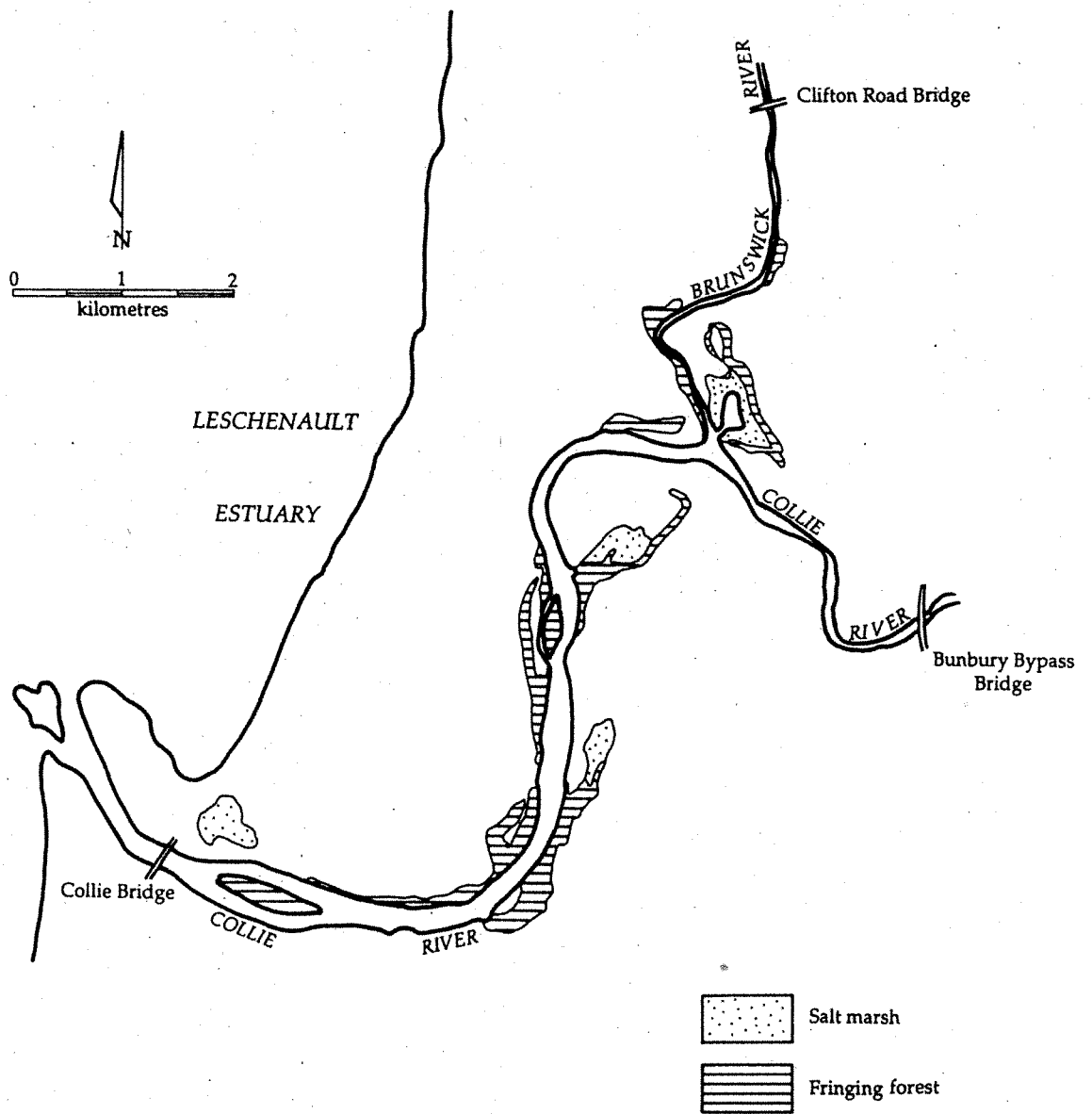


Figure 5.1: Areas of high quality fringing vegetation, including forest with largely intact native understorey, along the lower Collie and Brunswick Rivers.

stands are to be found upstream. A small stand of *E. rudis* - *M. raphiophylla* woodland is on the northern bank of the Collie River just upstream of Alexander Island (see Map 1). *Eucalyptus rudis* - *A. flexuosa* woodland is commonly found on the narrow flood plains of both rivers above the Bunbury Bypass and probably represents the relic of a forest community dominated by flooded gum and peppermint, which is no longer extant in the study area. On the sides of the river valleys, the *E. calophylla* - *A. flexuosa* woodland is common and may also be found over adjacent higher pastured land. This woodland is probably a relic of the *Eucalyptus calophylla* - *Agonis flexuosa* open forest - tall open forest - woodland, which was most probably very widespread in the study area prior to the advent of Europeans.

#### 4.6.6 Mixed sedgeland and weed community

A mixed sedgeland of the introduced sedges club-rush, clubnut rush and bulrush and the native sedges jointed twig rush and shorerush is found in one locality along the Brunswick River (Map 9). The weeds couch and wild aster are particularly numerous. Regeneration of paperbarks (*M. raphiophylla* and *M. incana*) suggest that this chaotic assemblage of plants is only transitory and will be replaced by vegetation of the *E. rudis* - *M. raphiophylla* complex in time.

## 5. NATIVE SPECIES REPLACEMENT AND REGENERATION

In the study area today, there are no plant communities which have not been invaded by introduced weeds. In most areas, native shrubs, sedges and herbs have been almost entirely replaced by exotic plant species. However, relatively natural and healthy plant communities remain along the more estuarine sections of the Collie and Brunswick Rivers (Fig. 5.1).

### 5.1 Vanishing understorey

Much of the native fringing forest which once occupied the Collie and Brunswick River valleys has been lost through the clearing of land for agriculture. What remains is largely represented by the native tree species, flooded gum, sheoak and swamp paperbark, as most of the understorey has been replaced by introduced weeds, mostly grasses. Most likely, the native shrubs, sedges, grasses and herbs were replaced slowly over time through clearing, livestock grazing and trampling and an increase in the frequency of fire which favoured species with short life cycles, most of which are introduced. In the study area today, all of the forest or woodland with largely intact understorey resides in the lower sections of the Collie and Brunswick Rivers (see Fig. 5.1). Upstream the native understorey becomes progressively sparse.

### 5.2 Resilient native understorey species

Despite the abundance of weeds and severe disturbance from livestock and fire, a few native species persist in the understorey of forest and woodland communities upstream of the junction of the rivers. They are the shrub *Astartea fascicularis*, the sedge *Baumea juncea* and the rushes *Juncus pauciflorus* and *J. subsecundatus*. In conditions of severe disturbance these species are often found growing along the immediate periphery of the rivers.

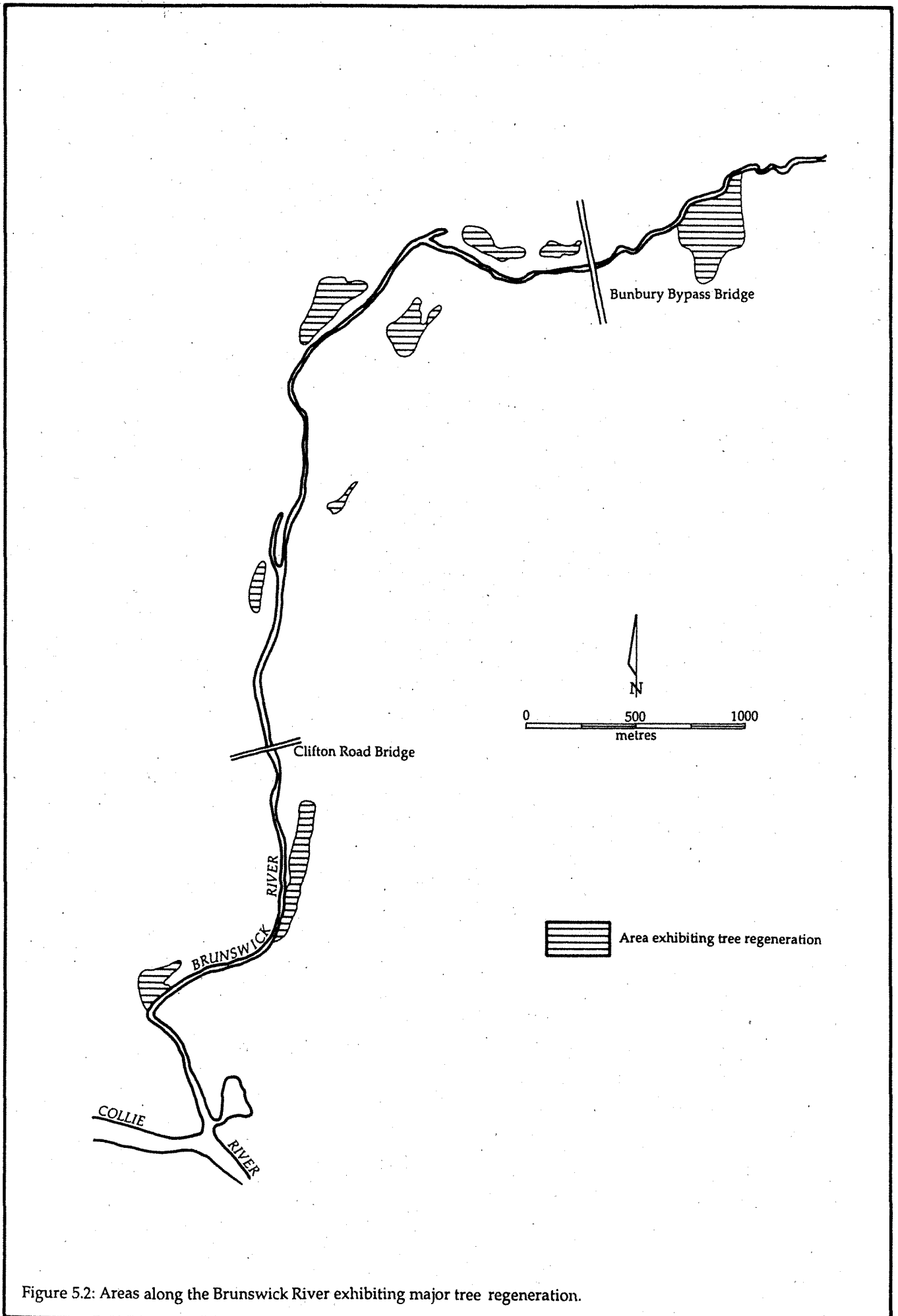


Figure 5.2: Areas along the Brunswick River exhibiting major tree regeneration.

### 5.3 Tree regeneration

There is considerable evidence of tree regeneration on old pasture on the Brunswick River below the Wellesley River. This can be seen either by the presence of seedlings and saplings over pasture and weeds or in the homogeneous size structure, and presumably age structure, of young mature stands of trees. In quite a few sites the swamp paperbark is regenerating slowly on boggy pasture, while the flooded gum shows evidence of spectacular regeneration on flood plain, where large numbers of seedlings have grown into dense stands of young trees. The paperbark, *Melaleuca incana*, which is not common in the study area, also shows significant regeneration. Figure 5.2 shows the main sites of tree regeneration along the Brunswick River.

### 5.4 Endangered species

No doubt many native species have become extinct in the study area. Some of these would have been common while others were uncommon. The loss of uncommon species is to be expected in an area subject to intensive agriculture, but the loss of species which were once widely distributed is cause for concern. Such species could have played a major rôle in the riverine ecosystem. Today, four plant species lie on the edge of extinction which would most likely have been far more abundant and widely distributed in the past, given the widespread availability of conditions which support their relic stands today. They are the tall twig rushes, *Baumea articulata* and *B. riparia*, the sedge *Carex appressa* and the tall shrub red robin (*Melaleuca laterita*). Today these species are found in only a few sites on the Brunswick River.

## 6. MANAGEMENT

### 6.1 Erosion

Erosion of the riverbank is a serious problem in certain sections of the study area. Those sections of the two rivers most seriously affected are shown in Figure 5.3.

The area with the greatest potential for severe erosion in the long term lies between Point Latour and Snake Island. Here, a very steep sandy rise flanks the river on the western bank. It supports sandy rise vegetation of *Eucalyptus calophylla* - *Agonis flexuosa* woodland, which has been greatly disturbed by four wheel drive vehicles, motorbikes, human trampling and frequent fires. These have thinned out the vegetation and undermined trees in places, leading to a major subsidence in one area which requires quick attention to prevent further serious erosion.

The Collie and Brunswick Rivers cut mostly through agricultural land used for the grazing of livestock. During the course of this study no section of either river in the study area was observed to be entirely fenced off to prevent livestock from trampling the foreshore. Some old fence lines remain in places, but these were all in disrepair. It would appear that the rivers represent defacto fences on most properties. As cattle are the main livestock in the area, the damage suffered by both rivers and their tributary creeks is very severe. Undermining of trees is a common site above the Bunbury Bypass, and would be the main cause of tree loss, which has rendered much of the upper Collie and Brunswick River channels unsupported by trees. In these sections, riverbank undercutting is most severe and sandy sediment deposits of eroded material are common on the turns of the rivers. In some sections, native shrubs and sedges and/or weeds protect the river margins, but in others there is only muddy or sandy foreshore.

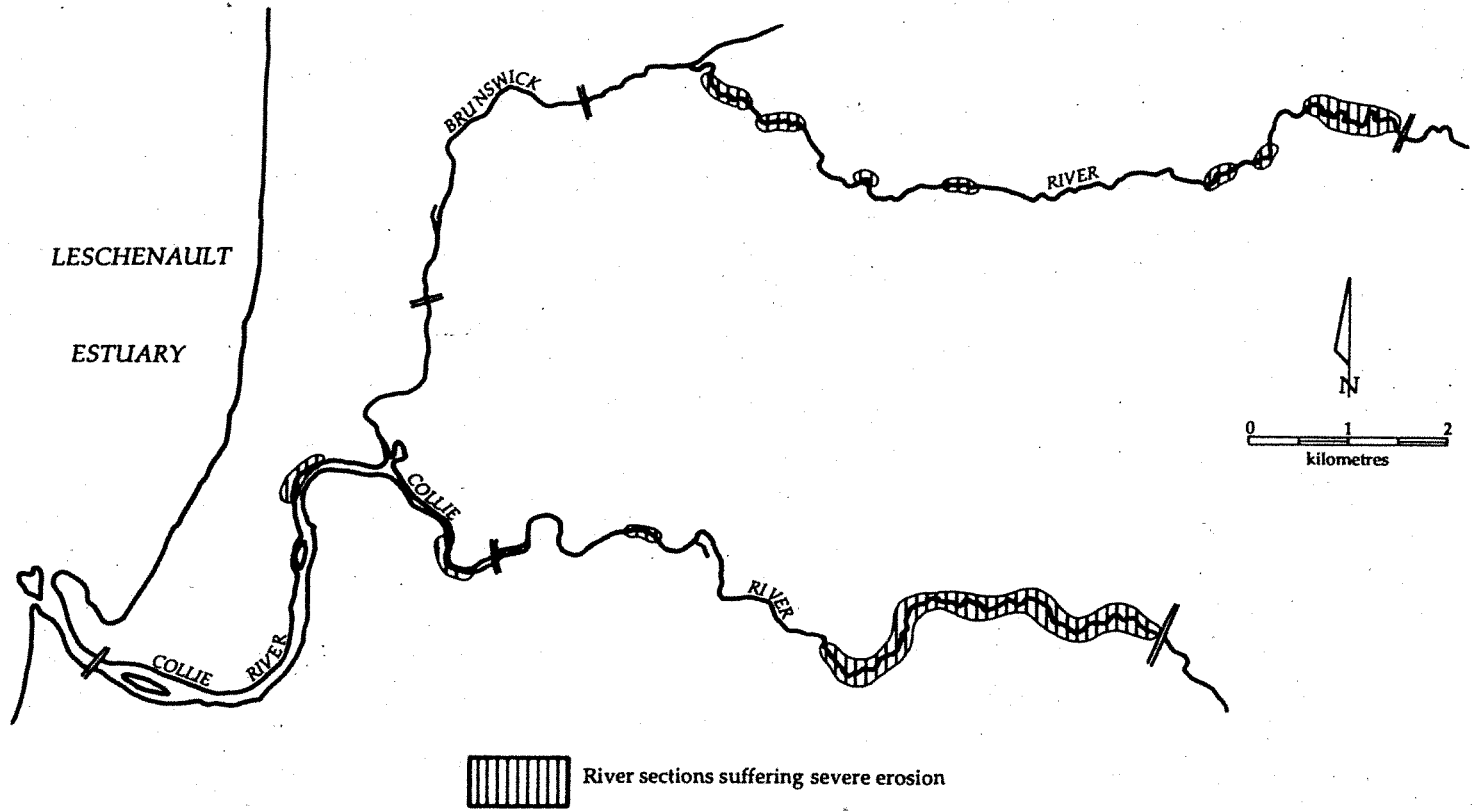


Figure 5.3: Sections of the Collie and Brunswick Rivers within the study area suffering severe erosion.

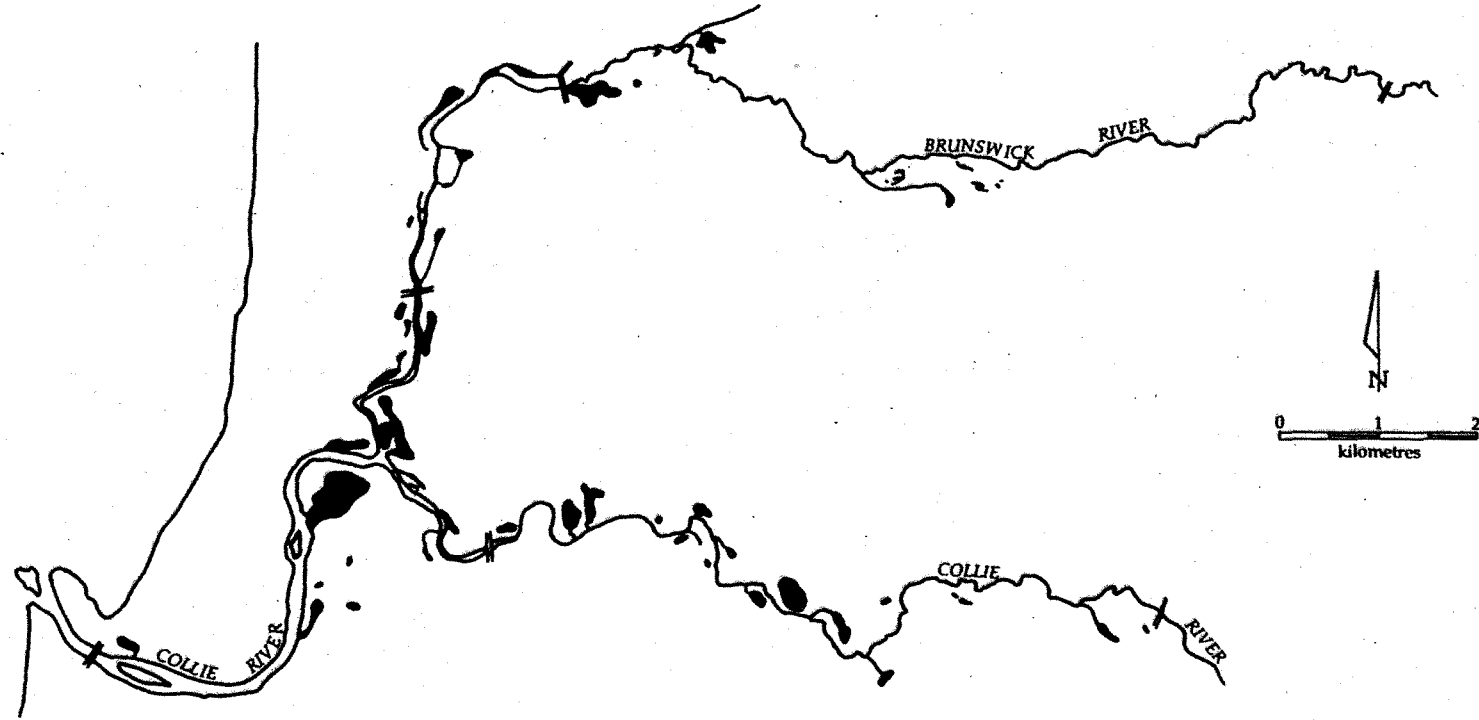


Figure 5.4: Associated wetlands of the Collie and Brunswick Rivers below the South West Highway



## 6.2 Associated wetlands

The Brunswick River below its junction with the Wellesley River and the entire Collie River in the study area have considerable numbers of associated wetlands. That is, wetlands that either connect to rivers or which lie within the river flood plain (see Fig. 5.4). These associated wetlands take a number of forms including river backwaters, tidal lagoons, freshwater lakes fringed with mature trees or small lakes which have had their fringing vegetation cleared. Some of these lakes not only have their tree cover, but also some of their original native understorey species, although all suffer the effects of severe livestock grazing and trampling.

The presence of these wetlands along rivers enhances the ecological value of the study area. This is because the wetlands increase the range of habitats present along the rivers and the rivers themselves provide ecological corridors along which animals can move freely, not only between the wetlands, but also to and from the Leschenault Estuary. Even today, there is ample evidence (footprints, scats, animal sightings) that kangaroos are able to move along the western foreshores of the Collie and Brunswick Rivers between the Collie Bridge and the Bunbury Bypass.

The number and diversity of wetlands in the study area suggest that they have sufficient ecological value for management as a regional park for wildlife conservation. Rehabilitation of fringing vegetation around some of the more disturbed wetlands would increase the ecological value of the area substantially.

## 6.3 Protection of relatively natural fringing forest

Figure 5.1 indicates the areas which presently supports the most natural stands of fringing vegetation. These areas require the highest level of protection from:

- (a) livestock trampling;
- (b) frequent fire (ie. greater than 5 years);
- (c) weed invasion (see Section 5.1);
- (d) vehicle damage; and
- (e) heavy uncontrolled human trampling.

## 6.4 Landscape

The natural or "semi-natural" landscape of the study area can be divided into six components, each of which consists of a number of elements, which may be landform, soil colour and texture, the presence of standing water and the conspicuous plant species. Each of the landscape components is described separately.

**Saline river.** This landscape type consists of shorerush overhung by sheoak, paperbark and flooded gum along the river. It is found between Snake Island and the Collie Bridge.

**Saline flats.** Here broad stands of shorerush backed by paperbarks and maybe sheoaks and flooded gum fringe either standing tidal water or dry mud flat. This landscape type is to be found on flood plain along the lower Collie and Brunswick Rivers.

**Freshwater river.** This landscape type pertains not only to the freshwater sections of the rivers, but also to the associated wetlands which retain their tree cover. The component consists of flooded gum and paperbark overhanging the river or the standing water of lakes.

**Sandy rises.** Only found along the lower Collie River, this landscape component consists of large marri trees overhanging the river from steep sandy rises of the foreshore. The smaller peppermint trees are also a conspicuous element as is the often exposed bright white sand.

**River valley embankments.** On the moderate slopes of the sides of the river floodway, marri and peppermint trees form groves over rich pasture. Old split post and wire fence lines may also be a feature.

**River flood plain.** This landscape component consists of broad expanses of pasture dotted with scattered flooded gums or broken by groves of flooded gum or more occasionally of peppermints and marri. The background often consists of a line of flooded gums and paperbarks or sheoaks with fringing groves of peppermints and isolated marri trees along the river channel or along dissecting creeks; often delineated by an old split post and wire fence in disrepair. Other features such as the remnants of old buildings, farm machinery or stock yards and the redness of the exposed alluvial soil may also be important elements in this landscape.

## 6.5 Major weed species

Major weed species are those which have the capacity to dominate an area. Not only will they replace understorey species, but in time they can even replace large shrubs and trees.

On the Collie River only pampas grass (*Cortaderia selloana*) represents such a species. Nowhere is it particularly common but it is widely distributed in the understorey of estuarine and freshwater fringing forest.

On the Brunswick River there are a number of major weed species enjoying considerable success. They include giant reed or bamboo (*Arundo donax*) and weeping willow (*Salix* sp.), in the upper reaches, and blackberry brambles (*Rubus* spp.) throughout.

Interestingly, a number of major weed species which are common or abundant along the Canning River near Perth are also found in the study area (Pen, In prep.). They include those mentioned above, the common fig (*Ficus carica*) and the vine, blue periwinkle (*Vinca major*). Although the latter two are uncommon in the study area, the presence of these species indicates that certain large introduced species are greatly favoured by the riverine conditions of the Swan Coastal Plain. On the other hand, Castor oil bush (*Ricinus communis*), which is very common along the Canning, is absent from the study area.

## 6.6 Native vegetation rehabilitation

Rehabilitation of the fringing vegetation of the study area is necessary to combat riverbank erosion and to maintain the ecology and landscape of the riverine system. A list of plant species is given below. This list has been divided into estuarine and riverine sections of the study area and further subdivided into the various zones of the river valley and adjacent land. Species which are rare or restricted in distribution should receive special attention and are denoted by an asterisk (\*).

### 6.6.1 Estuarine sections

#### Immediate foreshore or riverbank

<i>Casuarina obesa</i>	saltwater sheoak
<i>Melaleuca raphiophylla</i>	swamp paperbark
<i>Melaleuca viminea</i>	paperbark
<i>Eucalyptus rudis</i>	flooded gum
<i>Juncus kraussii</i>	shorerush

#### Upper foreshore

<i>Eucalyptus rudis</i>	flooded gum
<i>Melaleuca raphiophylla</i>	swamp paperbark
<i>Agonis flexuosa</i>	peppermint or native willow
<i>Gahnia trifida</i>	coastal saw sedge
<i>Baumea juncea</i>	twig rush
<i>Lepidosperma longitudinale</i>	common saw sedge
<i>Lepidosperma gladiatum</i>	coast sword sedge
<i>Oxylobium lineare</i>	

#### Salt-marsh

<i>Sarcocornia quinqueflora</i>	samphire
<i>Sarcocornia blackiana*</i>	samphire
<i>Suaeda australis</i>	seablite
<i>Sporobolus virginicus</i>	saltwater couch
<i>Halosarcia indica bidens</i>	shrubby samphire
<i>Melaleuca viminea</i>	paperbark
<i>Juncus kraussii</i>	shorerush

#### Tidal lagoon

<i>Melaleuca raphiophylla</i>	swamp paperbark
<i>Melaleuca viminea</i>	paperbark
<i>Casuarina obesa</i>	saltwater sheoak
<i>Juncus kraussii</i>	shorerush
<i>Gahnia trifida</i>	coastal saw sedge

## 6.6.2 Freshwater sections

### River channel embankments and foreshore

<i>Eucalyptus rudis</i>	flooded gum
<i>Melaleuca raphiophylla</i>	swamp paperbark
<i>Melaleuca incana*</i>	paperbark
<i>Casuarina obesa</i>	saltwater sheoak
<i>Astartea fascicularis</i>	Astartea
<i>Juncus kraussii</i>	shorerush
<i>Juncus pauciflorus</i>	rush
<i>Juncus subsecundatus</i>	rush
<i>Carex appressa</i>	

### Flood plain

<i>Eucalyptus rudis</i>	flooded gum
<i>Agonis flexuosa</i>	peppermint or native willow
<i>Melaleuca incana*</i>	paperbark
<i>Juncus pauciflorus</i>	rush

### Wet depression on flood plain

<i>Eucalyptus rudis</i>	flooded gum
<i>Melaleuca raphiophylla</i>	swamp paperbark
<i>Melaleuca laterita*</i>	red robin
<i>Baumea articulata</i>	jointed twig rush
<i>Baumea riparia</i>	sedge
<i>Juncus pauciflorus</i>	rush
<i>Carex appressa</i>	sedge

### River valley embankments

<i>Eucalyptus rudis</i>	flooded gum
<i>Eucalyptus calophylla</i>	marri
<i>Agonis flexuosa</i>	peppermint or native willow

### **Associated wetlands**

*Melaleuca raphiophylla*

(inundated areas)

swamp paperbark

*Eucalyptus rudis*

(fringing areas)

flooded gum

*Lepidosperma longitudinale*

common sword sedge

*Lepidosperma tetraquetrum\**

*Baumea juncea*

twig rush

*Baumea articulata\**

(inundated areas)

jointed twig rush

### **6.6.3 High sandy rises**

*Eucalyptus calophylla*

marri

*Eucalyptus gomphocephala*

tuart

*Eucalyptus marginata*

jarrah

*Agonis flexuosa*

peppermint or native willow

*Nuytsia floribunda*

Christmas tree

*Banksia attenuata*

candle banksia

*Banksia grandis*

bull banksia

*Acacia pullchella*

prickly moses

*Macrozamia reidleyi*

zamia palm

*Xanthorrea preissii*

black boy

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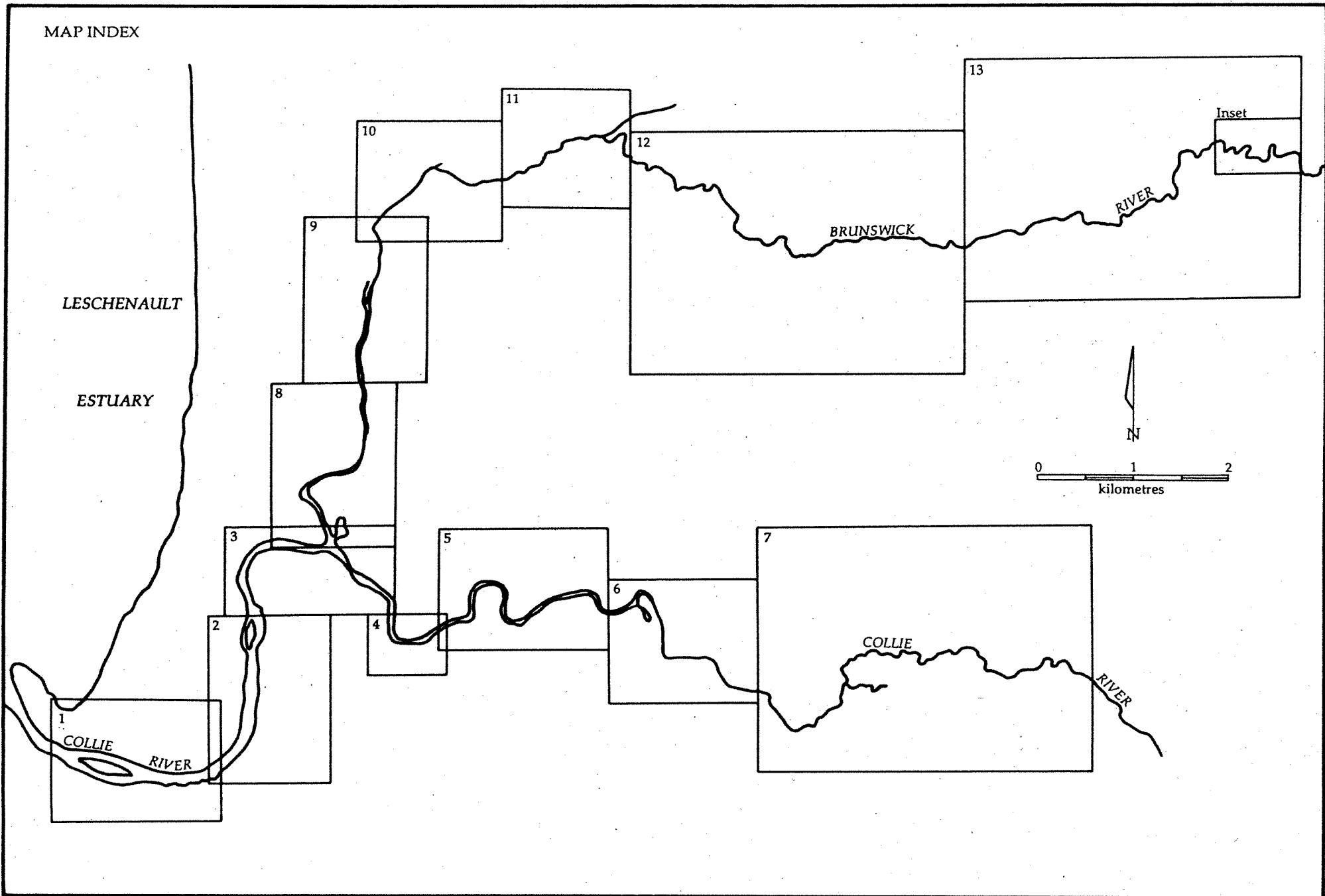
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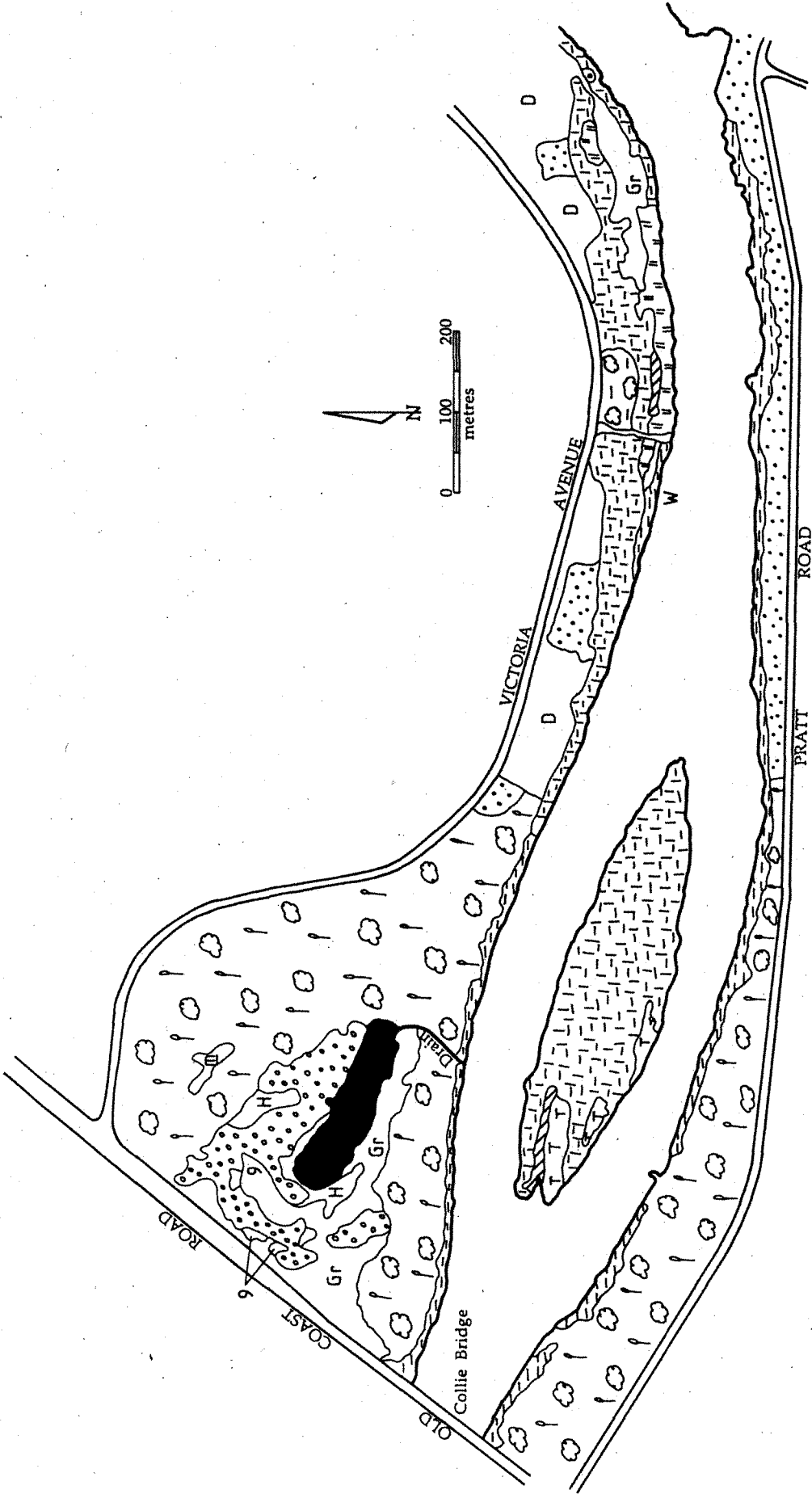
Pen, L. J. (1993) Fringing vegetation of the Canning, Southern and Wungong Rivers. Swan River Trust Report.

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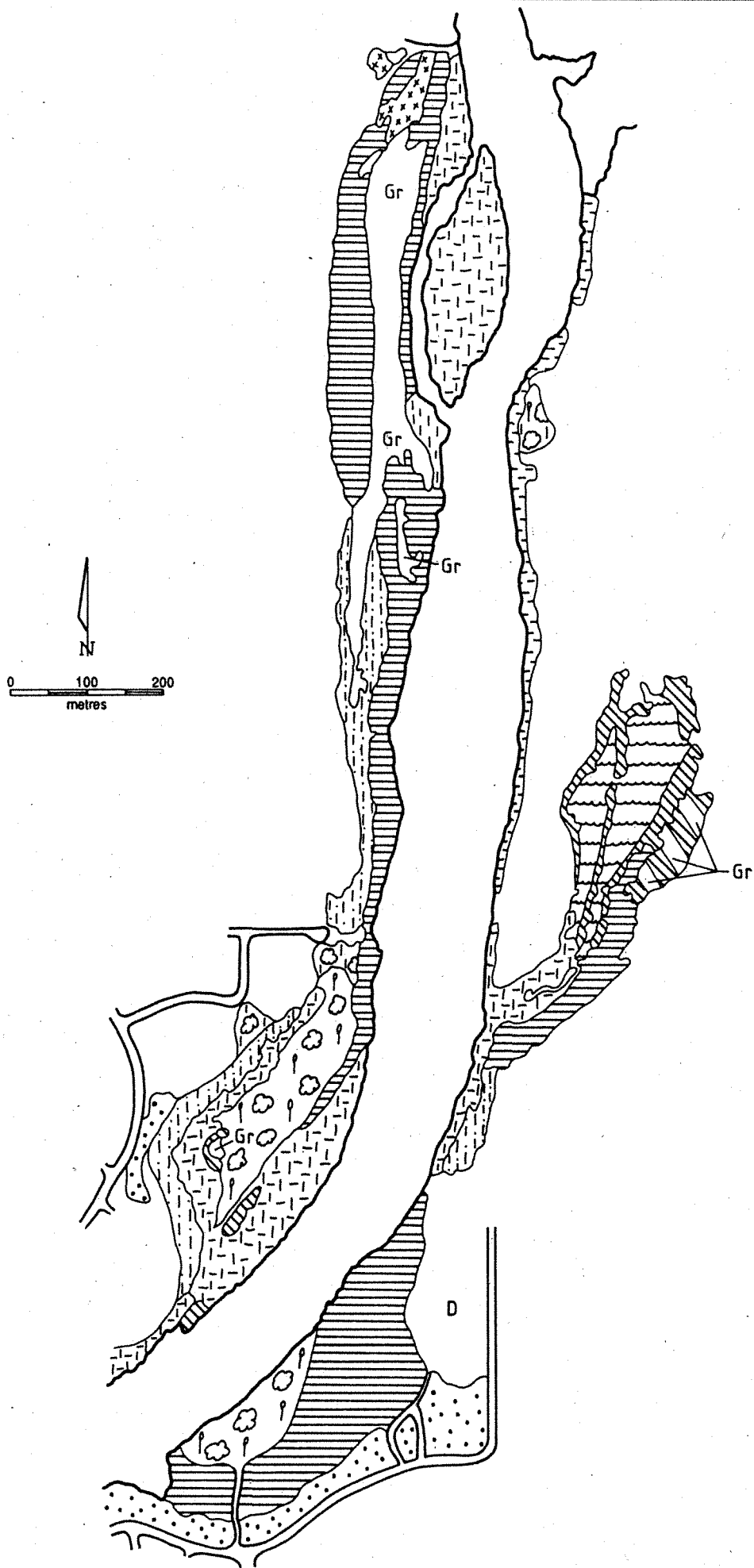
MAP INDEX

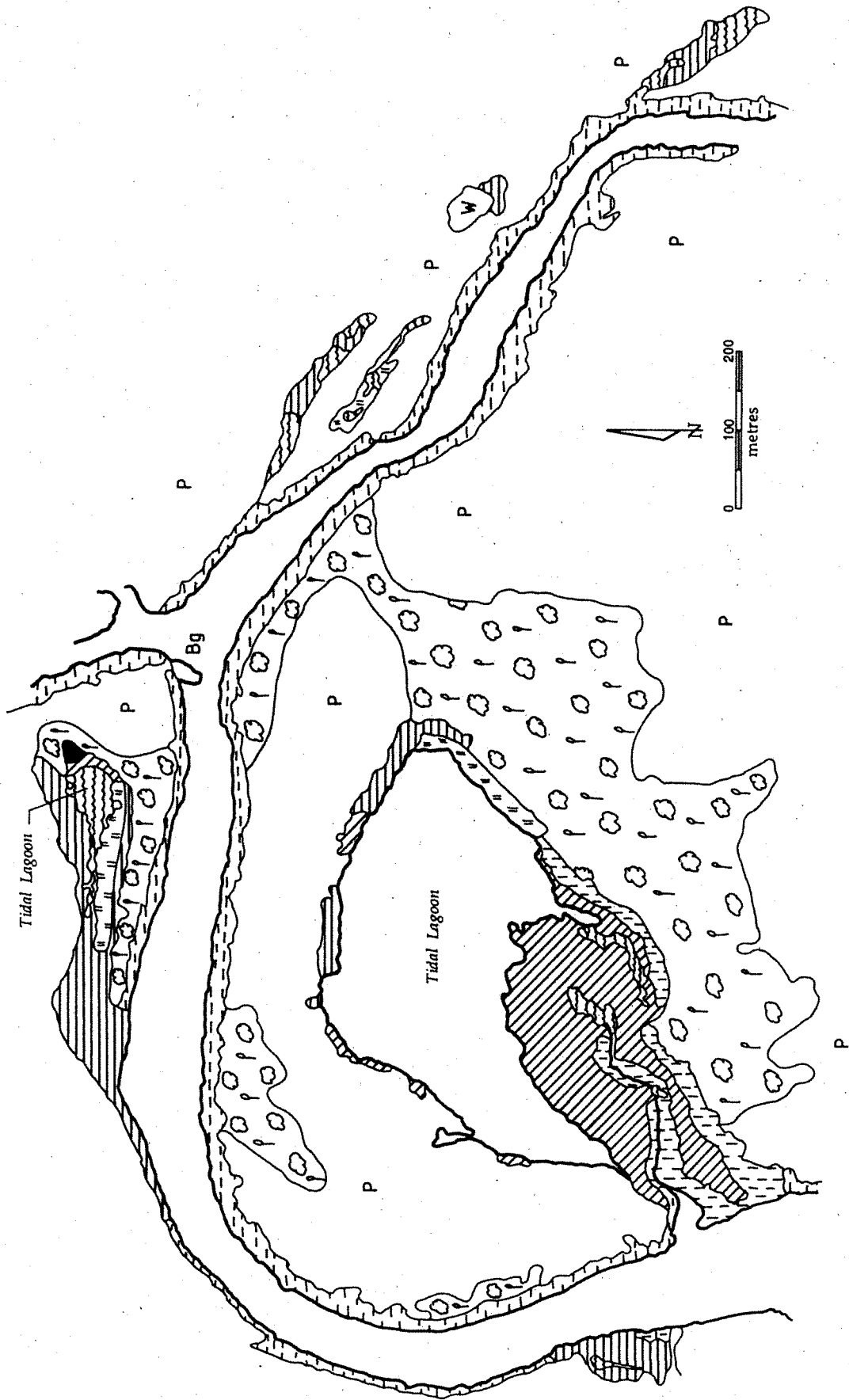


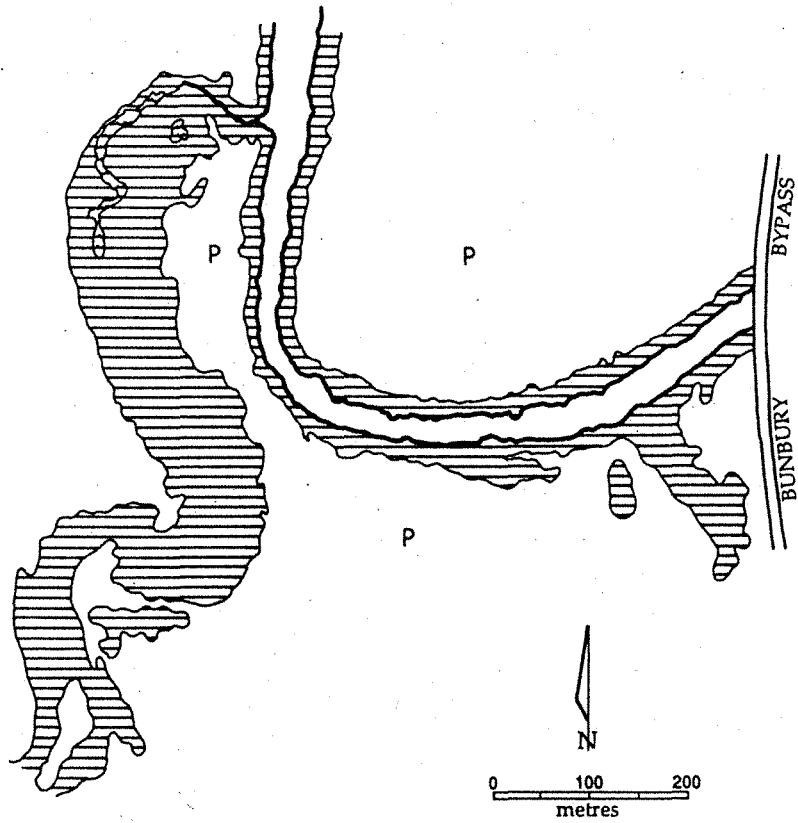
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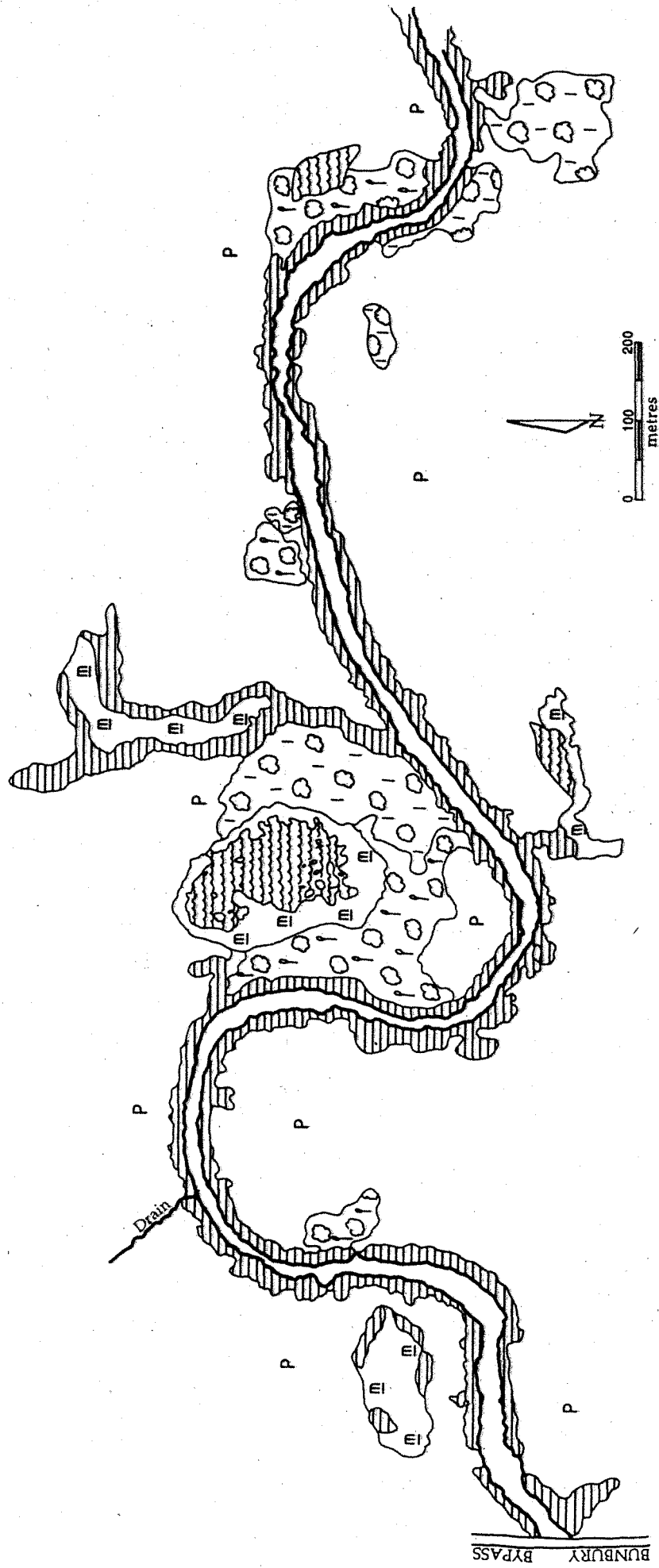


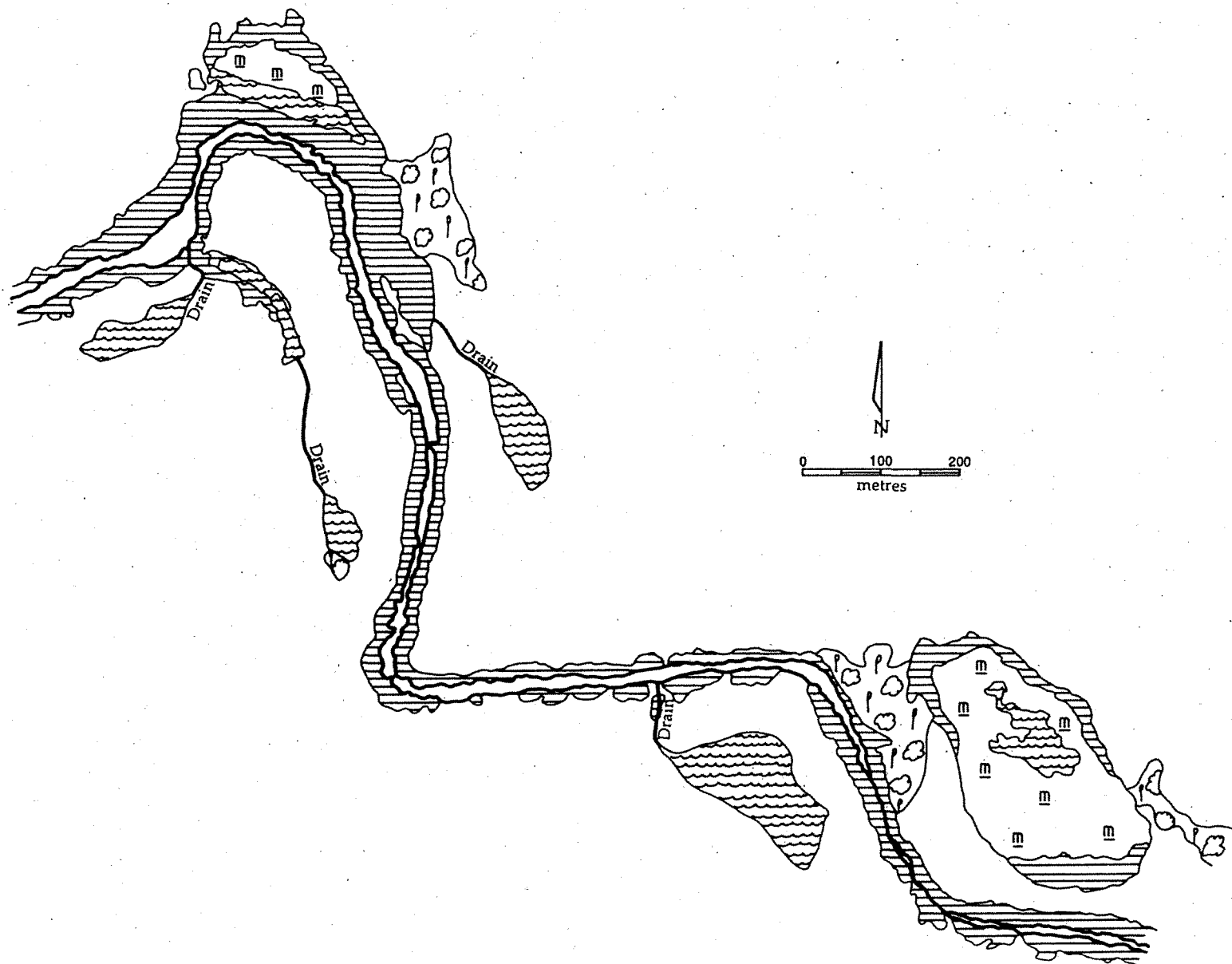


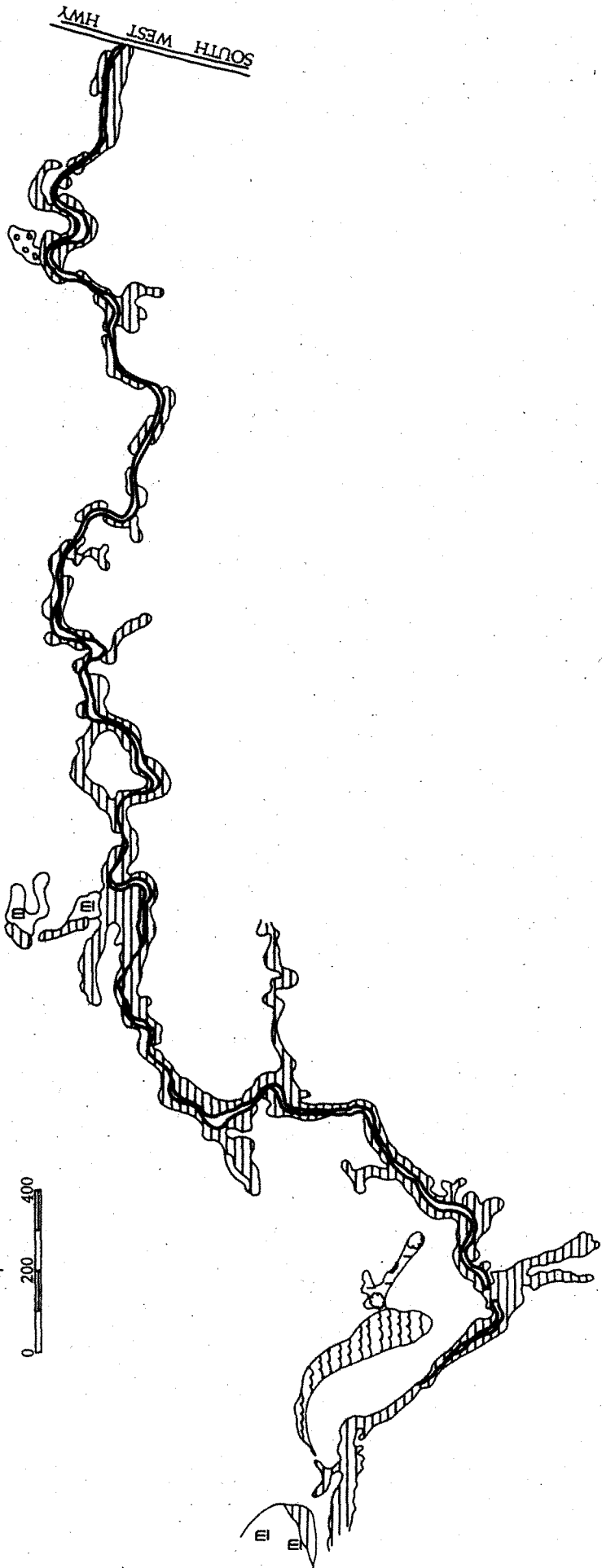


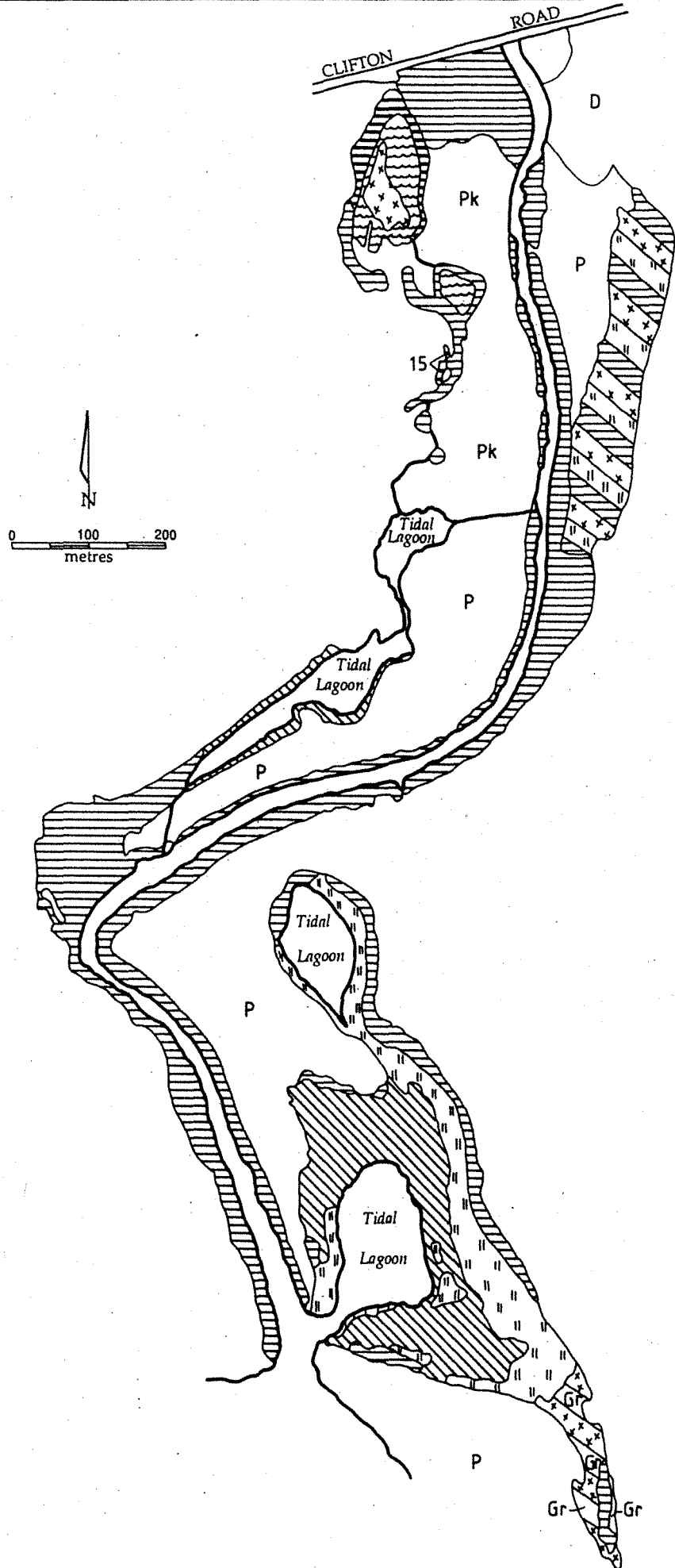


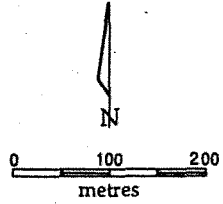
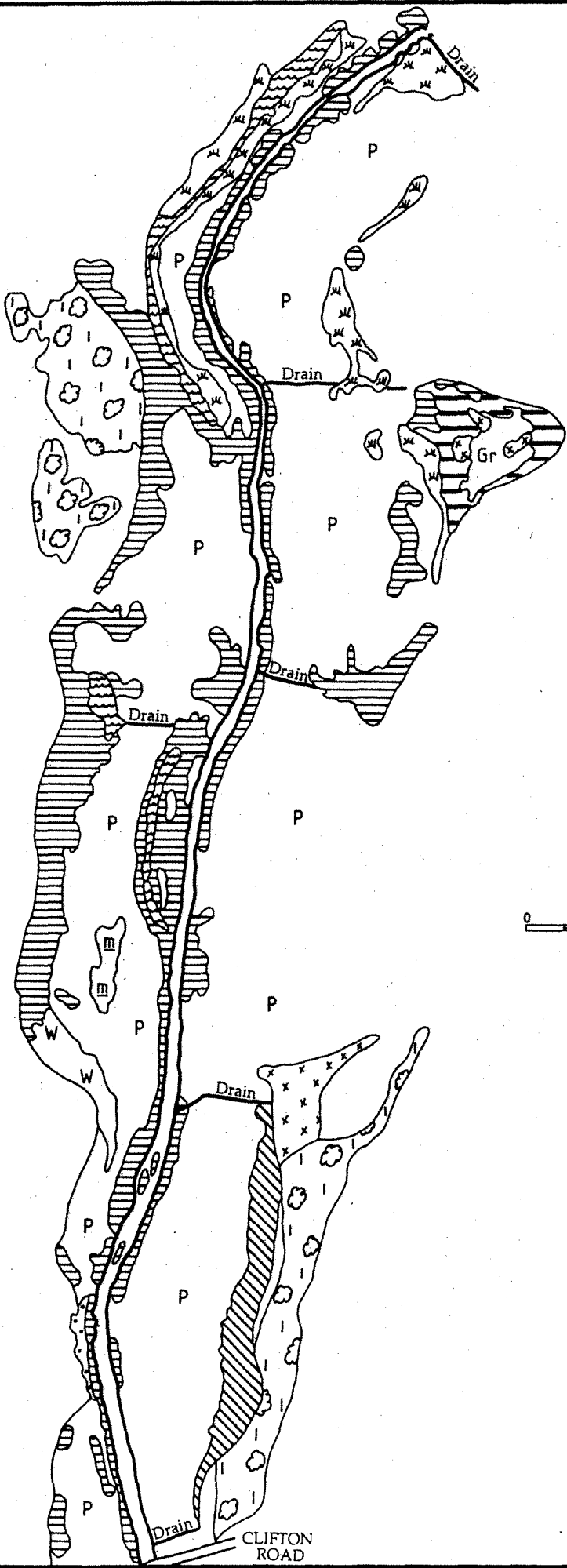






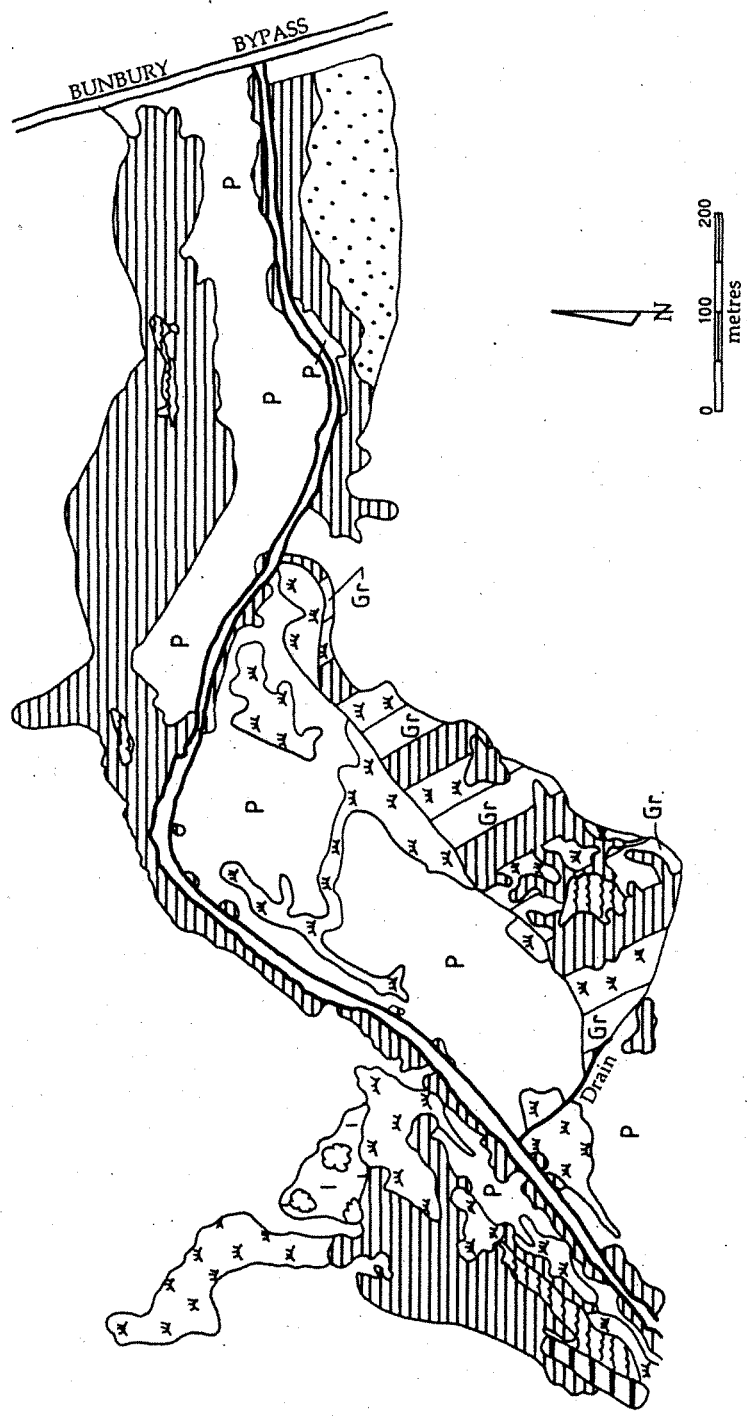


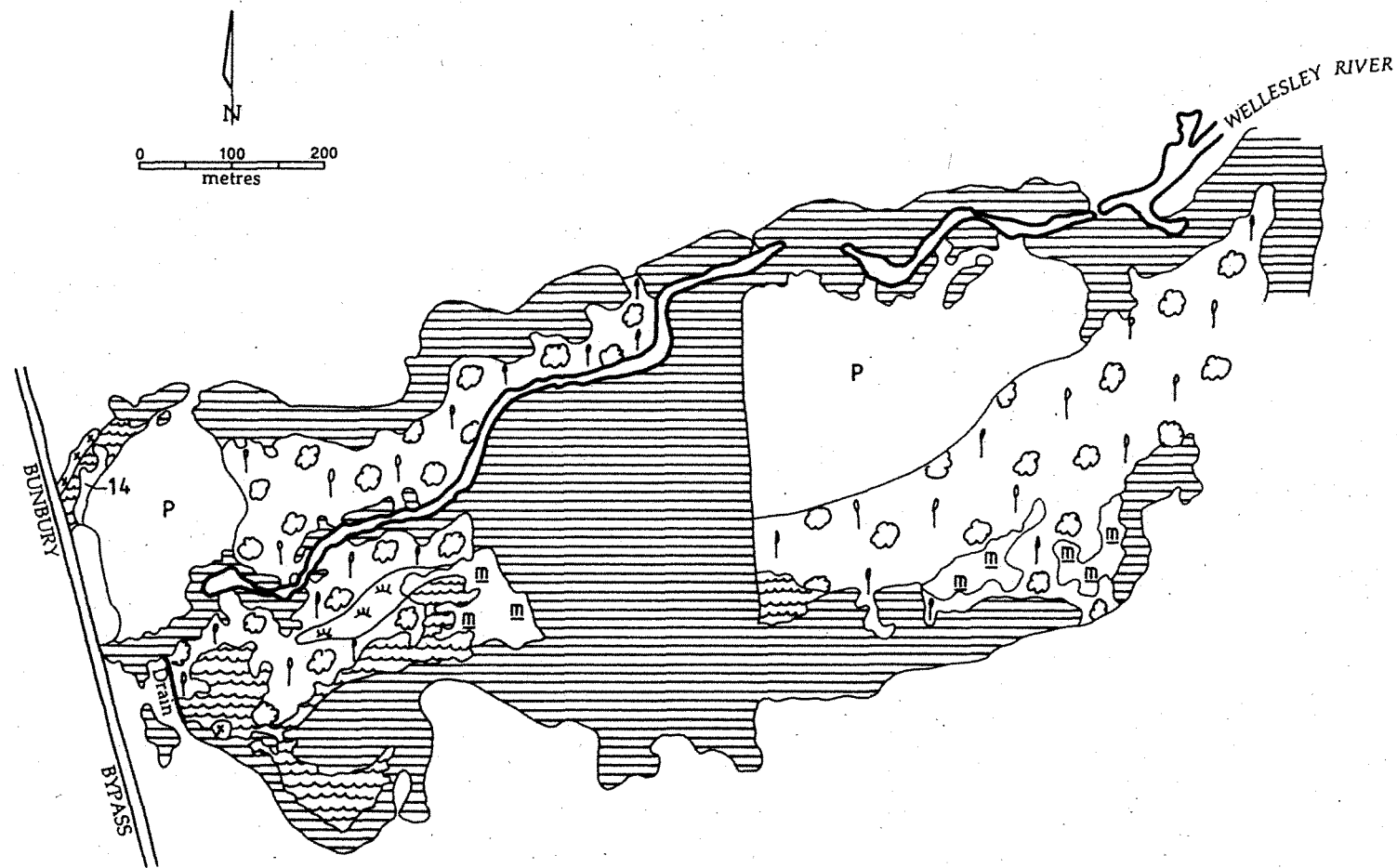




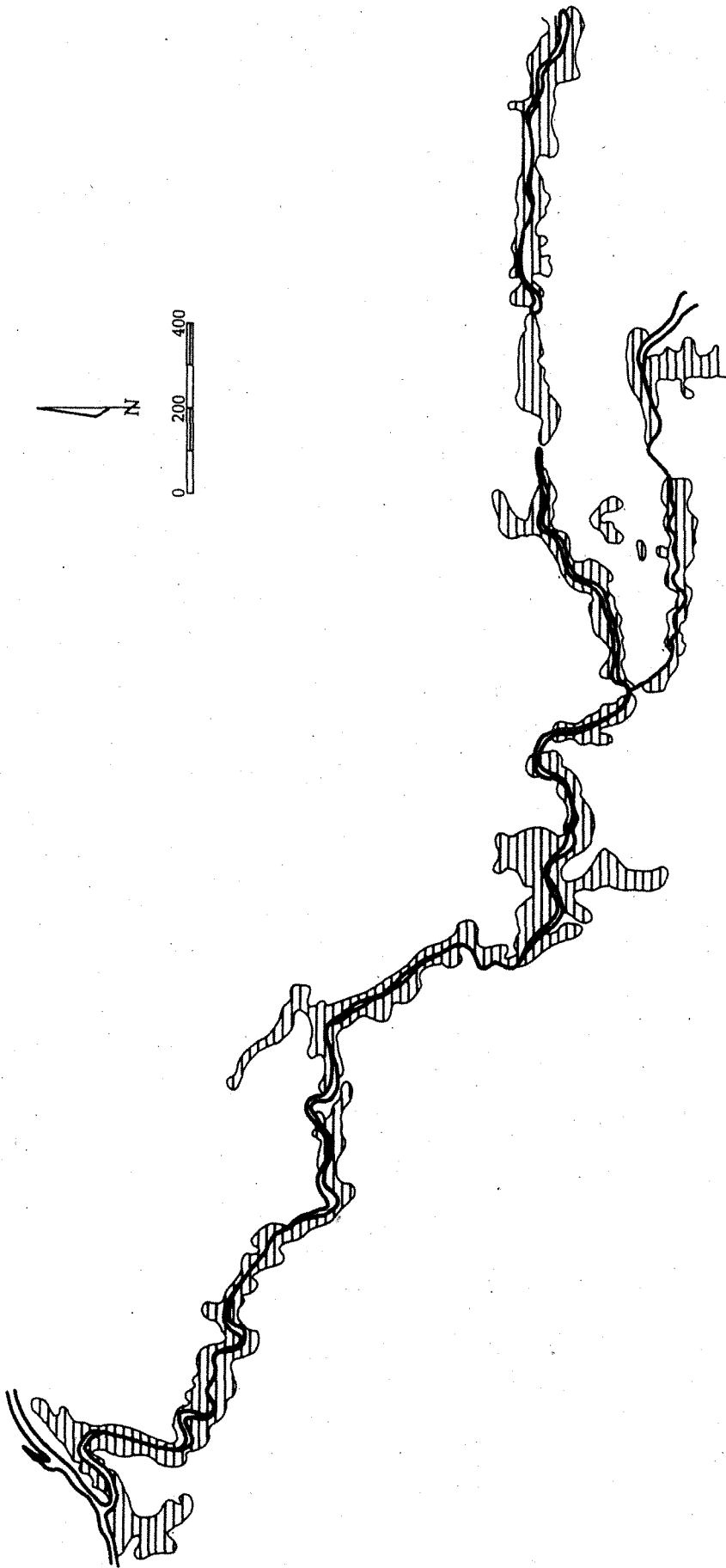


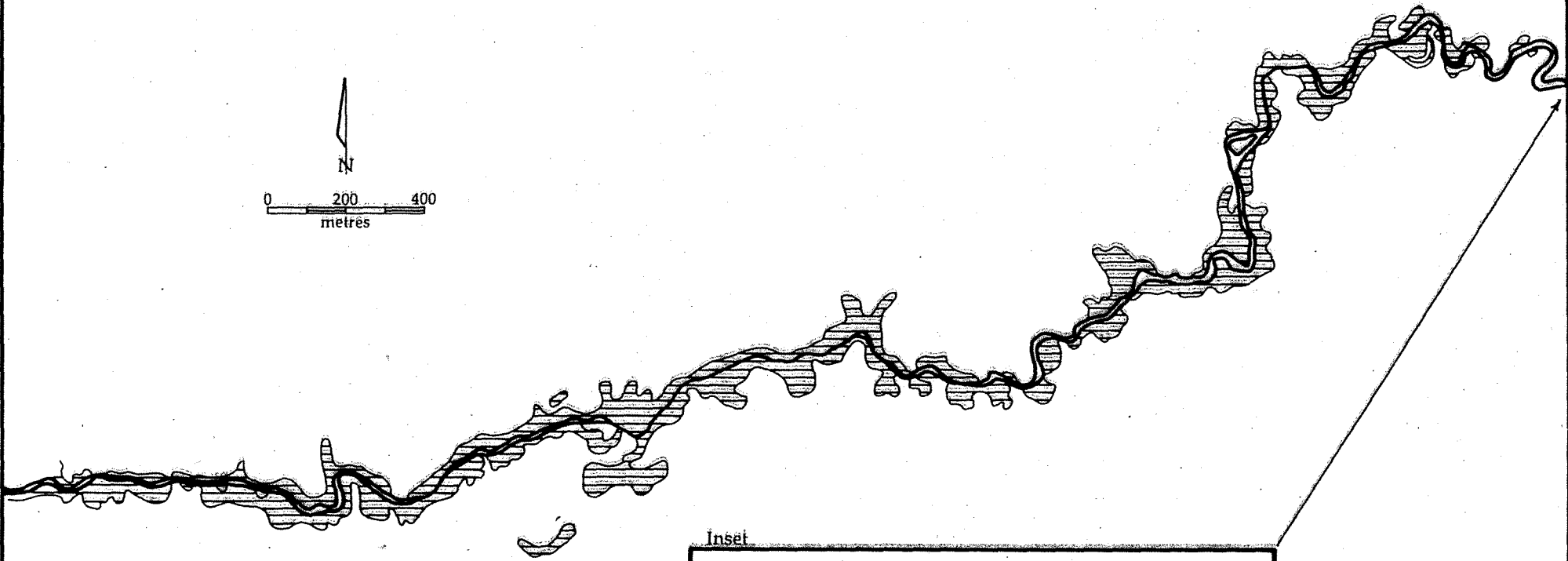
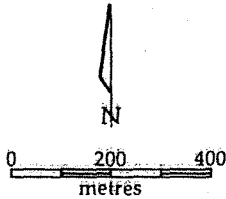
MAP 10





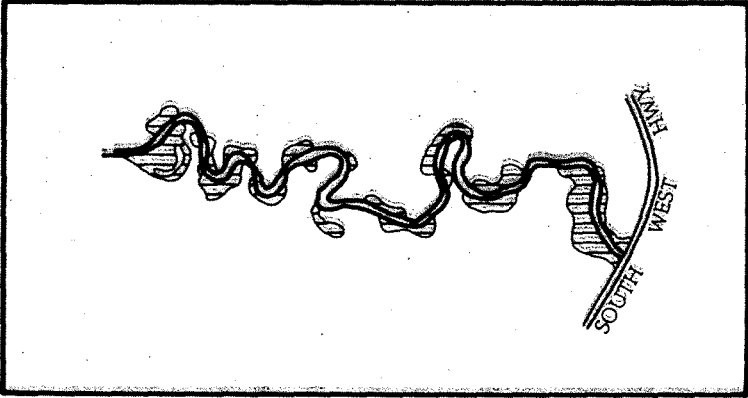
MAP 12





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# **APPENDIX 1: AERIAL PHOTOGRAPHS USED FOR VEGETATION MAPPING OF THE COLLIE AND BRUNSWICK RIVERS**

1989 Myalup - Ludlow 25.9.1989 1:10 000 Job No. 8890123

WA2770(C) Run 15 Nos 5168 - 5169  
Run 16 Nos 5103 - 5105  
Run 17 Nos 5052 - 5059

WA2778(C) Run 18 Nos 5200 - 5202, 5206 - 5208  
Run 19 Nos 5157 - 5159, 5163 - 5165  
Run 20 Nos 5109 - 5110, 5115 - 5116  
Run 21 Nos 5062 - 5063, 5068 - 5269  
Run 22 Nos 5020 - 5021, 5026 - 5027

WA2779(C) RUN 23 Nos 5071

## APPENDIX 2: SCIENTIFIC NAMES, VERNACULAR NAMES AND SHORT DESCRIPTIONS OF THE FRINGING PLANT SPECIES OF THE COLLIE AND BRUNSWICK RIVERS BELOW THE SOUTH WEST HIGHWAY

Scientific name	Common name	Description
<i>Acacia pulchella</i>	Prickly moses	shrub
<i>Acacia saligna</i>	Golden-wreath wattle	small tree
<i>Agonis flexuosa</i>	Peppermint	small tree
<i>Asclepias</i> sp.*	Cotton bush	erect herb
<i>Astartia fascicularis</i>	Astartea	medium shrub
<i>Aster subulatus</i> *	Wild Aster	annual herb
<i>Arundo donax</i> *	Giant reed	giant grass
<i>Avena</i> spp.*	wild oats	annual grasses
<i>Banksia attenuata</i>	Candle banksia	small tree
<i>Banksia grandis</i>	Bull banksia	small tree
<i>Baumea articulata</i>	Jointed twig rush	tall sedge
<i>Baumea juncea</i>	Twig rush	sedge
<i>Baumea riparia</i>		tall sedge
<i>Bolboschoenus caldwellii</i>	Club-rush	sedge
<i>Briza maxima</i> *	Blowfly grass	annual grass
<i>Carex appressa</i>		sedge
<i>Casuarina obesa</i>	Saltwater sheoak	small tree
<i>Centella cordifolia</i>		creeping herb
<i>Cortaderia selloana</i> *	Pampas grass	tall grass
<i>Cynodon dactylon</i> *	Couch	perennial creeping grass
<i>Cyperus</i> sp.*	Club-nut rush	sedge

<i>Ehrharta calycina</i> *	Perennial Veldt grass	tufted grass
<i>Eucalyptus calophylla</i>	Marri	medium to large tree
<i>Eucalyptus gomphocephala</i>	Tuart	large tree
<i>Eucalyptus marginata</i>	Jarrah	medium-large tree
<i>Eucalyptus rudis</i>	Flooded gum	medium to large tree
<i>Ficus carica</i> *	Common fig	large shrub to small tree
<i>Gahnia trifida</i>	Coastal saw sedge	tall tufted sedge
<i>Hakea prostrata</i>	Harsh hakea	large shrub to small tree
<i>Halosarcia indica bidens</i>	Shrubby glasswort	medium shrub
<i>Hemarthria uncinata</i>	Mat grass	creeping grass
<i>Jacksonia furcellata</i>	Grey stinkwood	large shrub
<i>Juncus kraussii</i>	Shore rush	rush
<i>Juncus pallidus</i>	Pale rush	rush
<i>Juncus pauciflorus</i>		tufted rush
<i>Juncus subsecundatus</i>		rush
<i>Lepidosperma gladiatum</i>	Coastal saw sedge	sedge
<i>Lepidosperma longitudinale</i>	Common sword sedge	sedge
<i>Lepidosperma tetraquetrum</i>		tall tufted sedge
<i>Lolium spp.*</i>	Rye grasses	annual and perennial grasses
<i>Lupinus spp.*</i>	Lupins	annual herbs
<i>Macrozamia riedlei</i>	Zamia palm	Cycad
<i>Melaleuca incana</i>		small tree
<i>Melaleuca laterita</i>	Red robin	large shrub to small tree

<i>Melaleuca raphiophylla</i>	Swamp paperbark	small tree
<i>Melaleuca viminea</i>	Paperbark	small tree
<i>Myrsiphyllum asparagoides</i> *	Bridle creeper	creeper
<i>Nuytsia floribunda</i>	Christmas tree	parasitic small tree
<i>Oxalis articulata</i> *	Wood sorrel	bulbous herb
<i>Oxalis pes-caprae</i> *	Soursob	bulbous herb
<i>Oxylobium lineare</i>		tall shrub
<i>Paspalum dilatatum</i> *	Paspalum	tufted perennial grass
<i>Paspalum distichum</i> *	water couch	perennial creeping grass
<i>Pennisetum clandestinum</i> *	Kikuyu	mat grass
<i>Polygonum sp.</i> *	Knotweed	aquatic herb
<i>Rubus spp.</i> *	Blackberry brambles	thorny creeping shrub
<i>Rumex crispus</i> *	Dock	perennial herb
<i>Salix sp.</i> *	Weeping willow	medium tree
<i>Sarcocornia blackiana</i>	samphire	decumbent small shrub
<i>Sarcocornia quinqueflora</i>	samphire	decumbent small shrub
<i>Sporobolus virginicus</i>	Saltwater couch	perennial creeping grass
<i>Stenotaphrum secundatum</i> *	Buffalo grass	perennial creeping grass
<i>Suaeda australis</i>	Seablite	small succulent shrub
<i>Vinca major</i> *	Blue periwinkle	creeping and climbing herb
<i>Watsonia bulbilifera</i> *	Watsonia	Bulbous herb



<i>Xanthorrhoea preissii</i>	Blackboy	large arborescent shrub
<i>Zantedeschia aethiopica</i> *	Arum lily	herb


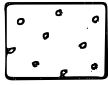

\* Denotes exotic species

Size	Scale
small tree	< 10 m
medium tree	10 - 30 m
large tree	> 30 m
small shrub	< 0.25 m
shrub (medium)	0.25 - 2 m
large shrub	> 2 m
herb	0.25 - 1 m
small herb	0.1 - 0.25 m
tiny herb	< 0.1 m
tiny sedge	< 0.25
small sedge	0.25 - 0.5 m
sedge (medium)	0.5 - 1 m
tall sedge	> 1 m
rush	< 1 - 1.5 m
tall rush	> 1.5 m
grass	< 1 m
tall grass	> 1 m



# LEGEND


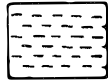

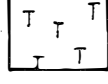
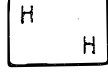
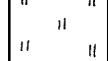
## SALT-MARSH VEGETATION

- 1  *Sarcocornia quinqueflora*  
closed herbland
- 2  *Halosarcia indica bidens*  
low open heath
- 3  *Juncus kraussii*  
closed sedgeland

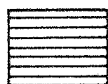

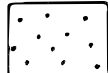
## FRINGING VEGETATION

- Bolboschoenus caldwellii*
- 4 Not shown closed sedgeland

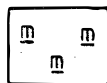

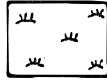
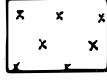
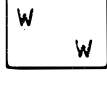
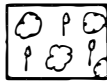
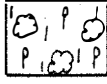
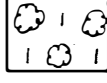
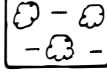
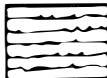
## ESTUARINE FRINGING FOREST VEGETATION

- 5  *Casuarina obesa-Melaleuca raphiophylla-Eucalyptus rudis*  
low-open forest
- 6  *Casuarina obesa-Eucalyptus rudis*  
open-closed forest
- 7  *Casuarina obesa-Melaleuca raphiophylla*  
low closed forest
- 8  *Casuarina obesa*  
open-closed forest
- 9  *Melaleuca viminea*  
low open-closed forest
- 10  *Melaleuca raphiophylla*  
low closed forest

## FRINGING FRESHWATER (RIVERINE) FOREST AND SANDY RISE VEGETATION

- 11  *Eucalyptus rudis-Melaleuca raphiophylla*  
forest complex
- 12  *Eucalyptus calophylla*  
open-closed forest
- 13  *Eucalyptus calophylla-Agonis flexuosa*  
open forest-tall open forest-woodland

## OTHER PLANT COMMUNITIES AND VEGETATION TYPES

- 14  *Melaleuca raphiophylla*  
low closed-open forest
- 15  *Baumea articulata*  
closed sedgeland
- 16  *Juncus pauciflorus*  
open sedgeland
- 17  *Typha orientalis*  
closed sedgeland
- 18  Mixed sedgeland and weed community
- PASTURED WOODLANDS
- 19  *Eucalyptus rudis*  
woodland
- 20  *Eucalyptus rudis-Agonis flexuosa*  
woodland
- 21  *Eucalyptus calophylla-Agonis flexuosa*  
woodland
- 22  *Eucalyptus rudis-Melaleuca raphiophylla*  
woodland
-  Standing water

- Bg Bare ground
- Sp Salt pan
- P Pasture
- Pk Parkland
- Gr Scattered grasses
- D Developed land