SWAN RIVER TRUST

Fringing vegetation of the Canning, Southern and Wungong Rivers

Swan River Trust
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FRINGING VEGETATION OF THE CANNING, SOUTHERN AND WUNGONG RIVERS

Report to the Swan River Trust

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FOREWORD

The Canning, Southern and Wungong Rivers between the Nicholson Road bridge and the base of the dams on the Canning and Wungong, support ten plant communities. Two fringing forest communities commonly occupy the river floodway, one associated with the seasonally flooded areas, while the other with permanently swampy conditions. An introduced sedge occasionally forms small stands, mostly near stormwater drain outfalls. Three forest or woodland types are sometimes found on the higher sections of river valley embankment. One low forest and three native sedge communities are found on the flood plain, the former on seldomly inundated flood plain, while the latter ones are found in low lying swampy areas. Two vegetation types, which are or were widespread in areas surrounding the rivers, occasionally fringe the river valleys.

One priority plant species for conservation, as listed by the Department of Conservation and Land Management Authority, was found along the Southern River.

The fringing vegetation of the rivers has been highly degraded through weed invasion, which has almost completely displaced the native understorey along all but the upper sections of the rivers. However, some native species are still successful, especially the two most common native trees, which have generally increased their cover-abundance along the Canning River over the last 50 years. Notwithstanding this their continued success is threatened in the long term by a variety of large exotic weeds which can hinder tree regeneration. Ultimately, the corridors of habitat and the landscape attribute which the rivers provide to the eastern coastal plain in the metropolitan area will be lost if these major weeds are not controlled.

Severe erosion is only occasionally present along the rivers, although a section of extensive erosion occurs along the upper Wungong, below the scarp. Sediment deposits are quickly stabilised by introduced perennial grasses.

TERMS OF REFERENCE

In 1981 a study was undertaken by Pen of the peripheral vegetation of the Swan and Canning Rivers upstream to Tonkin Highway Bridge and Nicholson Road Bridge respectively. The study has proved invaluable as both a planning tool and as a basis for undertaking vegetation rehabilitation works.

This report is an extension of the 1981 study and outlines the status of vegetation along the Canning, Southern and Wungong Rivers.

It was jointly funded by the Swan River Trust and the Department of Planning and Urban Development.

The study will be used by the Trust to provide more sound environmental advice on the impact of proposed developments in the area.

ACKNOWLEDGEMENTS

Gratitude is expressed to Bev Thurlow and Colin Chalmers and other officers of the Waterways Commission who assisted in the preparation of this report. Thanks to Greg Baxter for drafting the maps and figures. Special thanks to the staff of the WA Herbarium who identified plant specimens.

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1. INTRODUCTION

1.1 Vegetation change

The fringing vegetation of the Canning, Southern and Wungong Rivers today bares little resemblance to the natural vegetation which once lay along their river valleys and flood plains (Pen, 1981). Most of the native species have disappeared or drastically declined in abundance, leaving only the dominant native trees and a few relic native shrubs and sedges amongst a huge variety and abundance of weeds. Nevertheless, this new alien vegetation, along with the remaining native plant species, serve to protect the river valleys against erosion and provide a corridor of habitat for many native and introduced animals. These strips of fringing vegetation, which snake across the Perth metropolitan area, also serve to create breaks in the monotony of urban sprawl and to contribute towards the rural landscape of the eastern Swan Coastal Plain.

A description of the fringing vegetation of the Canning, Southern and Wungong Rivers today and recent and ongoing vegetation changes which have occurred as a result of 160 years of European settlememt are the subjects of this report.

1.2 General description and recent history of the rivers

The Canning and Wungong Rivers drain catchments mainly located in the Darling Range. The dry hot summers and cool wet winters, characteristic of the Perth region, result in highly seasonal river flows; high in winter and low in summer. The magnitude of winter flows has been greatly reduced by the placement of domestic water supply dams on these rivers.

From the base of the dams, the Canning and Wungong Rivers flow in a western direction through the Darling Range along deep river valleys for about 10 and 4 km, respectively (Fig. 1.1). Upon leaving the scarp they enter the Swan Coastal Plain and turn to flow in a northern or northwestern direction for a distance of 15 and 5 km, respectively. At its confluence with Neerigen Brook North the Wungong becomes the Southern River, and flows for a further 15 km in a northern direction until its confluence with the Canning River.

Land along the Canning and the Southern Rivers was first cleared in the 1830s and 1840s, but extensive clearing, for market gardens, orchards, dairies, vineyards and grazing, did not begin until the 1890s (Richards, 1991). Urban development along the Canning River was very slow before the 1940s and was only moderate in the 1950s and 60s, but has exploded since the 1970s (Hillar, 1986). Despite this, many paddocks and orchards remain along the Canning River on the coastal plain among dense residential development, while most of the Southern/Wungong River passes through a semi-rural area which is becoming increasingly urban. Apart from the Swan River, no other rivers in the south-west have been subjected to such an intense and wide range of human activities as these three. Only in the scarp are relatively natural conditions found and even these have been greatly altered by damming. A pipehead dam was located on the Canning River in the 1920s and replaced by the current dam was completed in the 1940s. Similarly a pipehead dam was located on the Wungong in the 1930s being replaced by the current dam in 1979.

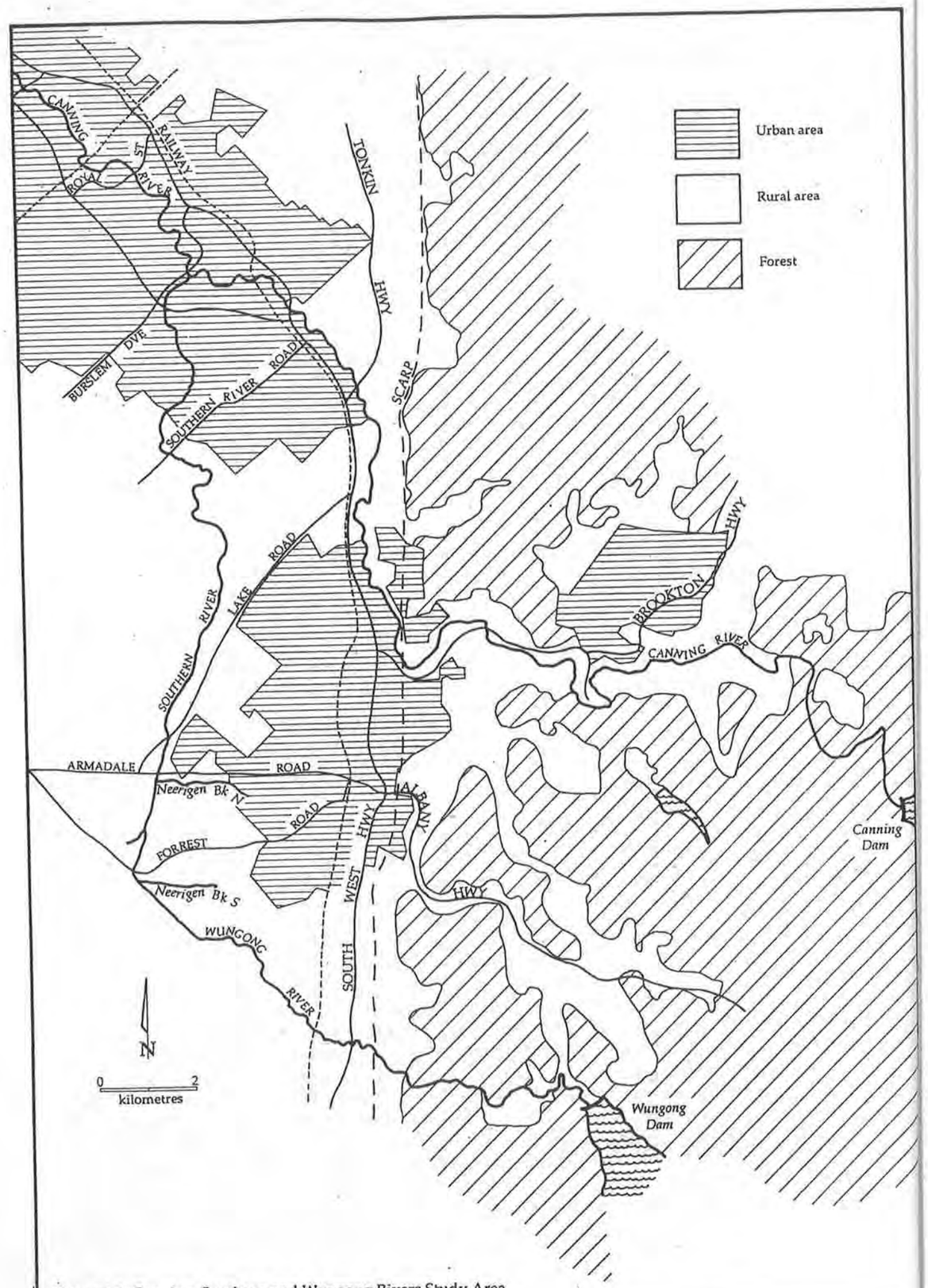


Figure 1.1: Canning, Southern and Wungong Rivers Study Area

2. THE STUDY AREA AND AIMS OF THE STUDY

2.1 Description of the study area

The study area lies between the Nicholson Road bridge on the Canning River and the bases of the Canning and Wungong dams. It includes the river floodways and the river valley embankments and a portion of land, usually about 10 to 20 m wide, either side of the valley. Where a definite river valley does not exist, such as where the Southern/Wungong River passes through broad flood plain, the Water Authority's 100 year flood levels were used to determine the extent of the study area (see Appendix 1).

The study area of the project was limited in its downstream extent to the Nicholson Road bridge because the river downstream of this point has been investigated and reported on a number of occasions in the past (Pen, 1981; Pen 1983; Brock and Pen, 1984; Thurlow et al., 1986).

2.1.1 Canning River

In the scarp below the Canning Dam the Canning River consists of a narrow channel of a few metres width, occupying a narrow floodway of about 70 m width. Near the dam the stream is broken by large pools of about 50 to 150 m in length and 20 m across. As the river leaves the scarp, the floodway, although not the channel, broadens from 70 to 150 m width, forming a shallow valley of a few metres to as much as 6 m below the immediate adjacent land. This situation basically continues right through to the river's confluence with the Southern River.

The Canning River broadens downstream of the Southern River, and the flood plain generally becomes more extensive, typically having a width of 50 to 100 m. It becomes very broad, extending over 300 m, at the base of the study area on the southern bank of the river near Nicholson Road bridge. Today most flood plain supports pasture or parkland. In places, the river takes a sharp turn and digs into sandy rises up to 20 m high. In other places it cuts through high flood plain consisting of deep alluvial soils. Seasonal backwaters and swampy areas commonly occur in low lying areas.

The upper 4 km of the Canning River in the scarp lies in forested land, while the lower 9 km passes through cleared farmland. On the coastal plain the river is bordered by paddocks, orchards and urban development, but beyond this narrow strip, there is mostly dense urban development.

2.1.2 Southern/Wungong River

The Wungong River leaves the forested scarp as a narrow river channel no more than a few metres across with a floodway of only about 20 m width. Between the South West Highway and Rowley Road it alternates between a narrow channel and broad floodway of about 100 m width with a floodfringeof up to 50 m wide. In this area and for about 600 m downstream the river passes through what are coalesced alluvial fans made up of sediment carried from the Darling Plateau and deposited at the foot of the scarp.

For about 600 m downstream of Rowley Road, the floodway and flood plain become quite broad until they narrow considerably as the river enters a man made canal or drain about 10 to 20 m across. This channel is a few metres below the adjacent land and is bordered by high levees, presumably created

when the channel was dug. Parts of the original river channel lie to the north-east. This canal-like situation prevails until about 700 m before Forrest Road, when the river flood plain broadens to about 70 m as the river approaches its confluence with Neerigen Brook South, another man made drainage channel. As the river passes the confluence of Neerigen Brook North it becomes the Southern River.

Between Forrest Road and the border of the Cities of Armadale and Gosnells the river enters a flat and low lying region broken only by small sandy rises of a few hectares in area and reaching only a few metres above the surrounding land. For this reason the floodway remains broad, about 70 m width, and the floodfringeextends up to a further 450 m from the floodway, although 100 to 200 m width is more typical. In places the sandy rises are very close to the river and as a consequence there is no floodfringe.

The river continues in this form downstream for about another 1 km until the river cuts into the Bassendean Dune complex. From here, until the river's confluence with the Canning River it resides in a shallow river valley of about 50 to 150 m across, bordered by sandy ridges rising from a few metres to 5 metres above the level of the main channel.

Forested land mostly surrounds the river in the scarp. On the coastal plain the river first passes through rural land and below Southern River Road, through increasing urban development.

2.2 Aims of the study

The aims of the study were as follows:

1. To classify the fringing vegetation of the Canning, Southern and Wungong Rivers between Nicholson Road bridge and the base of the Canning and Wungong Dams;
2. To map the plant communities along the rivers below the naturally forested areas of the scarp;
3. To identify the major management issues concerning the conservation of native fringing plant species in the study area, and
4. To consider the general quality of the vegetation and to make recommendations for its conservation and rehabilitation.

3. VEGETATION DESCRIPTION AND MAPPING

Black and white aerial photographs at 1:20 000 scale from the Department of Land Administration were obtained for the study area and sketchmaps were produced using a Ziess Aerosketchmaster to a 1:10 000 scale. The sketchmaps were drawn up to convey information on the distribution of vegetation and vegetation type, river and land form and landuse (pasture or urban). They were also viewed stereoscopically to observe landform in relation to vegetation.

These sketchmaps were then taken into the field and annotated with relevant information on landscape, plant communities and weed infestations. Transects of river form, along with the associated plant communities were sketched at regular intervals.

The Canning, Southern and Wungong Rivers between the junction of the Canning and Southern Rivers and the base of the Canning and Wungong dams were examined between the 13 July and 2 August 1992. The Canning River between the Nicholson Road bridge and the mouth of the Southern River was surveyed on the 14 August 1992. The fringing vegetation below Butcher Road on the Canning River and below the South West Highway on the Wungong River was mapped (see Fig 1.1).

Unknown plant species were submitted to the WA Herbarium for identification.

Vegetation was described on the basis of dominant species and projective foliage cover and height of the tallest stratum (Specht, 1981).

4. VEGETATION OF THE CANNING, SOUTHERN AND WUNGONG RIVERS

Appendix 4 contains the scientific names and a short descriptions of the common plant species of the study area. For clarity introduced weeds will be generally referred to by their common name and native species by their scientific name.

4.1 Riverine fringing vegetation

***Melaleuca rhaphiophylla* low open to closed forest**

This plant community mainly consists of a dense canopy of the small paperbark (less than 10 m), *Melaleuca rhaphiophylla*, over seasonal standing water, or an understorey of arum lily (*Zantedeschia aethiopica*), or ephemeral grasses. Sometimes the tall shrubs/small trees *Melaleuca viminea*, *M. polygaloides* and *Kunzea* species are present. Occassionally, the tall shrub *Astartea fascicularis* is common in the understorey. In the study area the community is found on the Southern/Wungong River on the low lying waterlogged soils between Verna Street and Rowley Road (Maps 8 to 11) and along the lower Canning in swampy areas (Maps 1 and 2). In places the community is broken by the *M. rhaphiophylla* - *Eucalyptus rudis* open to closed forest (see below).

***Eucalyptus rudis* - *M. rhaphiophylla* open to closed forest**

This is the most dominant community along the Canning and Southern/Wungong Rivers. Essentially it consists of the medium size tree (up to 30 m) flooded gum, *E. rudis*, and the small paperbark *M. rhaphiophylla*, over a huge range of introduced weeds. Chief among these weeds are arum lily, blackberry brambles (*Rubus* spp.), watsonia (*Watsonia bulbillifera*), soursob (*Oxalis pes-caprae*), guildford grass (*Romulea rosea*), the grasses watercouch (*Paspalum distichum*), paspalum (*Paspalum dilatatum*), buffalo (*Stenotaphrum secundatum*), kikuyu (*Pennisetum clandestinum*) and couch (*Cynodon dactylon*) and the vine bridle creeper (*Myrsiphyllum asparagoides*). Two native species, the bracken fern *Pteridium esculentum*, and the small tree *Acacia saligna*, act as weeds and are successful in this community.

Some of the larger introduced species represent a serious disruption to the upper storey and in the long term threaten to alter the native landscape which the rivers impart to the region. These species include edible fig (*Ficus carica*), castor oil bush (*Ricinus communis*), Japanese pepper (*Shinus terebinthifolius*), blackberry (*Rubus* spp.), bamboo (*Bambusa* spp.), fountain

grass (*Pennisetum setaceum*) and the introduced vines and creepers, bridle creeper (*Myrsiphyllum asparagoides*), morning glory (*Ipomoea indica*), Japanese honeysuckle (*Lonicera japonica*), dolichos pea (*Dipogon lignosus*) and blue periwinkle (*Vinca major*). These will be discussed in greater detail in Section 5.2.

The native understorey species of the once stable climax community of the river are all but gone today along both rivers below the scarp. Only the shrub *Astartea fascicularis* is consistently and sometimes commonly present. The large shrub *Viminaria juncea* is occasionally present along the Canning below the scarp, and common above the scarp, while the medium to large shrub *Labichea lanceolata* is found in the Kelmscott region of the Canning river and occasionally upstream. The large shrub Albizia *Paraserianthes lophantha*, is occasionally present along the upper Wungong River and the wattles *Acacia pulchella* and *A. alata* are sometimes present. The rush *Juncus pallidus* is commonly present but is never abundant. Other relic native species include the sedges *Lepidosperma longitudinale, L. tetraquetrum, Baumea juncea, B. riparia* and the grass *Hemarthria uncinata*. The shrub *Darwinia citriodora* is found in the study area along the Wungong River only.

Some hint of the original riparian plant community along the lower Canning on the coastal plain is given in the area between the Nicholson Road bridge and the Royal Street bridge. Here a number of tall shrub/small tree species are to be found as relics. They include *Melaleuca viminea, Viminaria juncea, Calycopeplus ephedroides* and a species of *Kunzea*. A number of sedges and rushes, which are rare elsewhere, are also present, including *Lepidosperma longitudinale, Baumea juncea, Schoenoplectus validus, Juncus kraussii* and *J. subsecundus*. In some seasonally inundated sites, the emergent aquatic plant *Triglochin procera* is present and on higher year round damp sites, a decumbent *Hydrocotyle* species, *Centella cordifolia*, forms extensive mats.

Near the scarp, two middle storey large shrub/small tree native species *Agonis linearifolia* and *Grevillea diversifolia*, are important. On the Southern/Wungong River, *Agonis* is found above the Forrest Road bridge and the *Grevillea*, upstream of the base of the scarp. Curiously, on the Canning the situation is somewhat reversed with the *Grevillea* found below the scarp upstream of McKenzie Grove and with the *Agonis* upstream of the Brookton Highway bridge. In the scarp, other large shrubs such as *Viminaria juncea, Grevillea glabrata* and *Trymalium grandiflorum* are also important and some native species including *A. fasicularis, Lepidosperma longitudinale, L. tetraquetrum* and *B. riparia*, which enjoy little or no success below the scarp, become increasingly important.

On the basis of the presence or absence of *Agonis linearifolia* and *Grevillea diversifolia* four sub-communities were recognised. They are listed together with their diagnostic species below:

***E. rudis - M. rhaphiophylla* open-closed forest 1**

E. rudis, M rhaphiophylla and *Astartea fasicularis*

***E. rudis - M. rhaphiophylla* open-closed forest 2**

As for 1 and *Agonis linearifolia*

***E. rudis - M. rhaphiophylla* open-closed forest 3**

As for 1 and *Grevillea diversifolia*

***E. rudis - M. rhaphiophylla* open-closed forest 4**

As for 1 and *Agonis linearifolia* and *Grevillea diversifolia.*

***T. orientalis* tall closed sedgeland**

Small stands of the bulrush (*T. orientalis*) were common along both rivers. These were mostly associated with stormwater runoff or recent physical disturbance. Unlike regions of the lower Canning and Swan Rivers, where bulrush is abundant and has displaced native plant communities, it does not appear to be a serious invader in the study area.

4.2 River valley embankment vegetation

***E. rudis - Eucalyptus calophylla* open-closed forest,**

***E. calophylla* open-closed forest and**

***E. marginatus - E. calophylla* open forest-woodland**

As the land rises above the floodway of the river, the *E.rudis - M. rhaphiophylla* low open to closed forest sometimes gives way to *E. rudis - E. calophylla* open forest and then *E. calophylla* open-closed forest. Occasionally, the large paperbark, *M. preissiana*, is a member of the upperstorey. Middle storey and understorey species are generally the same as for the *E. rudis - M. rhaphiophylla* low open-closed forest except that species typical of the Bassendean soils can be more important. Such species include *Acacia pulchella, Xanthorrhoea preissii*, veldt grass (*Ehrharta calycina*) and african love grass (*Eragrostis curvula*). In sandy areas, more typical of the river valley ridges of the Southern and Canning Rivers in the Gosnells municipality, *Eucalyptus marginata* joins *E. calophylla* to form an open forest or woodland. In this community, the small trees/large shrubs *Hakea prostrata, Banksia littoralis* and *Jacksonia sternbergiana* are typical and in wetter sites the braken fern, *Pteridium esculentum*, can be abundant.

As these vegetation types are found on the river valley ridges, they have generally been cleared for pasture and urban development and today little remains except some isolated small stands or very narrow bands on the fringe of the *E. rudis - M. rhaphiophylla* low closed-open forest which typically lines the rivers.

4.3 Flood plain and wetland vegetation

***Acacia saligna* low closed forest**

The small tree *Acacia saligna* forms dense stands in a few areas of flood plain along the lower Canning (Maps 1 and 2). Understorey vegetation tends to be sparse in this community.

***Juncus* closed sedgeland**

This is basically a single species community of a *Juncus* species, which grows to 1.5 m. It is found along the Southern River and wetlands between Armadale Road and Forrest Road (Map 10).

***Schoenoplectus validus* tall closed sedgeland**

This large rush, which grows to 2 m in height, forms extensive single species stands along the Swan River and some of Perth's wetlands. However, along the Canning and Southern Rivers it is quite uncommon, with only a few stands mostly dotted along the lower Canning River below Nicholson Road bridge. In the study area, it is present as small stands in the wetlands area between Armadale Road and Forrest Road on the Southern River and opposite O'Dell Street in Thornlie on the Canning (Maps 2 and 10).

***Baumea articulata* tall closed sedgeland**

Another single species community, *B. articulata* which grows to 2.5 m, is found in many coastal wetlands including the nearby Forrestdale Lake. Two stands in the wetlands area between Armadale Road and Forrest Road are the only ones known to the author along the Canning or Southern/Wungong Rivers (Map 10).

4.4 Winter wet depression vegetation

Winter wet depression complex

Most of the land adjacent to the southeastern corner of the study area along the Southern/Wungong River is very low lying and becomes waterlogged or even flooded in winter. Much of this land has been cleared for pasture and now only supports relic trees of *E. rudis* , *E. calophylla* and the large paperbark *Melaleuca preissiana*. However, large relatively undisturbed areas remain to the east of the river and support a huge range of plant species which constitute many plant communities. A thorough description of these complex communities is beyond the scope of this study and they will be recognised collectively as the winter wet depression complex. The dominant species include *E. calophylla*, a number of *Kunzea* species, *Verticordia* species, *Melaleuca* species and sedges of the family Restionaceae.

On occasion, this complex extends into the flood plain of the Southern/Wungong River and its extent within this zone has been mapped.

4.5 Sandy rise vegetation

***Banksia-Allocasuarina-Eucalyptus todtiana* low open forest**

This vegetation type occupies the sandy rises of the surrounding low lying land, and which on occasion come close to the rivers and occupy a portion of the river valley embankment. Understorey species are present to various degrees, from completely replaced by veldt grass or wholly intact, although the latter is very rare. Usually all that remains are the small trees *Banksia attenuata*, *B. menzeisii*, *B. ilicifolia*, *Allocasuarina fraseriana*, *Eucalyptus todtiana*, *Xylomelum occidentale*, the occasional *Eucalyptus marginata* and the shrubs *Jacksonia furcellata*, *Xanthorrhoea preissii* and *Stirlingia latifolia*, the cycad (*Macrozamia riedlei*), and the weeds common lupin (*Lupinus cosentinii*), veldt grass, ephemeral veldt grass (*Ehrharta longifolia*), the grass *Pentaschistis thunbergii* and red natal grass (*Rhynchelytrum repens*).

5. NATIVE SPECIES REPLACEMENT AND REGENERATION

5.1 Loss of understorey species

Today, below the scarp, the understorey of riverine forest communities largely consists of a huge variety of introduced weeds. Some native species remain, but mostly only as isolated individuals or small groups, and their future would appear to be very precarious. These relic plants of the original understorey community represent the genetic stock associated with these rivers on the coastal plain. It may be that only a short time remains in which to utilise the seed of these plants in any rehabilitation programmes.

5.2 Major weed infestations

Although the understorey of the riverine forest could be described as a conglomeration of weed infestations, some of the larger weed species represent more serious infestation problems. This is because they threaten to completely dominate the vegetation in the long term and alter the landscape by replacing the native trees, either through competition or by killing them directly by smothering or indirectly by exacerbating the effects of fire. Presently the smaller weeds do not prevent the regeneration of *E. rudis* and *M. rhaphiophylla*, the medium shrub *Astartea fasicularis* or the large shrubs/small trees *Agonis linearifolia* and *Grevillea diversifolia* and some others. However some, if not all, of the weeds listed below may represent a long term threat to these native species.

Species considered to be a potential major long term problem are listed below:

Trees:	Castor oil bush (*Ricinus communis*)
	Edible fig (*Ficus carica*)
	Coral (*Erythrina caffra*)
	Olive tree (*Olea europaea*)
	Poplar tree (*Populus* sp.)
	Japanese pepper (*Shinus terebinthifolius*)
	Willow tree (*Salix babylonica*)
	Victorian tea tree (*Leptospermum laevigatum*)
	Acacia longifolia (*Acacia longifolia*)
Vines or creepers:	Blackberries (*Rubus* spp.)
	Blue periwinkle (*Vinca major*)
	Morning glory (*Ipomea indica*)
	Japanese honeysuckle (*Lonicera japonica*)
	Dolichos pea (*Dipogon lignosus*)
	Bridle creeper (*Myrsiphyllum asparagoides*)
	Common lantana (*Lantana camara*)

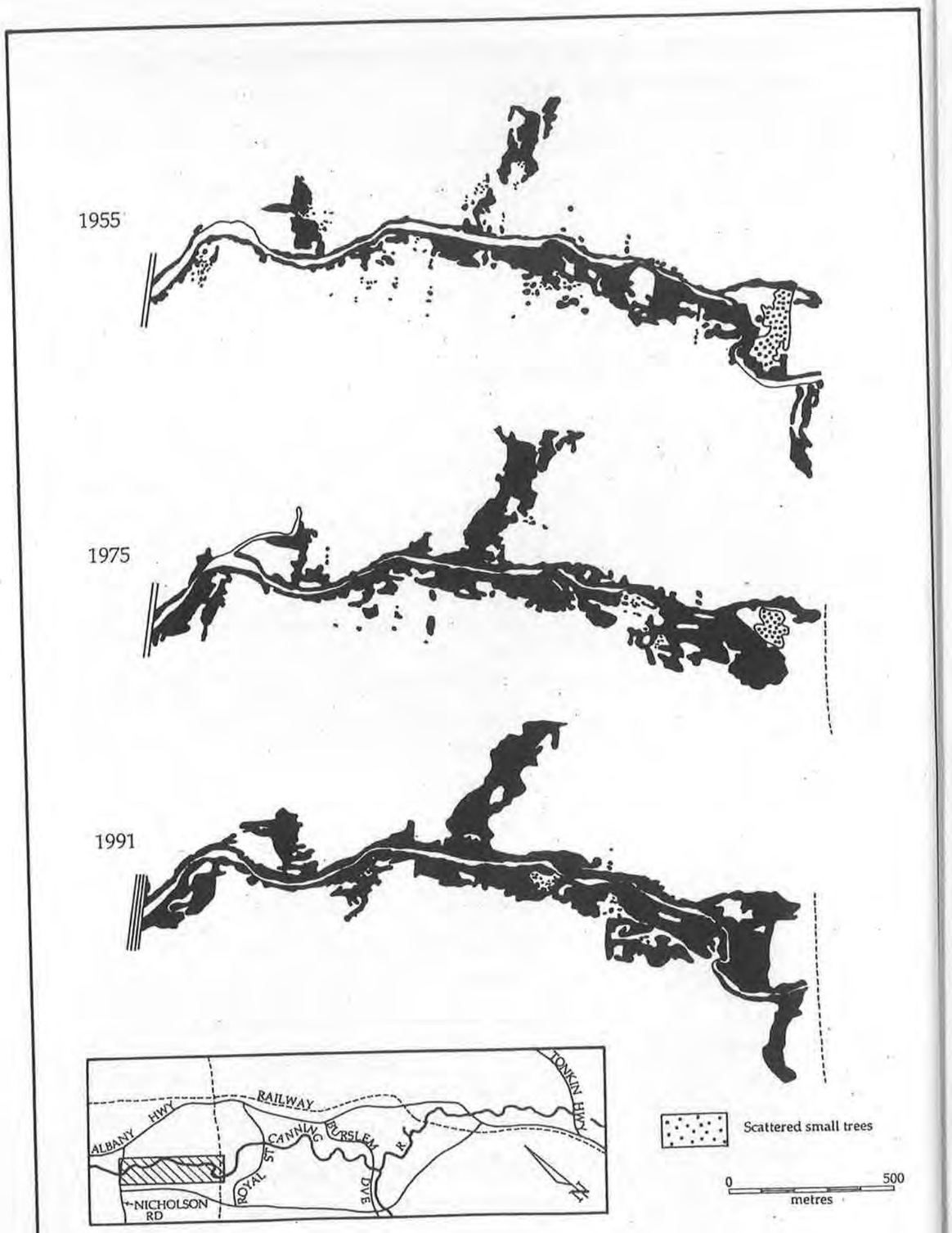


Figure 5.1: Tree cover along the Canning River between the Nicholson Road bridge and the immediately upstream railway bridge in 1955, 1975 and 1991

Giant grasses or bulrush:	Giant reed (*Arundo donax*)
	Fountain grass (*Pennisetum setaceum*)
	Giant bamboo (*Bambusa* sp.)
	Bamboo (*Bambusa* sp.)
	Pampas grass (*Cortaderia selloana*)
	Bulrush (*Typha orientalis*)
Tall herb	Canna lily (*Canna* x *orchiodes*)

Infestations of the above weed species, except bridle creeper which is present throughout the study area, are shown on the Weed Infestation maps. By far the worst infestation occurs over a one kilometre section of the Canning River upstream of the Orlando Street bridge (see Weed Infestation Map 6). Here the vines Japanese honeysuckle and morning glory are so abundant that they drape sections of the river valley and are smothering large trees.

A small infestation of the aquatic weed, *Hydrocotyle ranunculoides*, was found just above the Nicholson Road bridge.

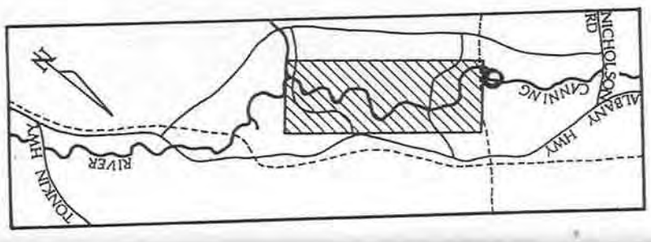
The Victorian tea tree, *Leptospermum laevigatum*, was found infesting a few sites on the rivers (Weed Infestation Maps 5 and 7). Although this species is currently not a problem, the author has observed it to be vigorous invader on sandy soils in the Albany region, suggesting that it could be a potential invader of the sandy rise vegetation within the study area.

5.3 Successful regeneration of native plant species

On the coastal plain, the trees *E. rudis* and *M. rhaphiophylla* and the shrub *Astartea fasicularis* are successfully regenerating along the rivers. Near the scarp the small trees/large shrubs *Agonis linearifolia* and *Grevillea diversifolia* are regenerating also. All of these species will continue to be found along the rivers below the scarp in the long term. To a lesser extent the rushes *Baumea juncea* and *Juncus pallidas* are regenerating, but nowhere are they as abundant as they are in undisturbed sites that the author has seen elsewhere. This suggests that the long term future of these two species on the rivers below the scarp is threatened.

The successful regeneration of trees along three sections of the Canning River is illustrated in Figures 5.1 to 5.3. In all three sections there has been a general and often substantial increase in tree canopy since as early as 1941 through to 1991. In all cases this is mainly due to the regeneration of *E. rudis* and *M. rhaphiophylla* on farmland, which has become less intensively used as the surrounding landuse has become increasingly urban. In the past, heavy livestock grazing and trampling, cropping for hay and the maintenance of orchards probably took a heavy toll on seedlings and saplings. In the absence of these impacts upon the land today, these two native species are now thriving. Nevertheless, the land along the rivers is still heavily disturbed by human trampling, vehicles and frequent fire and this has encouraged the explosive regeneration in some areas of *Acacia saligna*, a species which is known to exploit disturbed sites (Powell, 1990).

In the scarp, all native species are regenerating successfully. However, weed infestation remains a serious problem and could result in the extinction of many species along the rivers in the long term.



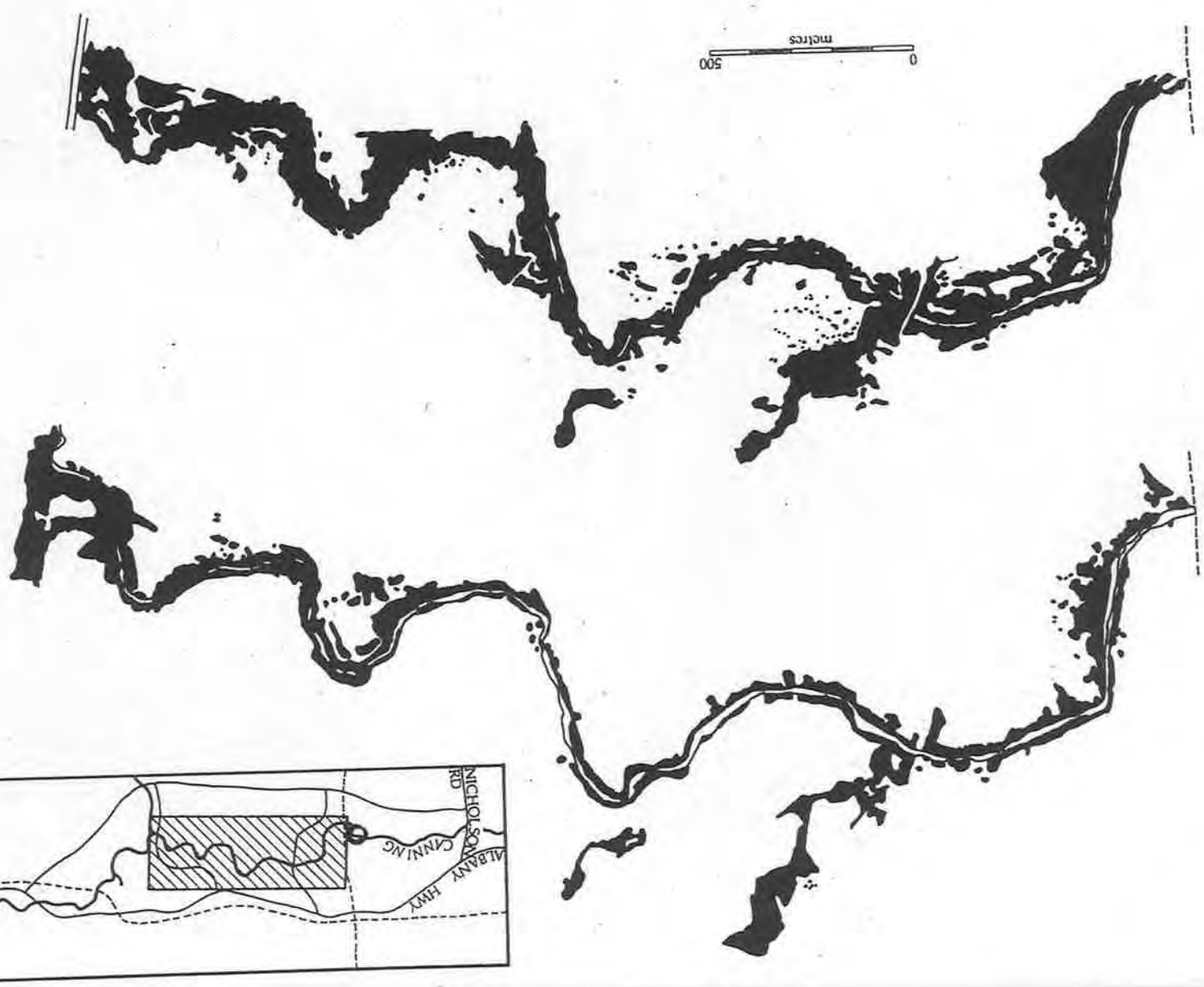


Figure 5.2: Tree cover along the Canning River between the Burslem Drive bridge and the immediately downstream railway bridge in 1963 and 1991

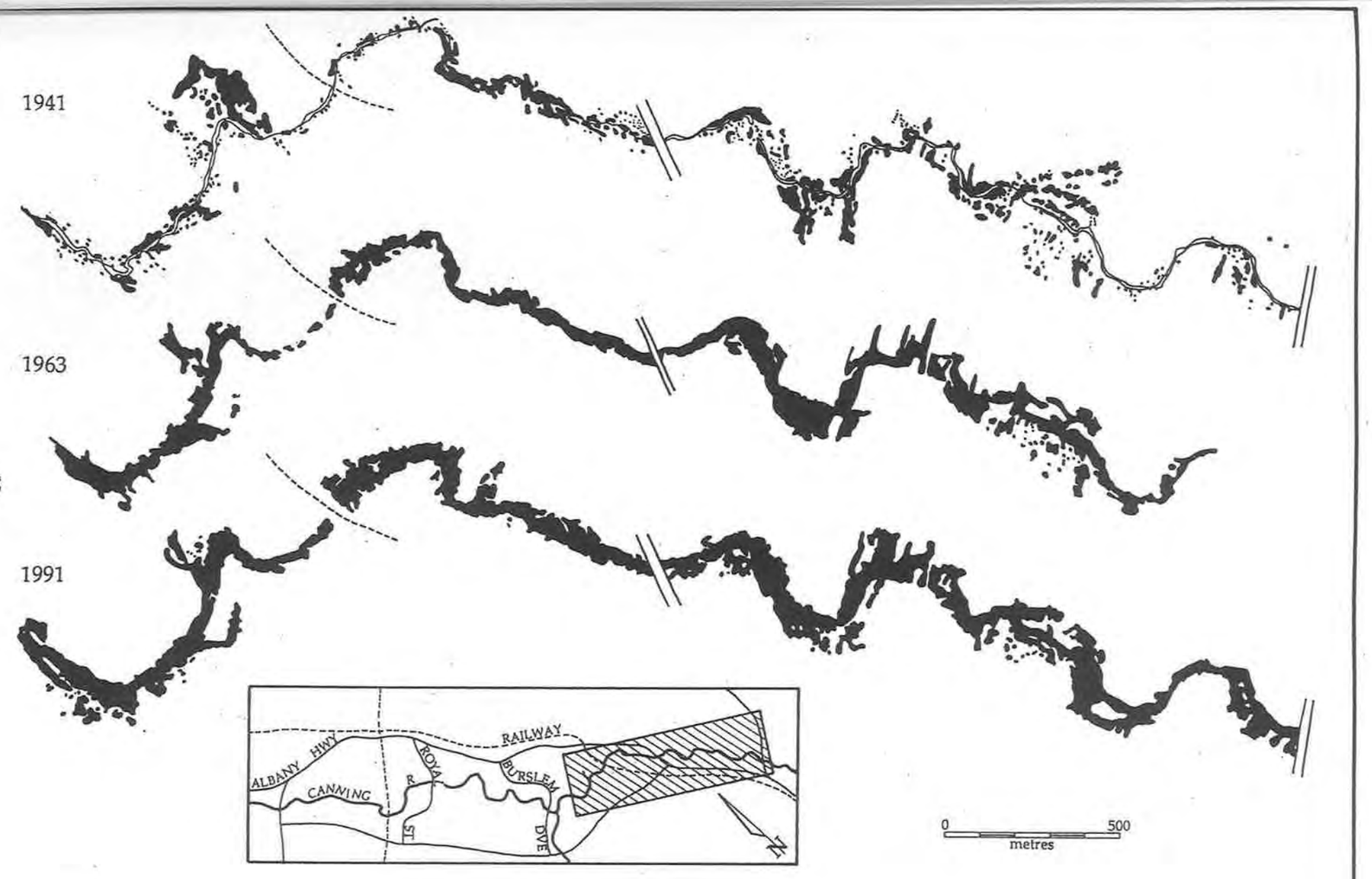


Figure 5.3: Tree cover along the Canning River between the Burslem Drive bridge and the Tonkin Highway bridge in 1941, 1963 and 1991

In paddocks and parklands there is little regeneration of trees. Park maintenance and the effects of heavy livestock grazing, such as trampling and ringbarking, largely prevent regeneration.

The large shrubs *Jacksonia furcellata* and *J. sternbergiana* thrive in disturbed sandy areas, as does *Acacia saligna*, and as a result these species are enjoying great success along the rivers today.

5.4 Vegetation change along the Canning between 1981 and 1991

In early 1981 the author surveyed the Canning River between the Nicholson Road bridge in Cannington and the Orlando Street bridge in Kelmscott (Pen, 1981). Comparison with the present study, suggests that the fringing vegetation over this section has changed in the last ten years. All of the minor and major weed species present today were observed in 1981 and were at about the same level of abundance. In 1981 the tall reed fountain grass (*Pennisetum setaceum*) occurred sparsely in the area opposite O'Dell Street in Thornlie and either side of the Orlando Street bridge in Kelmscott. Since then it has greatly increased its abundance in these two areas (see Weed Infestation Maps 2, 5 and 6).

6. MANAGEMENT

6.1 Erosion and siltation

The processes of erosion and siltation are typical of the riverine environment and are evident along both rivers.

When the river channel comes close to one side of the river valley, the valley embankment becomes, in effect, a steep channel embankment and serious erosion of high ground may occur. Such erosion does occasionally occur in places, undermining trees and fence posts. The weed infestation maps indicate spots along the rivers where this is taking place.

Sandy silt deposits are a more common sight than erosion, although they are quickly colonised and stablised by grasses (kikuyu, couch, buffalo or watercouch). Much of the sediment is probably not generated within the rivers themselves as for the most part they are well stabilised by peripheral vegetation. It is therefore probably carried into the river by tributaries which drain unstable rural or urban areas.

Damage to fringing vegetation and soil erosion caused by trampling by livestock and humans is apparent in some areas along the rivers, particularly in the sections just below the scarp. The Wungong River between Rowley Road and the South West Highway, is extensively and seriouly affected by this form of erosion.

6.2 Landscape

6.2.1 Landscape components

In the study area, the main components of the landscape, from an ecological perspective, are the dominant native trees and shrubs, pasture and orchards and the landforms associated with the river or which are adjacent to it. These components will be present in a variety of combinations leading to different

viewscapes in different areas and positions of viewpoint. This section describes the various components or essential features of the landscape rather than particular viewscapes.

Riverine vegetation This consists of both *Eucalyptus rudis* and *Melalleuca rhaphiophylla* or just *M. rhaphiopylla* in swampy areas. This component is typical, not only of the rivers, but also of their tributaries.

Embankment vegetation Found above the level of the riverine vegetation on the river valley embankments, it consists of *E. rudis* and/or *Eucalyptus calophylla*, or in very wet areas, these two species and *Melaleuca preissiana*. In dry sandy areas, *Eucalyptus marginata*, *Banksia littoralis* and *Hakea prostrata* are important.

Winter wet depressions Along the Southern/Wungong River, these areas mostly support heavy pasture with groves of Myrtaceae species including *M. rhaphiophylla* , *M. preissiana* , *M. viminea* , *M. polygouloides* and *Kunzea ericifolia* and *K. recurva*. Wide pools of water are present in winter.

Pasture or parkland on flood plains This consists of scattered trees or groves of *E. rudis*, *M. preissiana* and *E. calophylla* over pasture. Usually they occur in single species stands with *E. calophylla* on slightly higher ground than the other two species.

Sandy rises A mixture of *Banksia attenuata*, *B. menzeisii*, *B. ilicifolia*, *Allocasuarina fraseriana*, *Eucalyptus todtiana*, *Xylomelum occidentale* and *E. marginata* over veldt grass and exposed grey-white sand.

Orchards Small citrus orchards are scattered along the length of the Canning River, mainly below the scarp and they add to the character of the river.

Steep "V" shaped slopes of the scarp The trees together with the steep slopes rising to the ridge tops characterise the river valley landscape of the Darling Range in the study area. The trees on the slopes are either large *E. calophylla* or stunted *E. rudis* over native understorey, pasture or small granite outcrops. In places the white barked *Eucalyptus wandoo* is important, though only near the escarpment.

6.2.2 Landscape disruption

Urban and rural development represent disruptions in the natural landscape, but it is not this form of disruption which is of concern. Elements of the natural landscape still remain in many areas, imparting a uniquely south-western Australian landscape. These elements are mainly native trees, shrubs, rushes and sedges.

A number of introduced species have become conspicuous in the riverine vegetation. They include the giant reed (*Arundo donax*), the willow tree (*Salix babylonica*), the castor oil bush and the various species of vines and creepers (see Section 5.2). All of these represent major disruptions in the landscape. The edible fig currently does not disrupt the landscape. However given that it can grow to the size of a small tree, is quite common in the area and is deciduous means that it will form a major disruption in the landscape in the future. Two medium size introduced trees, also deciduous, the coral (*Erythrina caffra*) and the cape lilac (*Melia azedarach*) are often planted on land adjacent to the river and both contribute an alien effect to the landscape.

6.2.3 Loss of landscape

With increasing urbanization, many of the rural areas along the river which now support native trees over pasture or orchards will be lost. It is these rural areas, together with the riverine forested corridor which impart much of the unique character or landscape of the area. If they are lost, then the viewscape will be of a thin belt of forest surrounded by urban development.

6.3 Rare and endangered and priority species

No species declared rare or endangered by the Department of Conservation and Land Management (CALM) were found along the rivers during the course of this study. However, the sedge *Restio stenostachyus*, which is listed as a priority species, was found under *Melaleuca rhaphiophylla* low closed forest on the western bank of the Southern River north of the Allen Road reserve (see Map 9).

6.4 Ecological corridors and wildlife habitat

6.4.1 The riverine corridor

The peripheral vegetation and the river itself provides a corridor of habitat. This corridor aids the growth of plant and movement of animal species up and down the river. It also provides habitat for invertebrate, reptilian and bird fauna. Urban birdlife capable of breeding and living in urban parks also use it as addditional habitat. The larger and older native trees along the rivers are of particular importance as they flower more heavily than young trees, and hence provide more nectar for insects and birds and support a larger invertebrate fauna which in turn supports reptiles and birds. The high branches and gnarled shape of the older trees also provide more nesting sites than do the young trees.

The effectiveness of the riverine corridor in enabling the safe movement of animals up and down the river will be maximised by reducing the number and size of the breaks in the corridor and by increasing its width. This can be done by safe-guarding the existing vegetation and by rehabilitating those areas of floodway and adjacent embankments or floodfringe which now support little or no native vegetation.

6.4.2 Riverine aquatic habitat

The only relatively natural stream habitat remaining on the Canning or Southern/Wungong Rivers below the dams occurs in the forested regions in the scarp. Here most of the peripheral vegetation that existed prior to European settlement remains and actually grows into the river channel. As a result the flow of the water is retarded and emergent aquatic plants, such as *Triglochin procera*, are more successful than elsewhere. Such areas are today isolated by the upstream dam walls and the severely degraded conditions which occur downstream.

6.5 Loss of trees

In the study area, trees, particularly the large ones, provide habitat for invertebrates and birds, stabilise the river channel and the river valley embankment and contribute greatly to the landscape. Presently trees are being lost on rural land through ring barking by cattle and horses or by wiring of trees as part of fence lines or apparatus to operate pumping facilities. In some

areas of the rivers trees are being undermined by erosion (see Section 6.1). A more long term threat is the general ageing of trees in the absence of regeneration. This occurs in over grazed paddocks where stock eat young trees and in parklands where lawn maintenance prevents regeneration.

6.6 Associated wetlands

Between Armadale Road and Rowley Road, there are three small wetlands (see Maps 10 and 11). These wetlands support extensive stands of *Melaleuca rhaphiophylla* low closed forest and *Juncus* closed sedgeland and small stands of *Schoenoplectus validus*, *Baumea articulata* and *Typha orientalis* tall closed sedgelands in close proximity to permanent and seasonal standing water bodies. As such, they provide valuable waterbird habitat, especially over the dry summer/autumn period.

6.7 Native vegetation rehabilitation

The following is a list of the native plant species recommended for rehabilitation of the native vegetation, broken down into the various zones of the river valley. Species which are rare or restricted in distribution should receive special attention. These species are denoted by the asterisk (*).

River channel and floodway

Eucalyptus rudis	flooded gum
Melaleuca rhaphiophylla	swamp paperbark
Astartea fascicularis	
Agonis linearifolia	swamp peppermint
Viminaria juncea	golden spray
Grevillea diversifolia	valley grevillea
Grevillea glabrata (Scarp only)	smooth glabrata
Hakea trifurcata (Scarp only)	two leaf Hakea
Labichea lanceolata	tall Labichea
Paraserianthes lophantha	Albizia
Trymalium grandiflorum (Scarp only)	
Baumea juncea	twig rush
B. riparia	
Lepidosperma gladiatum	coastal sword sedge
(coastal plain)	
L. effusum (Scarp only)	
L. longitudinale	common sword sedge
L. tetraquetrum	

J. subsecundatus	
J. pallidus	giant rush
Hemarthria uncinata	mat grass
Calycopeplus ephedroides	

River valley embankment

Eucalyptus rudis	flooded gum
E. calophylla	marri
Banksia littoralis	swamp Banksia
Hakea varia	variable leaf Hakea
Hakea trifurcata	two leaf Hakea
Acacia saligna	coojong
Viminaria juncea	golden spray
Pteridium esculentum	braken fern

Sandy embankment

Eucalyptus calophylla	marri
E. marginata	jarrah
E. todtiana	prickly bark
Allocasuarina fraseriana	sheoak
Xylomelum occidentale	native pear
Banksia attenuata	slender Banksia
B. grandis	bull Banksia
B. ilicifolia	holly leaf Banksia
B. menziesii	firewood Banksia
Hakea prostrata	harsh Hakea
Hakea varia	variable leaf Hakea
Grevillea vestita	
Acacia pulchella	prickly moses
Jacksonia furcellata	grey stinkwood
J. sternbergiana	stinkwood
Isolepis nodosa	knotted club-rush
Hardenbergia comptoniana	native Wisteria

Winter wet depressions on flood plain

Melaleuca preissiana	modong paperbark
M. rhaphiophylla	swamp paperbark
M. viminea	mohan
M. polygaloides	grey honeymyrtle
Kunzea ericifolia (sandy)	spearwood
K. micrantha (sandy)	
Pericalymma ellipticum (sandy)	swamp tea tree

Near standing water

*Baumea articulata**	jointed twig rush
*Schoenoplectus validus**	lake club-rush
*Juncus polyanthemus**	sedge

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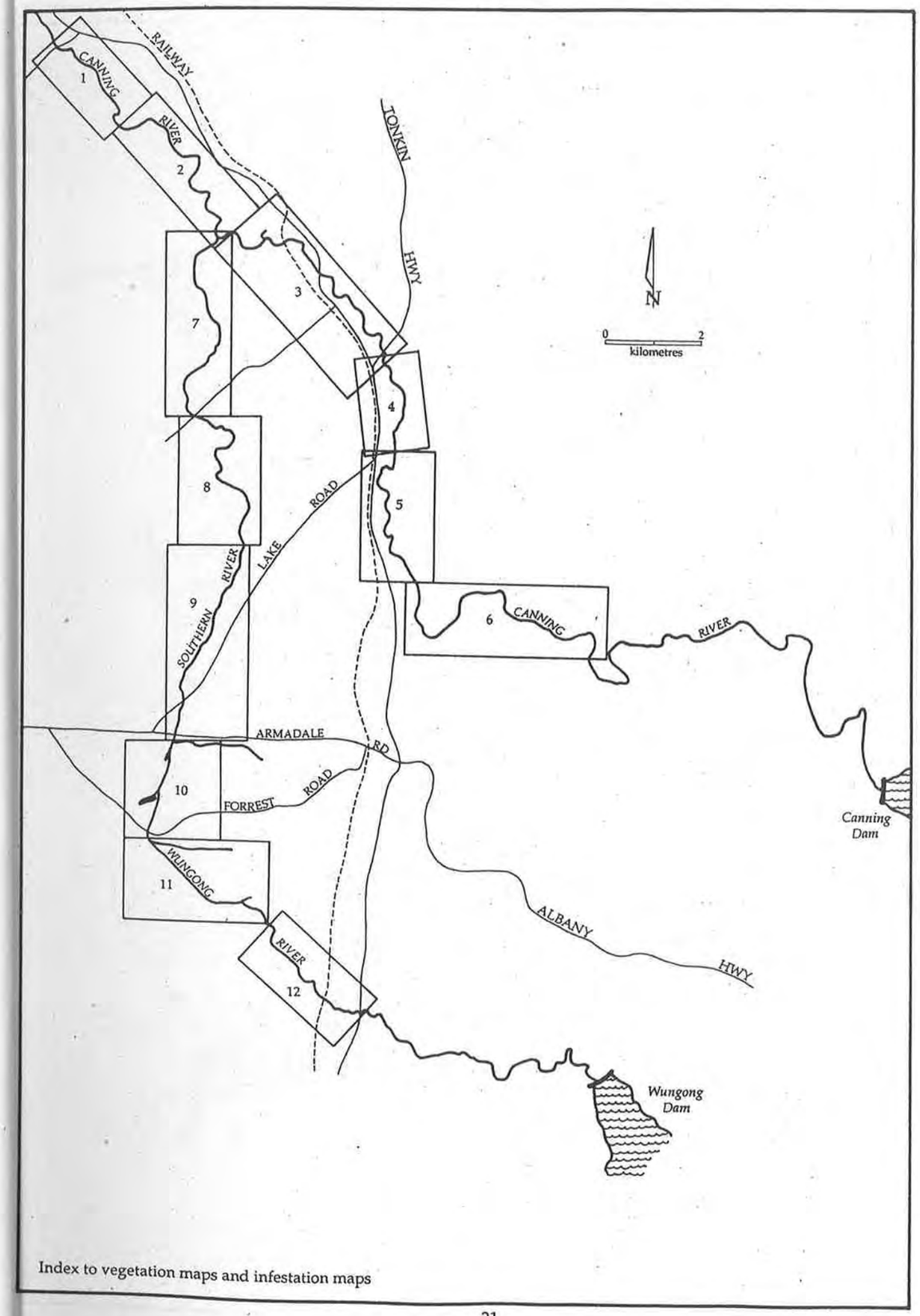

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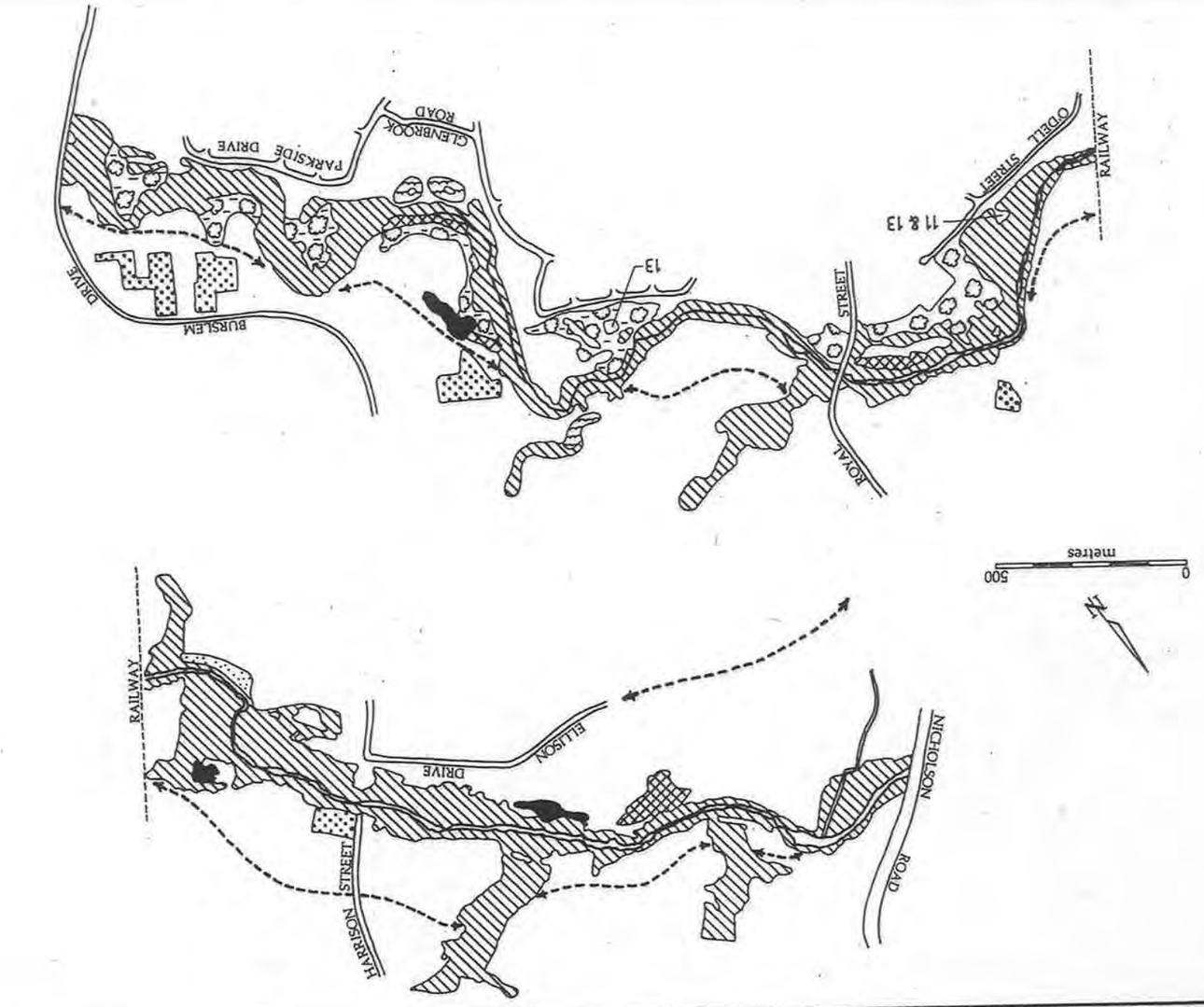

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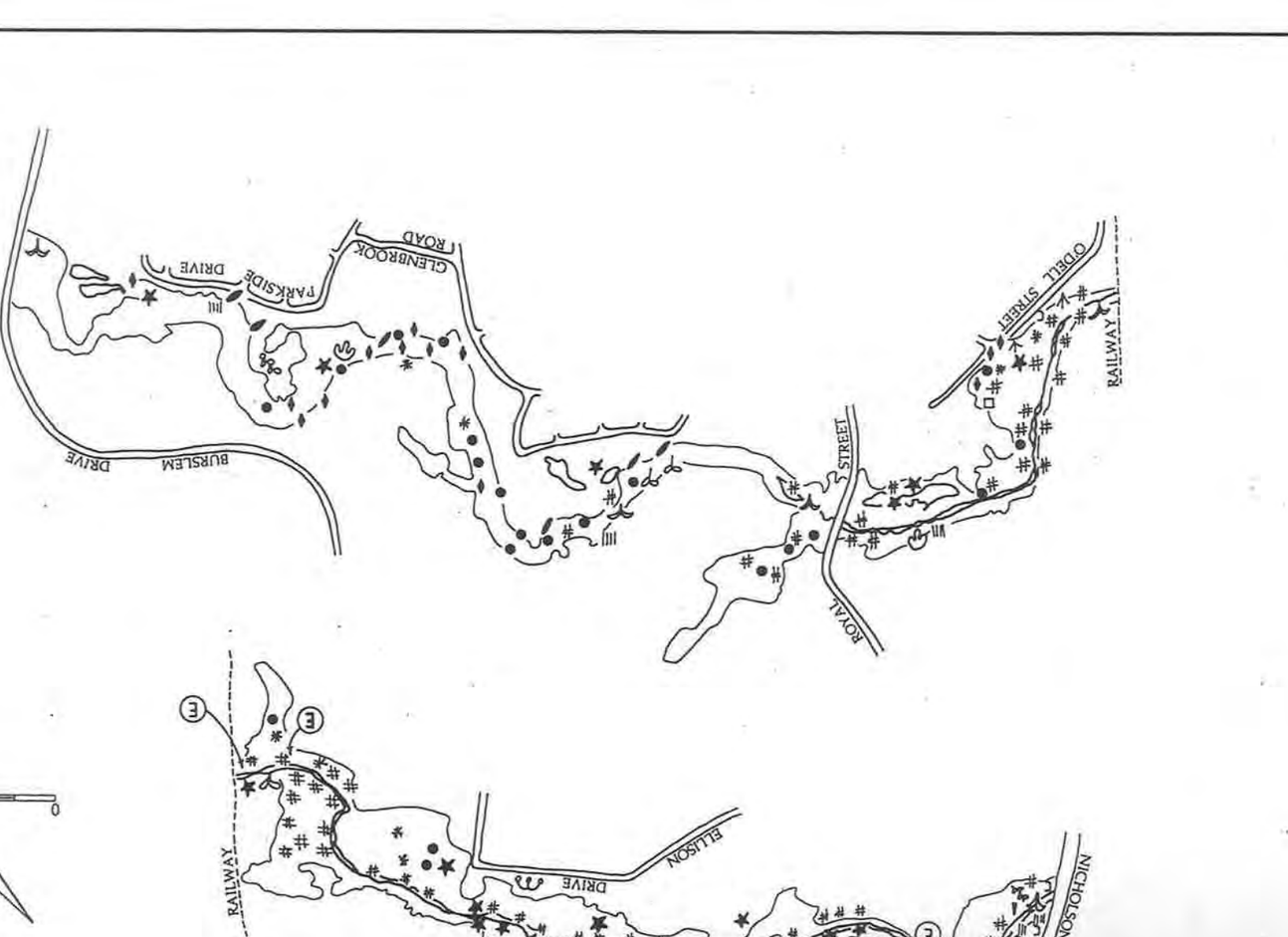

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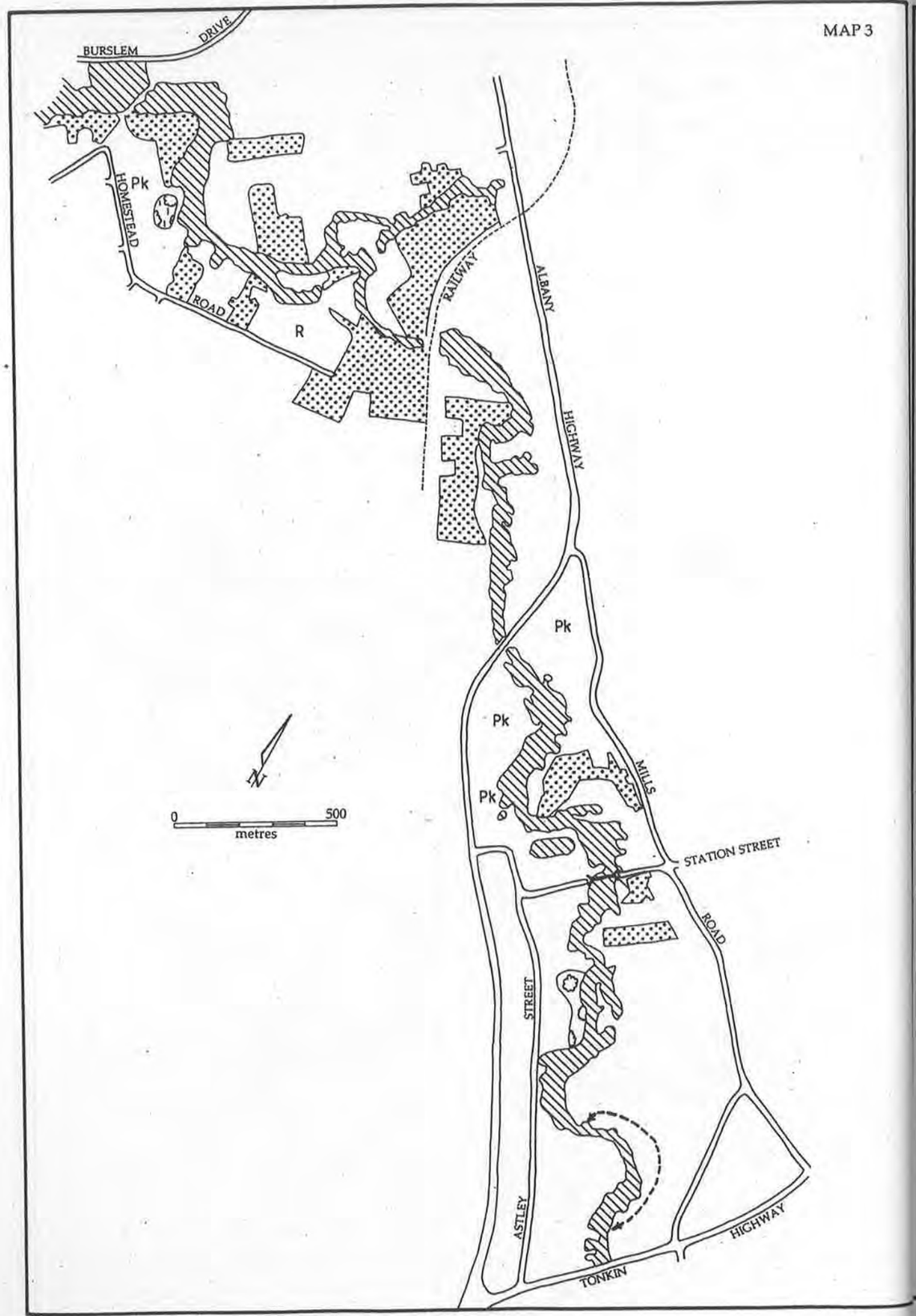
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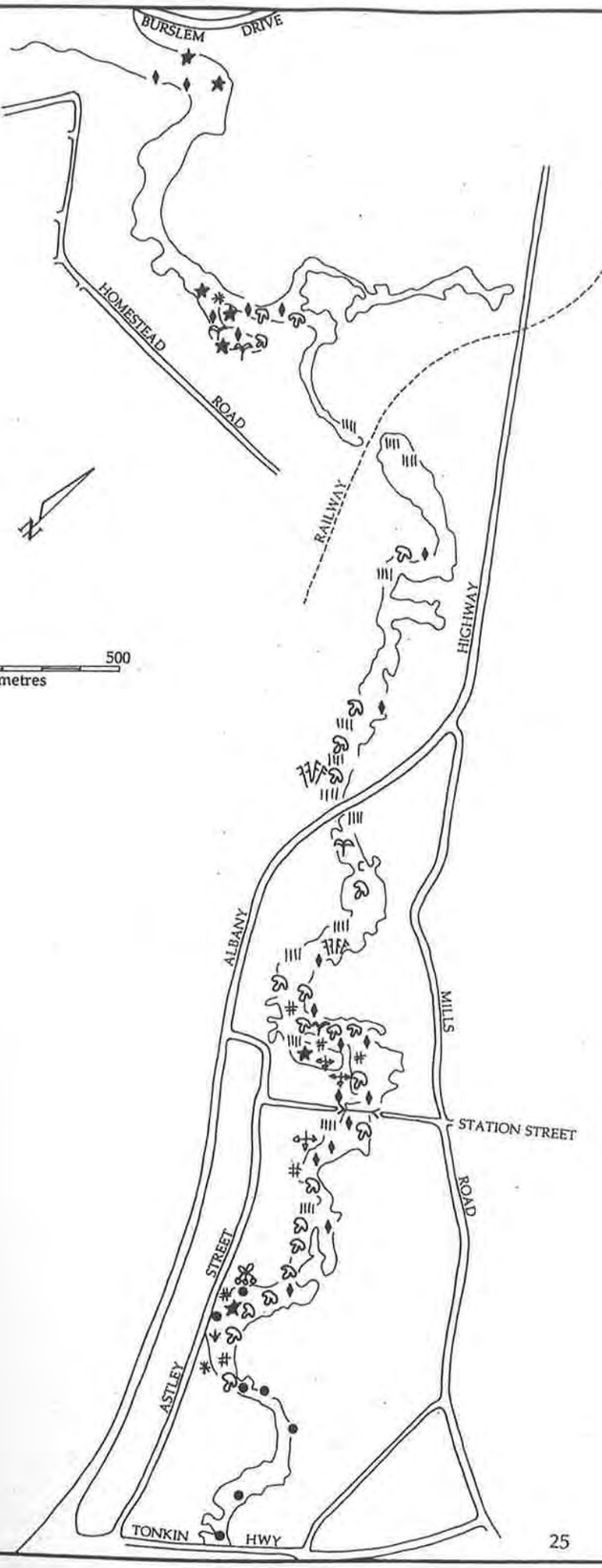
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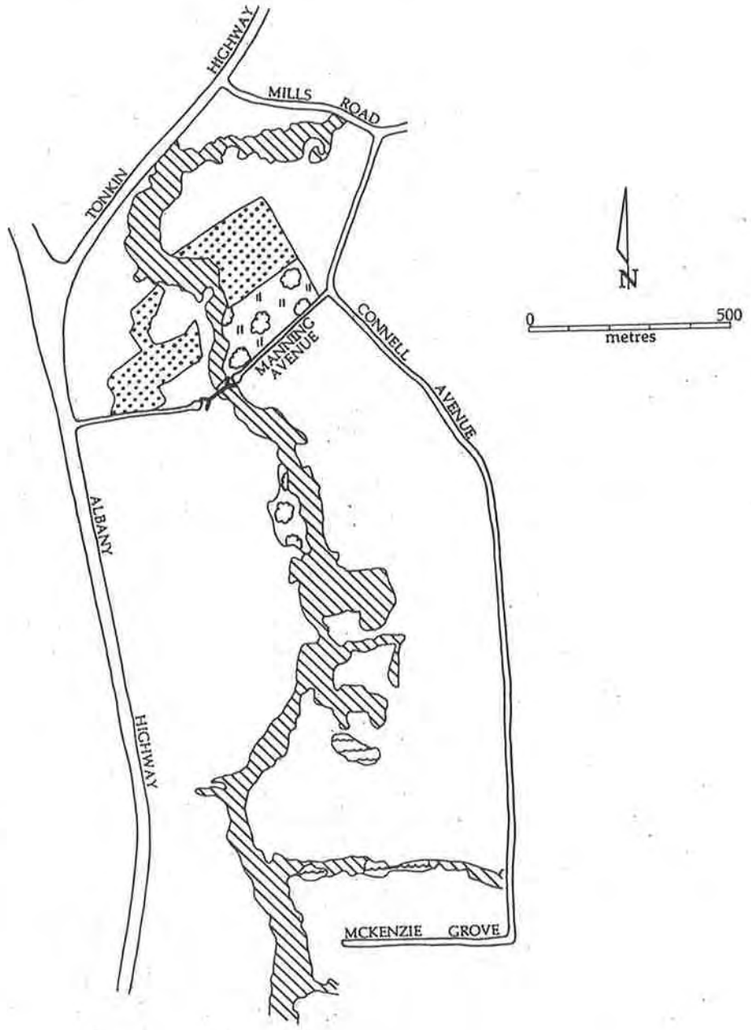
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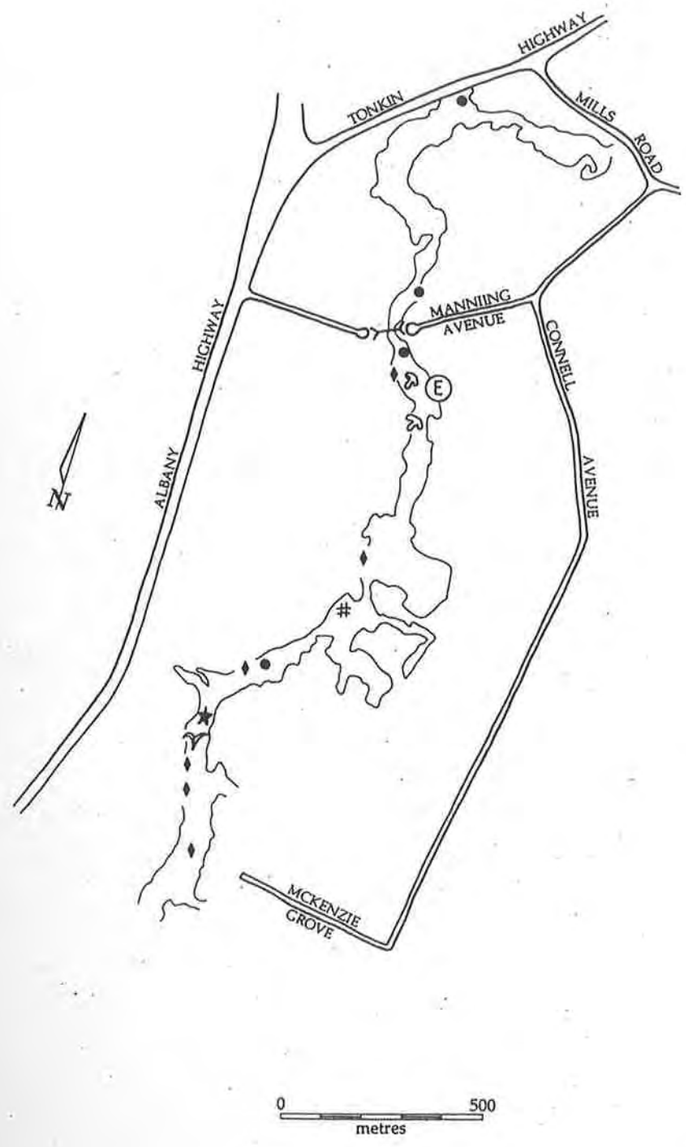
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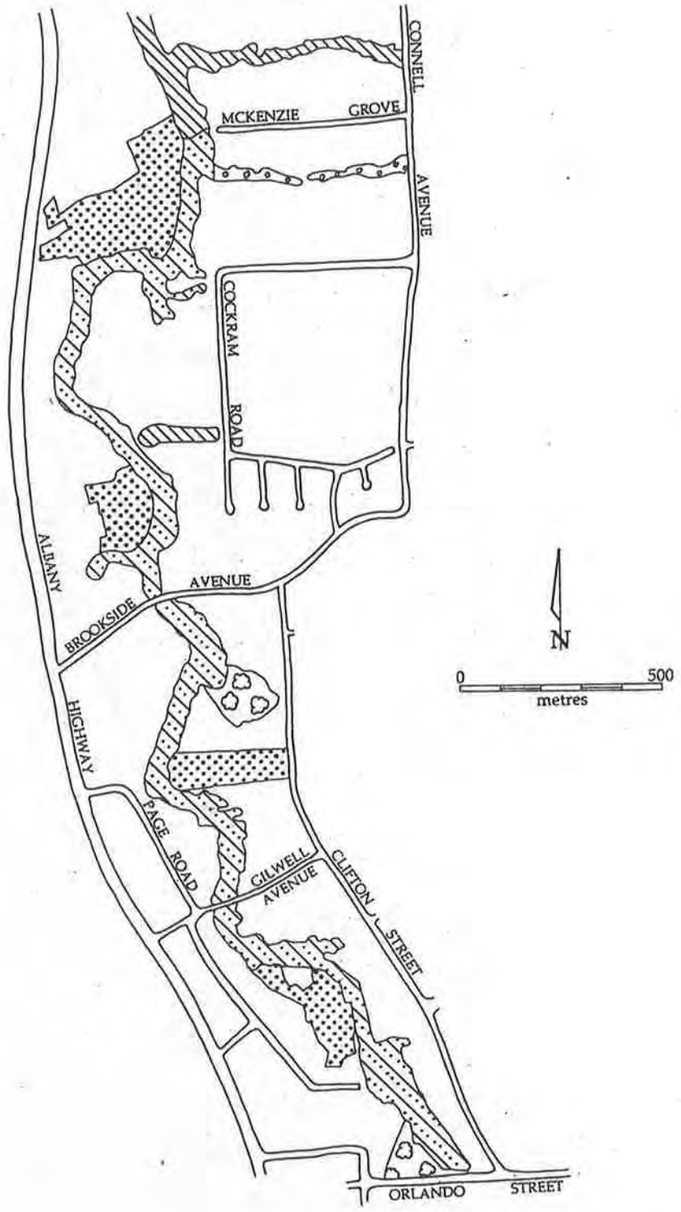
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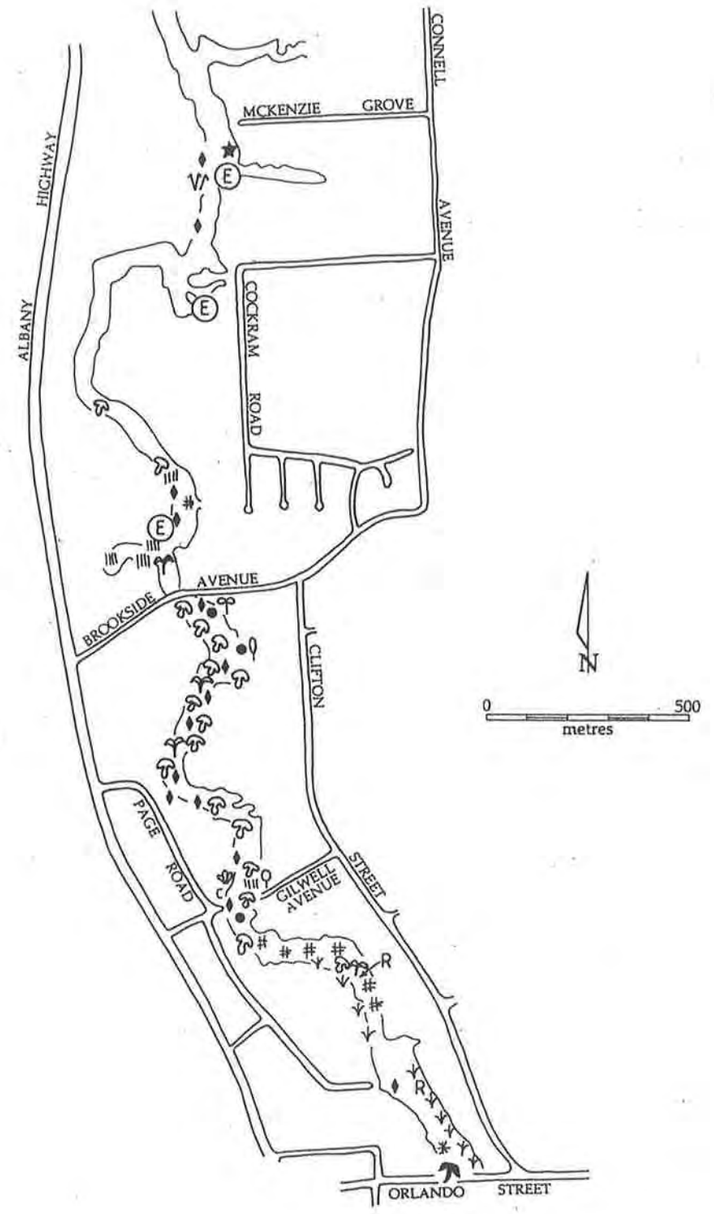
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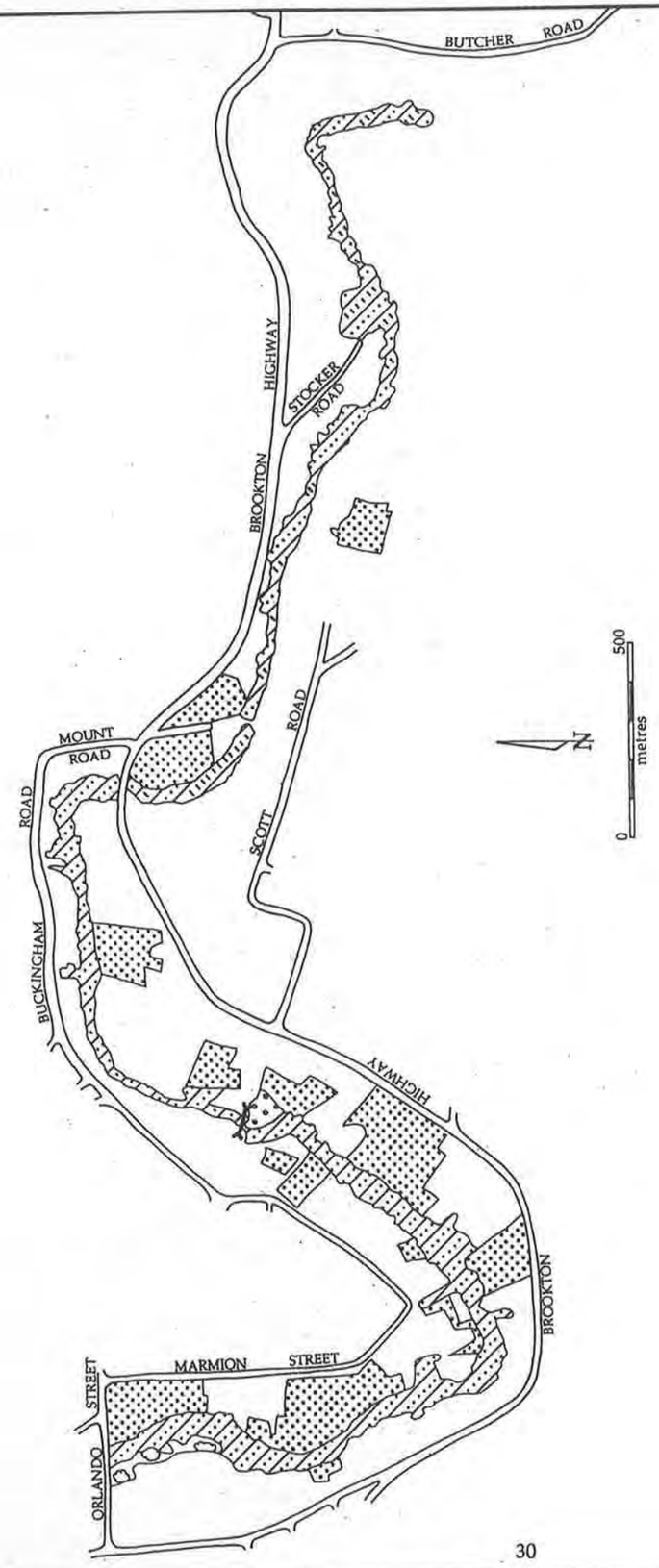
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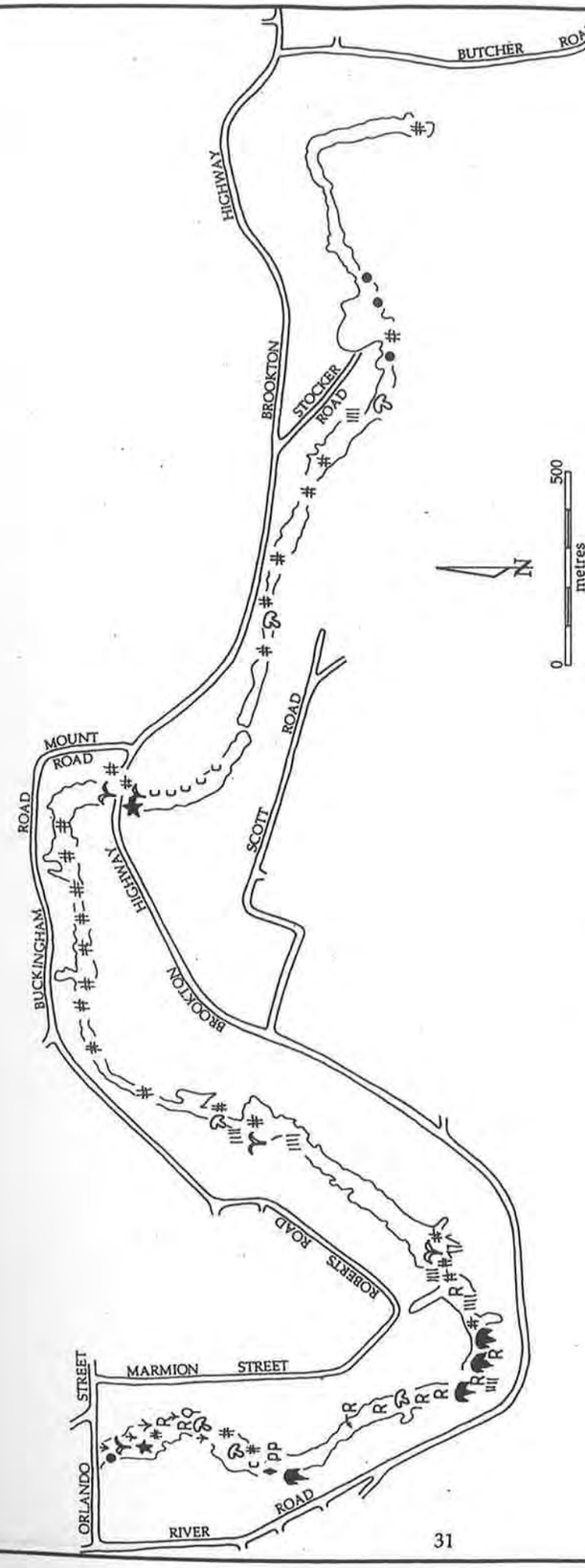
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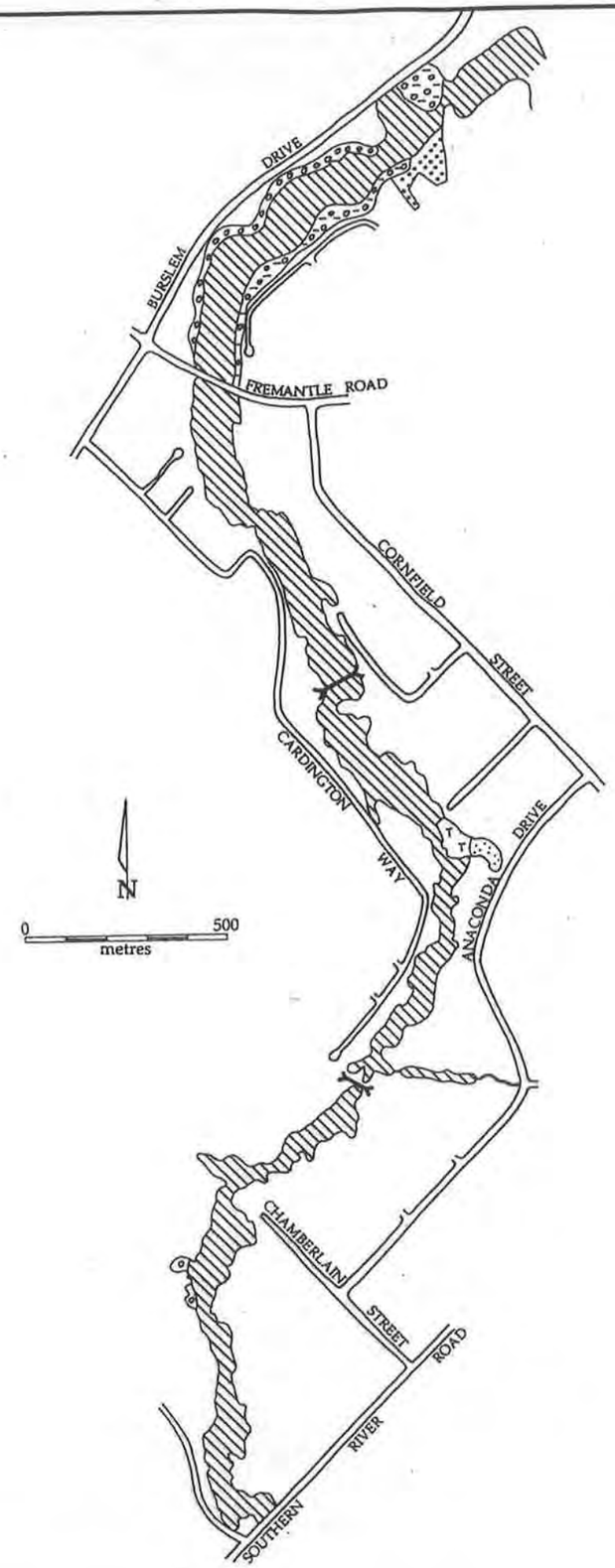
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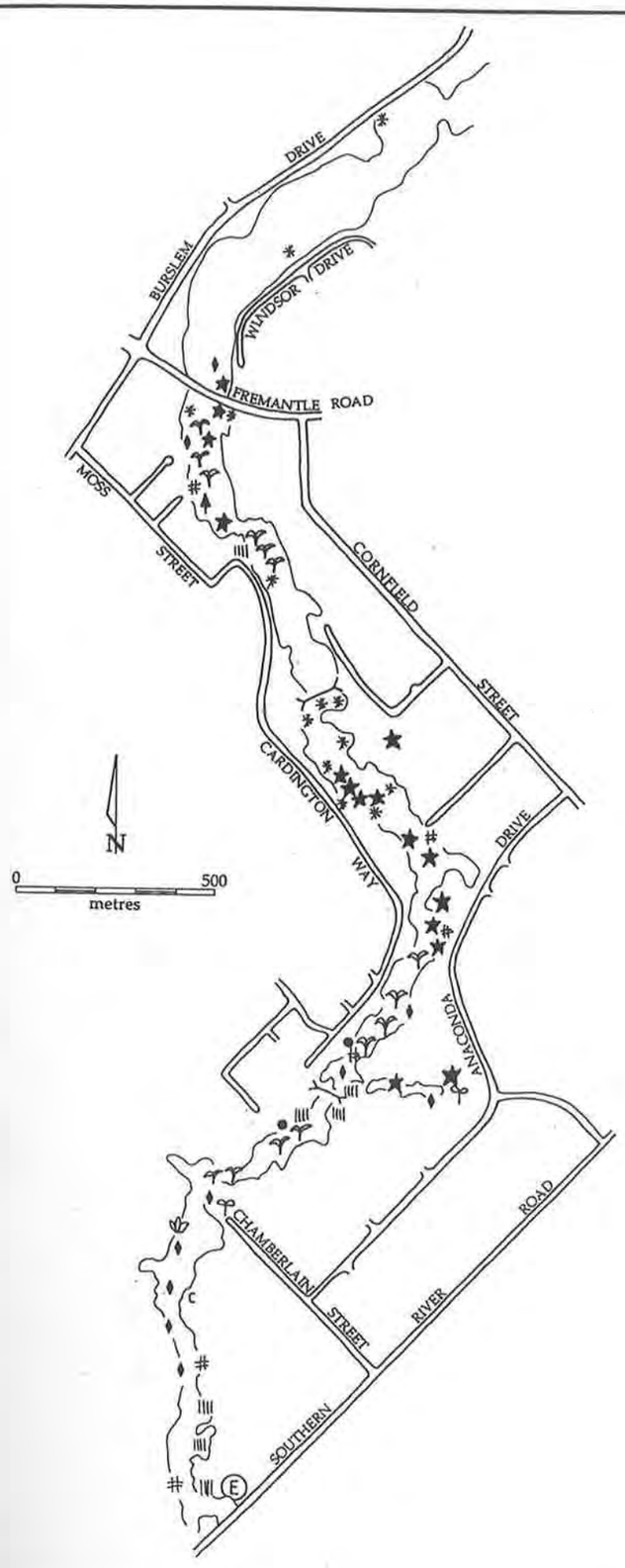
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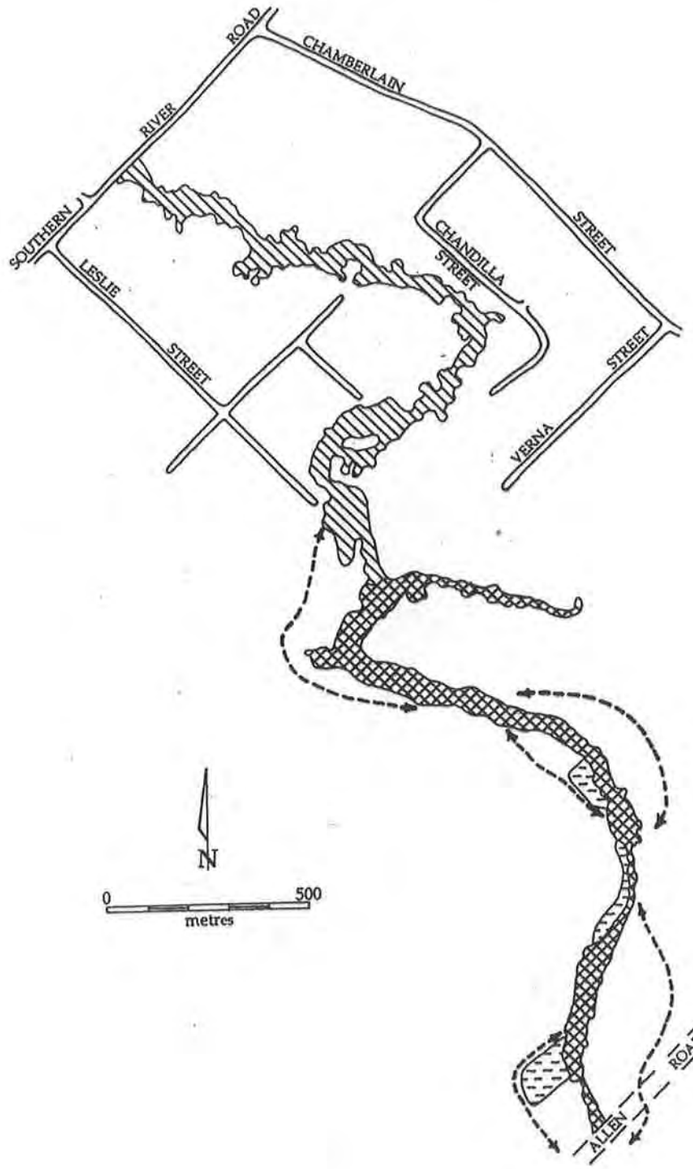
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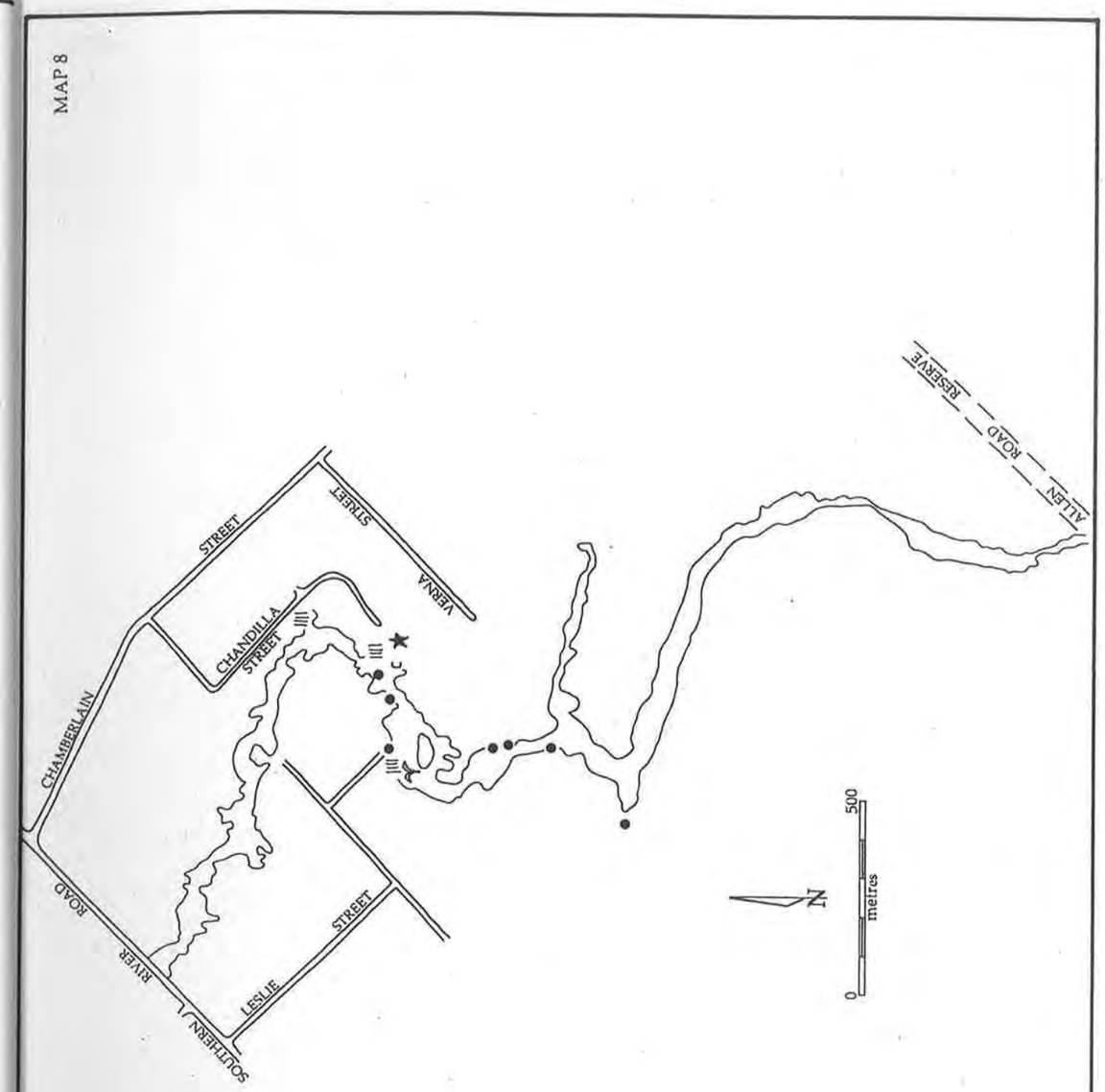
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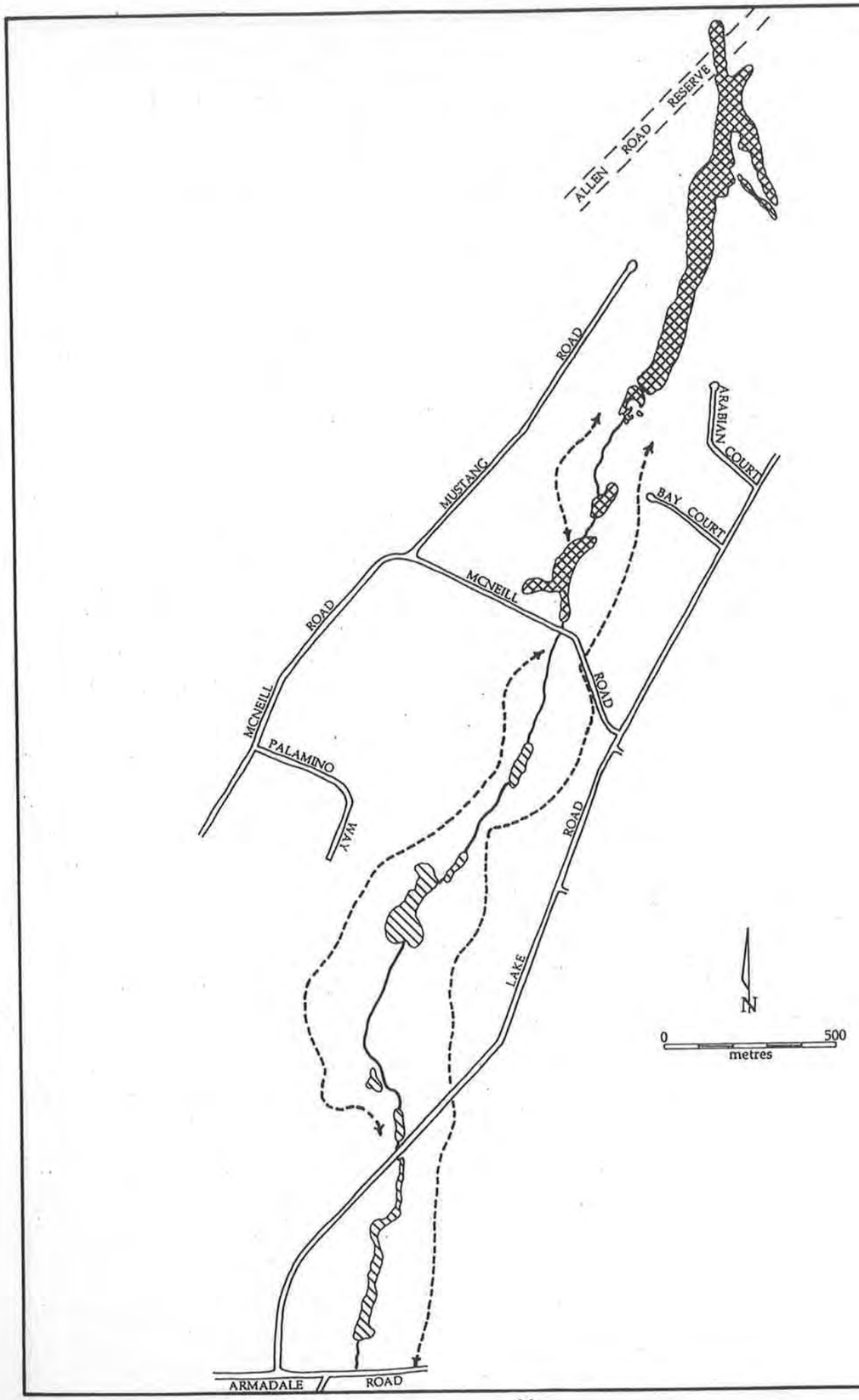
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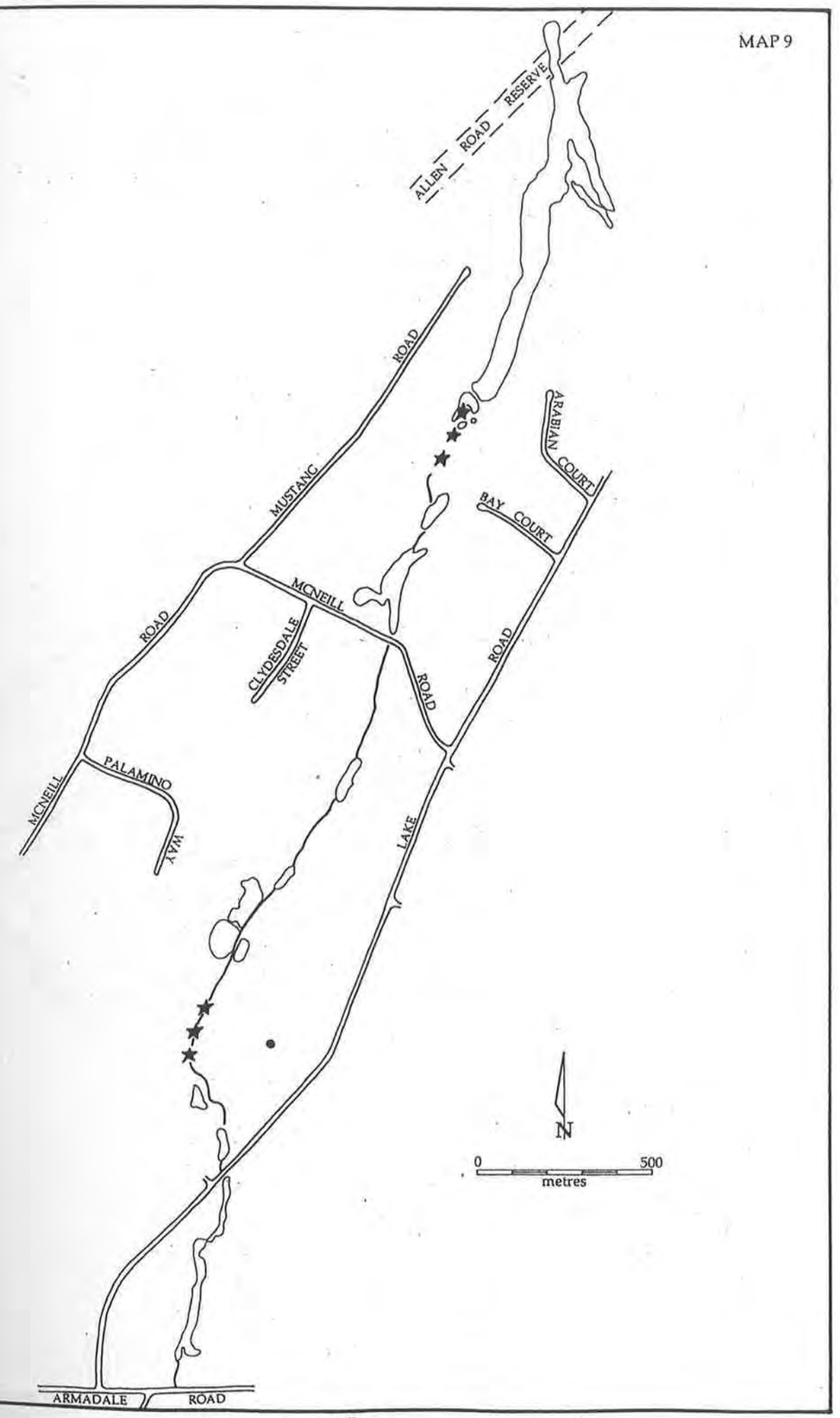
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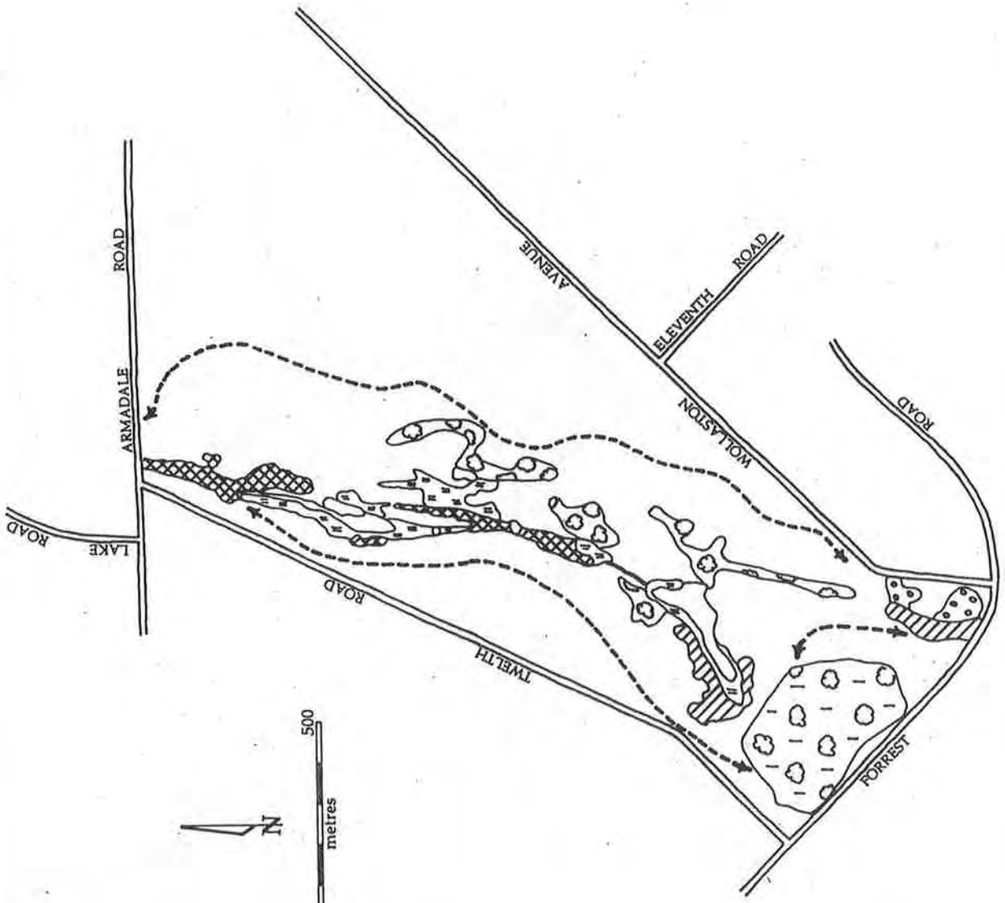
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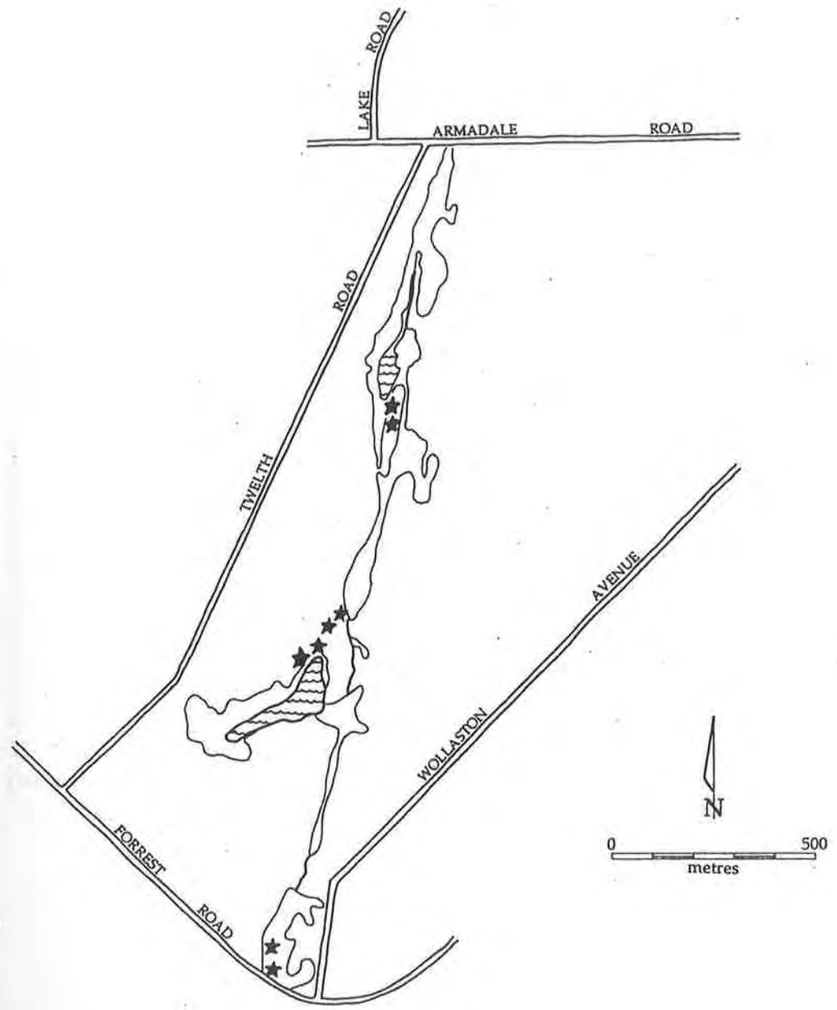
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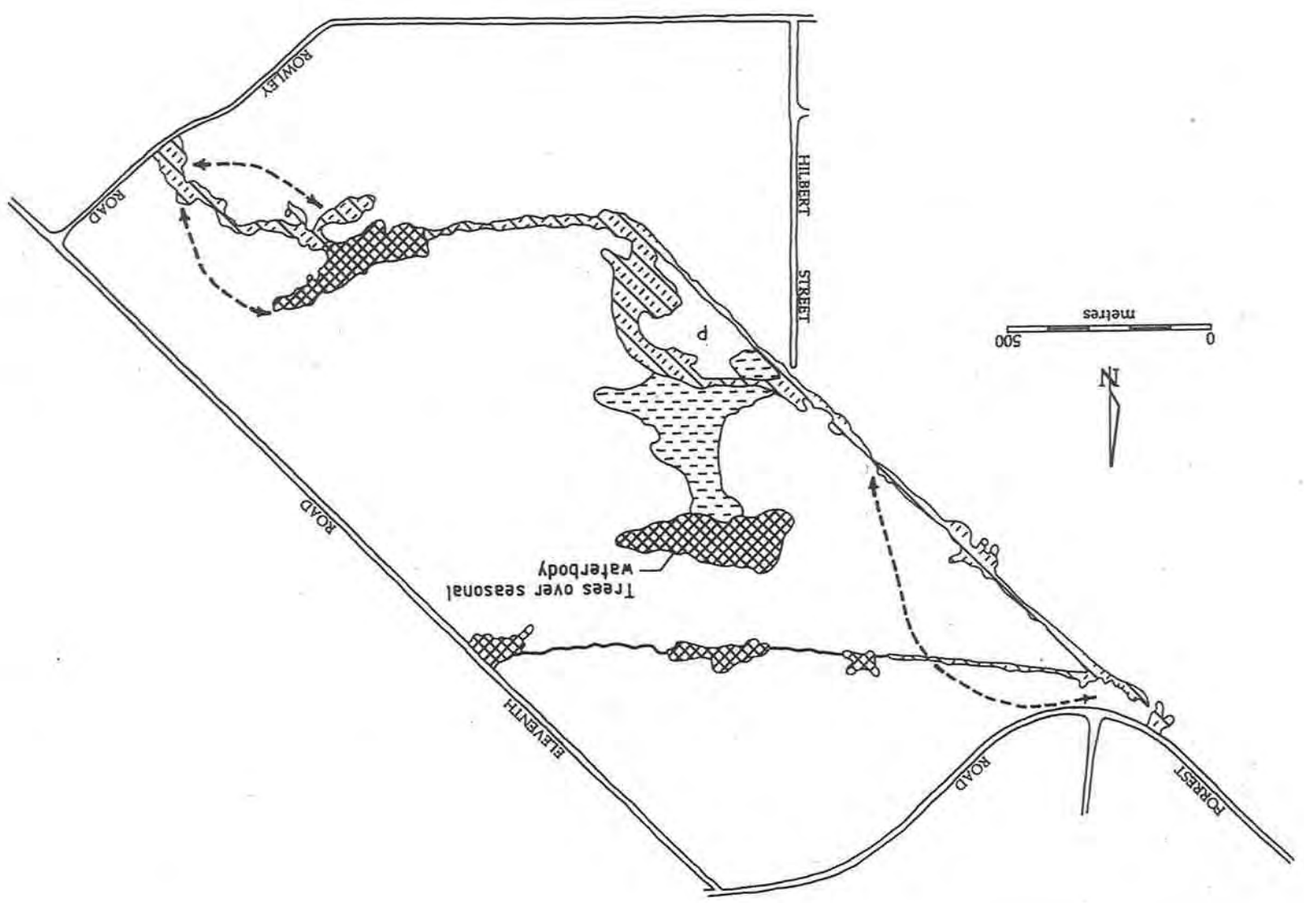

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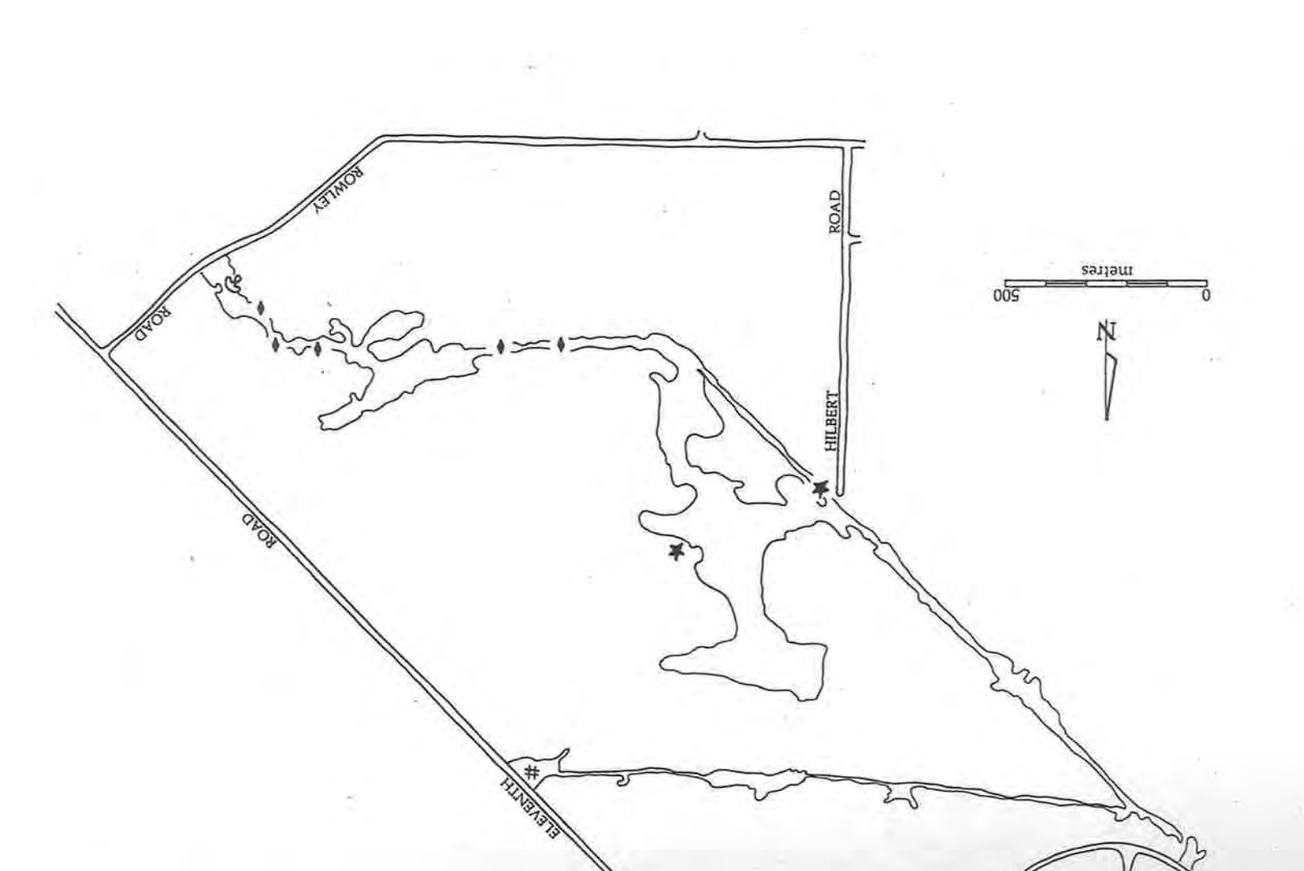

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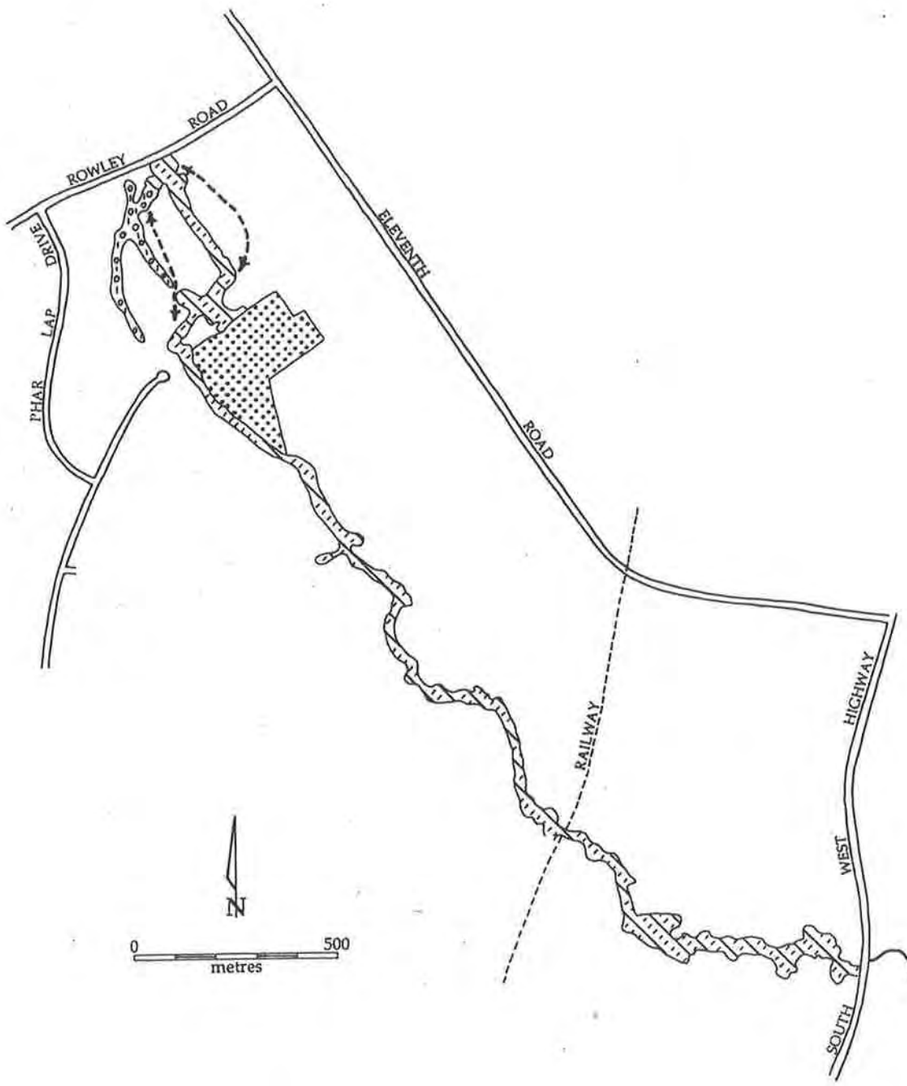
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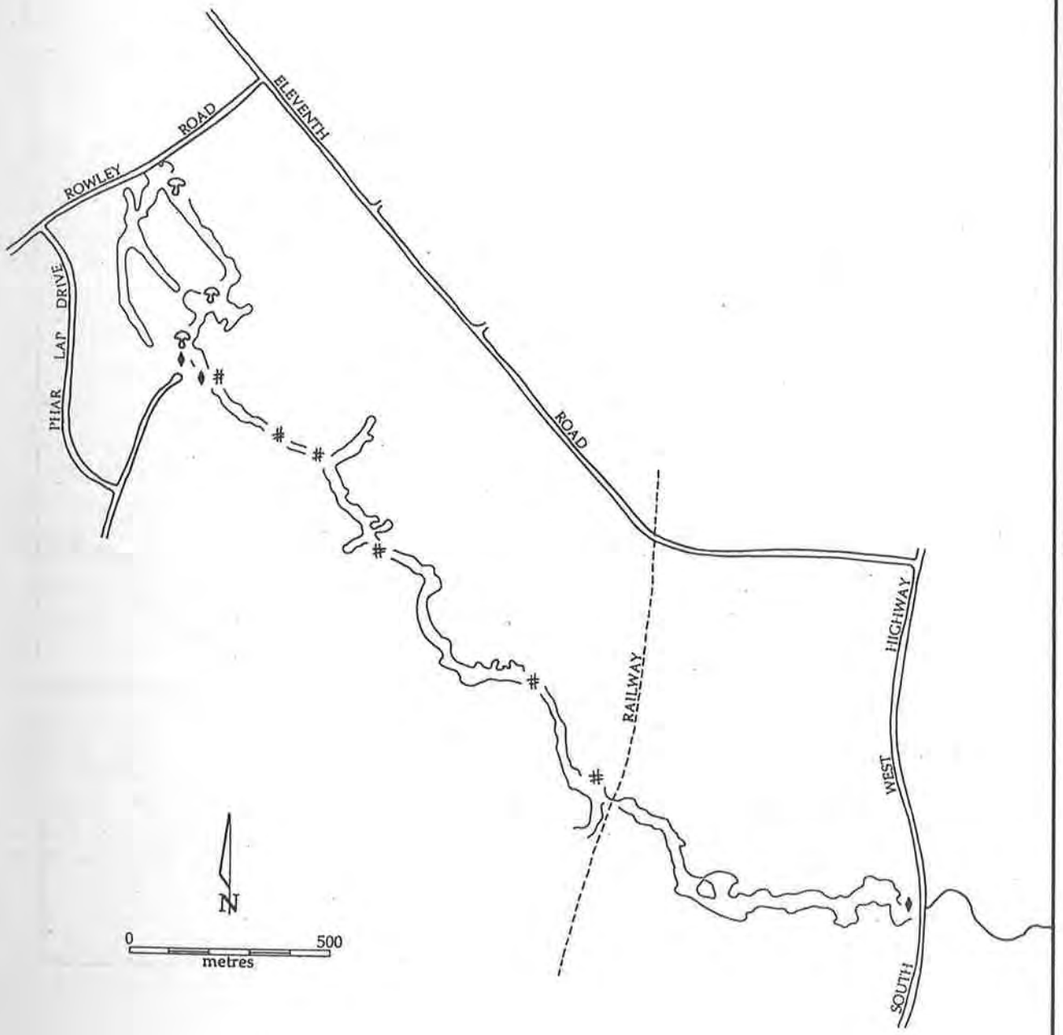
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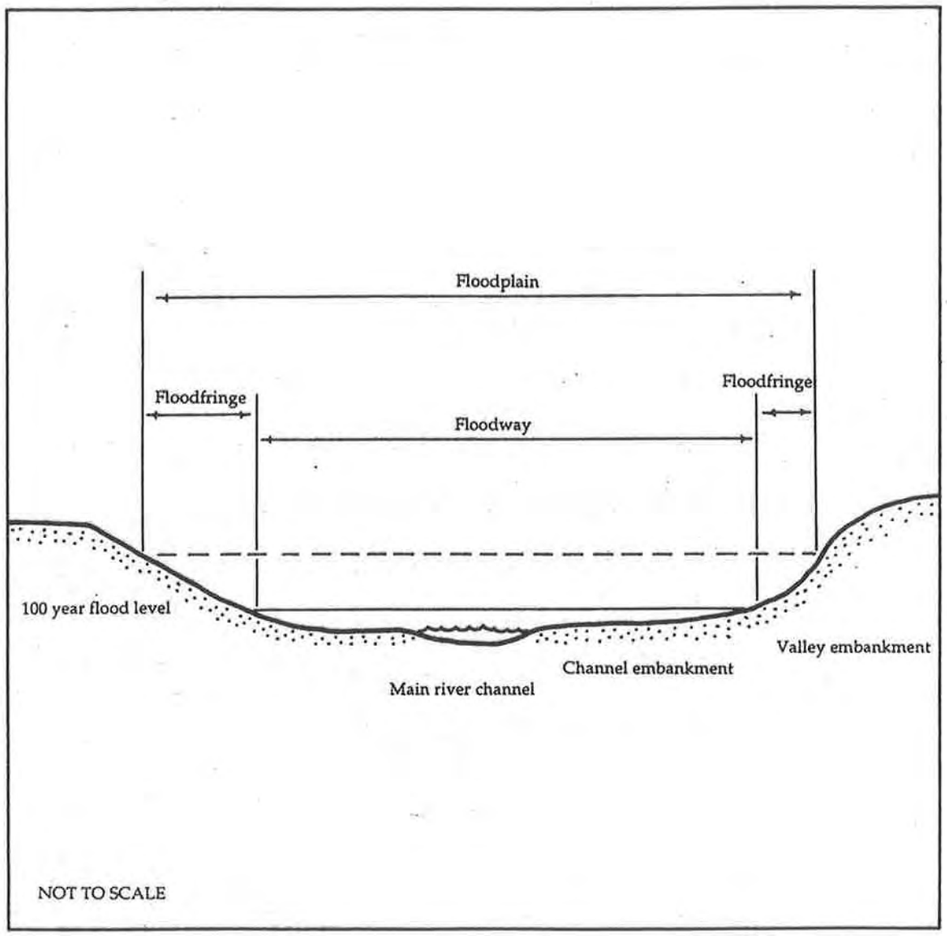

Figure A1: Terms used to describe river valley form.

APPENDIX 1

RIVER VALLEY FORM AND NOMENCLATURE

Figure A1 illustrates typical river valley form and the nomenclature used to describe it.

Each river consists of a floodway which resides in a valley, which may have very deep, as is the case in the scarp, very shallow, as is the situation for the Canning River in the study area below the scarp or almost non-existent, as in case of the Southern/Wungong River in the north-western part of the City of Armadale. Within the floodway water generally flows along a main channel, which will wander from one side of the floodway to another as the water moves downstream. Sometimes on the Canning there are two channels, a primary one, which always carries water, and a secondary one which will carry water in times of flood. At times of heavy discharge the entire floodway will carry water.

When the floodway is contained within a shallow or steep valley, the embankments on each side will contain the water from even the most severe flooding and therefore the extent of the extra floodfringeis minor. On the other hand, when there is no obvious valley form, the flood plain (i.e. floodway plus flood fringe) may extend over a very wide area. As mentioned above, significant flood plain areas are found in the low lying areas adjacent to the Southern/Wungong River between Allen Road and Forrest Road. Such an areas exist on the Canning at the very bottom of the study area.

Fringing vegetation seldom occupies the main channel, but where water movement is very slow, due to the frictional effects of vegetation or stream debris, some aquatic species are able to take root. On the other hand the channel embankment and the floodway support dense vegetation which may extend over a broad flood plain or up the river valley embankments. Flood plain and river valley embankments can support their own distinctive plant communities, which are often more relatively open than those of the floodway.

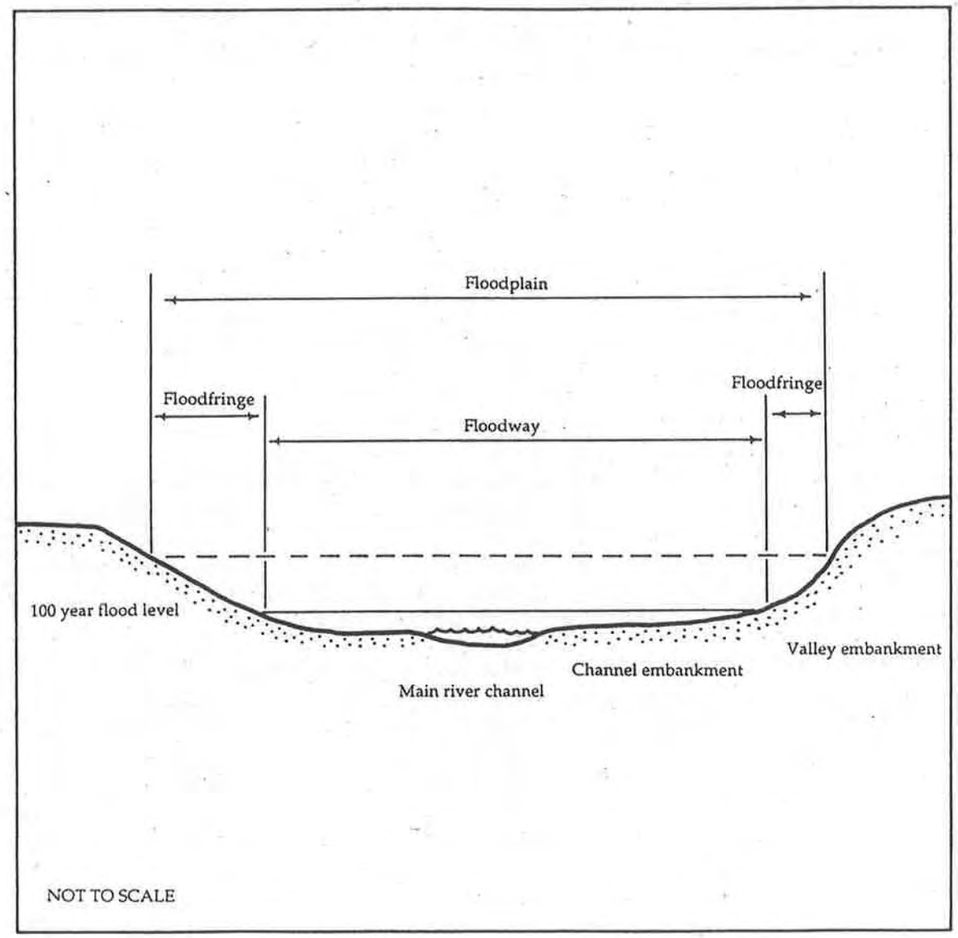

Figure A1: Terms used to describe river valley form.

APPENDIX 2

AERIAL PHOTOGRAPHS USED TO DOCUMENT VEGETATION CHANGES BETWEEN 1941 AND 1991

Figure 5.1

1955 WA195 Metropolitan Area (PWD) Run 4 No. 14

1975 WA1568 Metro Road Guide Rev. 1975 Scale 1:25 000 11.6.1975
Proj. Q98 Run 9 No. 5223

1991 WA2942(C) Metro Street Directory and Ext. Scale 1:20 000 5.1.1991
Job no. 910400 Run 12 No. 5151

Figure 5.2

1963 WA838 Wanneroo - Lake Clifton 14.10.63 Proj. D28
Run 24 No. 5333

1991 WA2942(C) Metro Street Directory and Ext. Scale 1:20 000 5.1.1991
Job no. 910400 Run 12 No. 5151

Figure 5.3

1941 Kelmscott Map 1453 (Mission No. KD710)
Run 5 Nos 3906 - 3909

1963 WA838 Waneroo - Lake Clifton 14.10.1963
Run 25 No. 5293

1991 WA2938(C) Metro Street Directory & Ext. Scale 1:20 000
4.1.1991 Job no. 910400 Run 13 No. 5177

APPENDIX 3

AERIAL PHOTOGRAPHS USED TO MAP THE VEGETATION ALONG THE CANNING, SOUTHERN AND WUNGONG RIVERS

Metro Street Directory & Ext. 1:20 000 5.1.1991 Job no. 910400

WA2942(C)	Run 12	Nos 5143 - 5152
WA2938(C)	Run 13	Nos 5169 - 5179
WA2938(C)	Run 14	Nos 5124 - 5137
WA2938(C)	Run 15	Nos 5059 - 5065
WA2938(C)	Run 16	Nos 5027 - 5029

APPENDIX 4

SCIENTIFIC NAMES, VERNACULAR NAMES AND SHORT DESCRITIONS OF PLANT SPECIES FOUND ALONG THE CANNING AND SOUTHERN/WUNGONG RIVERS BETWEEN NICHOLSON ROAD BRIDGE, CANNINGTON, AND THE CANNING AND WUNGONG DAMS

Scientific name	Common name	Description
Acacia alata	Winged wattle	medium shrub
Acacia longifolia		small tree
Acacia pulchella	Prickly Moses	shrub
Acacia saligna	Coojong	small tree
Agonis linearifolia	Swamp peppermint	large shrub - small tree
Allocasuarina fraseriana	Sheoak	small tree
Alternantera nodiflora	Joyweed	creeping herb
**Arctotheca calendula*	Capeweed	small herb
**Arundo donax*	Giant reed	tall grass
**Asclepias curassavica*	Redhead cottonbush	perennial herb
* *Astartea fascicularis*		large shrub
**Aster subulatus*	Wild aster	annual herb
**Avena barbata*	Bearded oats	annual grass
Banksia attenuata	Slender Banksia	small tree
Banksia grandis	Bull Banksia	small tree
Banksia ilicifolia	Holly Banksia	small tree
Banksia littoralis	Swamp Banksia	small tree
Banksia menziesii	Firewood Banksia	small tree
Baumea articulata	Jointed twig rush	giant sedge
Baumea juncea	Twig rush	sedge
Baumea riparia		large sedge
**Bolboschoenus caldwellii*	Club rush	medium sedge

**Briza maxima*	Quaking grass	annual grass
**Briza minor*	Lesser quaking grass	annual grass
Calycopeplus ephedroides		tall shrub -small tree
**Canna* x. *orchiodes*	Canna lily	large herb
Cassytha sp.	Doda	parasitic vine
Centella cordifolia		stoloniferus herb
**Chenopodium glaucum*	Glaucous goosefoot	annual herb
**Conyza bonariesis*	Tall fleabane	annual herb
Cotula coronopifolia	Waterbuttons	tiny herb
**Cynodon dactylon*	Couch	perennial creeping grass
**Cyperus tenuiflorus*	Scaly sedge	sedge
Darwinia citriodora	Lemon-scented Darwinia	medium shrub
Dichanthium fecundum		tall grass
**Dipogon lignosus*	Dolichos pea	herbaceous twiner
Drosera macrantha	Bridal rainbow	tiny herb
**Ehrharta calycina*	Perennial veldt grass	tufted shrub
**Eragrostis curvula*	African lovegrass	tufted grass
**Erythrina caffra*	Coral tree	medium tree
Eucalyptus calophylla	Jarrah	large tree
Eucalyptus rudis	Flooded gum	large tree
Eucalyptus todtiana	Pricklybark	medium tree
Eucalyptus wandoo	Wandoo	large tree
**Ficus carica*	Edible fig	small tree
**Foeniculum vulgare*	Fennel	large herb

**Gladiolus angustatus*	Long tubed painted lady	bulbous annual herb
**Gomphocarpus fruticosus*	Cottonbush	erect shrub
Grevillea diversifolia	Valley Grevillea	large shrub
Grevillea glabrata	Smooth Grevillea	large shrub
Hakea prostrata	Harsh Hakea	large shrub - small tree
Hakea ruscifolia	Candle Hakea	erect busy shrub
Hakea trifurcata	Two-leaf Hakea	erect shrub
Hakea varia	Variable leaf Hakea	large shrub - small tree
Hardenbergia comptoniana	Native Wisteria	twining shrub or climber
Hemarthria uncinata	Mat grass	creeping grass
Hibbertia hypericoides	Buttercup	medium shrub
**Holcus lanatus*	Yorkshire fog	annual grass
**Homeria flaccida*	Cape tulip	annual herb
Hydrocotyle ranunculoides		floating aquatic herb
**Ipomoea indica*	Morning glory	herbaceous twiner
Isolepis nodosa	Knotted club-rush	sedge
**Isolepis prolifera*	Budding club-rush	perennial herb
Jacksonia furcellata	Grey stinkwood	large shrub
Jacksonia sternbergiana	Stinkwood	large shrub
**Juncus acutus*	Spiny rush	rush
Juncus holoschoenus	Jointleaf rush,	perennial rush
Juncus kraussii	Shorerush	rush
Juncus pallidus		rush
Juncus subsecundatus		rush
Juncus sp. (*polyanthus*)		rush

Kunzea ericifolia	Spearwood	large shrub - small tree
Kunzea micrantha		large shrub - small tree
**Lanatana camara*	Common lantana	climbing shrub
Labichea lanceolata	Tall Labichea,	tall shrub
Lepidosperma longitudinale	Common sword sedge	sedge
Lepidosperma tetraquetrum		large sedge
Leptocarpus scariosus		sedge
Leptocarpus sp.		
**Leptospermum laevigatum*	Coast teatree	tall shrub
**Lolium perenne*	Rye grass	annual grass
**Lonicera japonica*	Japanese honeysuckle	woody climber
**Lupinus cosentinii*	Common lupin	annual herb
Lyginia barbata		sedge
Macrozamia riedlei	Zamia palm	cycad
Melaleuca aff. *rhaphiophylla*	Paperbark	small tree
Melaleuca polygaloides	Grey honeymyrtle	small tree
Melaleuca preissiana	Modong paperbark	medium tree
Melaleuca rhaphiophylla	Swamp paperbark,	small- medium tree
Melaleuca viminea	Mohan	small tree
Melaleuca sp.	Paperbark	small tree
**Melia azedrach*	Cape Lilac	medium tree
**Myrsiphyllum asparagoides*	Bridal creeper	delicate creeper/climber
Nuytsia floribunda	Christmas tree	small tree
**Olea europaea*	Olive tree	small tree
**Oxalis pes-caprae*	Soursob	perennial herb

Paraserianthes lophantha	Albizia	large shrub
Patersonia sp.		perennial herb
**Paspalum dilatatum* grass	Paspalum grass	perennial tufted
**Paspalum distichum*	Water couch	perennial creeping grass
**Pennisetum clandestinum*	Kikuyu	perennial creeping grass
**Pennisetum setaceum*	Fountain grass	tall weeping grass
**Pentaschistis thunberii*		tall perennial grass
Pericalymma ellipticum	Swamp tea-tree	shrub
Plantago lanceolata	Ribwort	perennial herb
Pteridium esculentum	Braken fern	fern
**Raphanus raphanistrum*	Wild radish	annual herb
Restio stenostachyus		sedge (priority species)
**Ricinus communis*	Castor oil bush	small tree
**Romulea rosea*	Guildford grass	annual bulbous herb
**Rubus* spp.	Blackberry	thorny creeping shrub
**Rumex acetosella*	Sorrel	perennial herb
**Rumex crispus*	Dock	perennial herb
**Rhynchelytrum repens*	Red natal grass	tufted tall annual grass
**Salix* sp.	Willow tree	medium tree
Schoenoplectus validus	Lake club-rush	tall sedge
**Shinus terebinthifolius*	Japanese pepper tree	large shrub - small tree
**Sonchus asper*	Prickly sow thistle	annual herb
**Solanum nigrum*	Black nightshade	annual herb
**Stenotaphrum secundatum*	Buffalo grass	perennial creeping grass
Stirlingia latifolia	Blue boy	small shrub

**Thunbergia alata*	Blackeyed Susan	small creeping shrub
Trymalium grandiflorum		large shrub - small tree
Triglochin procera	Water ribbons	annual emergent aquatic herb
**Vinca major*	Blue periwinkle	creeping perennial
Viminaria juncea	Golden spray	large shrub
Verticordia ? densiflora		shrub
**Watsonia bulbilifera*	Wild watsonia	bulbous herb
Xanthorrhoea preissii	Blackboy	large shrub
Xylomelum occidentale	Woody pear	small - medium tree
**Zantedeschia aethiopica*	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
Small sedge	<0.5 m
Sedge (medium)	0.5-1 m
Tall sedge	>1 m
Rush	<1.5 m
Large rush	>1.5 m
Grass	< 1 m
Tall grass	> 1 m

Legend Vegetation Map A3 fold out A4 RHS

Legend Vegetation Map A3 fold out A4 RHS

LEGEND

FRINGING FOREST VEGETATION

1 *Melaleuca rhaphiophylla*
low open to closed forest

2 *Eucalyptus rudis-Melaleuca rhaphiophylla*
open to closed forest Type 1

3 *Eucalyptus rudis-Melaleuca rhaphiophylla*
open to closed forest Type 2

4 *Eucalyptus rudis-Melaleuca rhaphiophylla*
open to closed forest Type 3

5 *Eucalyptus rudis-Melaleuca rhaphiophylla*
open to closed forest Type 4

6 *Eucalyptus rudis-E. calophylla*
open-closed forest

7 *Eucalyptus calophylla*
open-closed forest

8 *Eucalyptus calophylla-E. marginata*
open forest

9 *Acacia saligna*
low closed forest

FRINGING VEGETATION

10 *Juncus*
sedgeland

11 NO SYMBOL *Schoenoplectus validus*
closed sedgeland

12 NO SYMBOL *Baumea articulata*
closed sedgeland

13 *Typha orientalis*
closed sedgeland

OTHER PLANT COMMUNITIES

14 Winter wet depression complex

15 *Banksia-Allocasuarina-Eucalyptus todtiana*
low open forest

OTHER VEGETATION TYPES

16 *Eucalyptus rudis*
pastured woodland

17 *Eucalyptus rudis-Melaleuca rhaphiophylla*
pastured woodland

18 *Eucalyptus calophylla*
pastured woodland

19 *Eucalyptus rudis-E. calophylla*
pastured woodland

20 Orchard

SYMBOLS

Standing water

Extent of broad floodplain

Footbridge

Legend Weed Infestation Map A3 fold out A4 RHS

LEGEND

#	Blackberry brambles	*Rubus spp*
	Weeping willow	*Salix babylonica*
IIII	Giant reed	*Arundo donax*
C	Coral	*Erythrina caffra*
	Caster oil bush	*Ricinus communis*
●	Japanese pepper	*Shinus terebinthifolius*
	Bulrush	*Typha orientalis*
□	Club-rush	*Cypera spp*
	Edible fig	*Ficus carica*
	Blue periwinkle	*Vinca major*
	Cape lilac	*Melia azedarach*
Δ	Hydrocotyle	*Hydrocotyle ranunculoides*
*	Pampas grass	*Cortaderia selloana*
	Dolichos pea	*Dipogon lignosus*
	True bamboo	*Bambusa spp*
	True giant bamboo	*Bambusa spp*
	Fountain grass	*Pennisetum setaceum*
	Poplar tree	*Populus spp*
PP	Common prickly pear	*Opuntia stricta*
	Morning glory	*Ipomea indica*
R	Japanese honeysuckle	*Lonicera japonica*
	Pinaster pine	*Pinus pinaster*
	Grapevine	*Vitis spp*
	Common lantana	*Lantana camara*
	Olive tree	*Olea europaea*
	Canna lily	*Canna x orchiodes*
	Acacia longifolia	*Acacia longifolia*
	Victorian tea tree	*Leptospermum laevigatum*
E	Point of severe erosion	
	Footbridge	