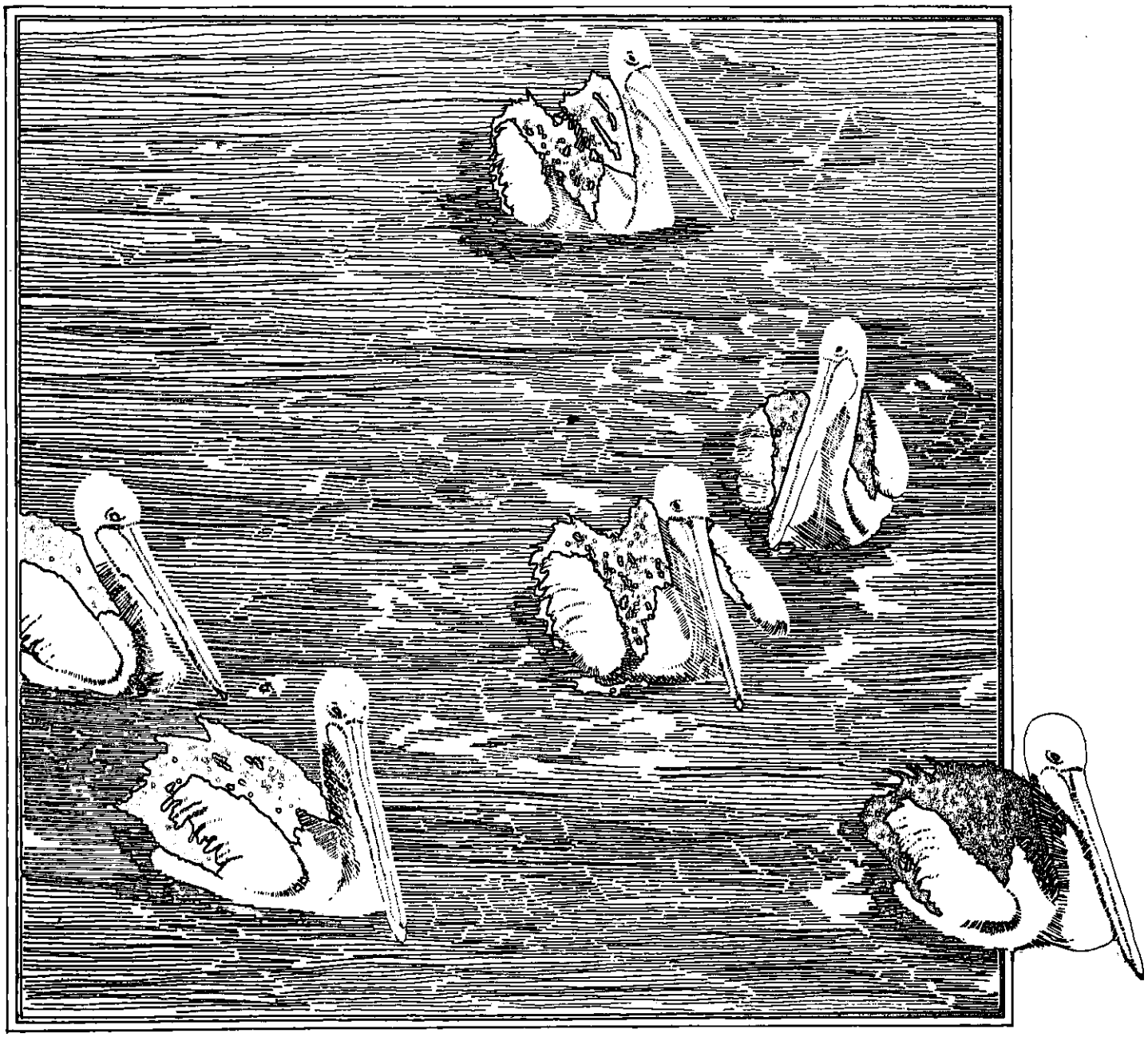
Sandy



a biological and conservation survey of the river murray in south australia

I. Krastins
1974

Revised 1981
South Australian Department of Environment and Planning

THE RIVER MURRAY PLANNING STUDY

"A BIOLOGICAL AND CONSERVATION SURVEY OF THE RIVER MURRAY IN SOUTH AUSTRALIA"

Original Report Prepared for the Director of Planning

by

IVARS KRASTINS JULY 1974

Revised by

South Australian Department of Environment and Planning

May 1981

PREFACE

The original contents of this report were prepared by Ivars Krastins in 1974 for the Director of Planning, State Planning Office, South Australian Department of Environment and Conservation. That report contained a valuable inventory of the conservation status of wetlands along the River Murray in South Australia.

The original report was limited by a lack of time and resources to only a rough compilation of text and diagrams, and was not easily read or reproduced. In this revision, the original report has been edited and the layout modified to conform with standard SADE presentations. The aim has been to present the information in a more readable format and to print the report formally for more ready circulation of the material. Thus current work on wetlands along the River Murray can build on the information in the original report.

Peter Sullivan prepared the revised draft report for the Assessments Branch of the Department of Environment and Planning in May 1981.

IMPORTANT NOTE: Only minor alterations have been made to the original manuscript. The information in this report should be used with discretion, as some facts have altered with time and many generalizations have not been substantiated. The original survey was in the nature of a preliminary investigation with follow-up studies anticipated to evaluate the initial conclusions and recommendations. Such a follow-up would involve a substantial investigation to update and confirm Krastins' findings.
Much of the material in Krastins' report has been included in the Murray Valley Planning Study, published by the State Planning Authority (1978).

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ACKNOWLEDGEMENTS

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and all interested persons and organisations who took the trouble to research and prepare submissions concerning the conservation of the River Murray.

[NOTE: Many of the persons listed above have changed their employment and/or responsibilities since 1974]

SUMMARY

This report presents a preliminary survey of potential conservation areas along the River Murray in South Australia, while attempting to view the river system as a whole management unit. A review of the physical and biological aspects of the River is discussed with emphasis on the biological environment and its disturbances. Thirty three areas of conservation potential are identified and their conservation value discussed. It is concluded that the whole of the River Murray in South Australia should be treated as a possible conservation area. More detailed surveys of the River should be undertaken to determine more accurately the conservation value of specific areas and their management requirements.

1. INTRODUCTION

The purpose of this study is to summarise the important aspects of the biology of the River Murray in South Australia, and to select areas of land and water along the River Murray which merit conservation.

The Study Area involves the whole of the River Murray in South Australia, Lakes Alexandrina and Albert, and the land two kilometres either side of the 1956 flood line.

In many instances this report is superficial and has had to brush over or completely ignore some important considerations. However, the production of a report such as this is considered worthwhile, since it is the only attempt to date which has considered the ecology of the lower River Murray as one unit. If for no other purpose, this report may assist in the preliminary stages of a detailed study of the River Murray environment.

2. BIOLOGY OF THE STUDY AREA

2.1 Features of the Study Area

2.1.1 Climate

Temperatures recorded along the River Murray in South Australia range from mean annual temperatures of 15°C at the Lakes to 17.5°C at Renmark. Temperatures increase within this range of 2.5°C the further inland one goes. The trends in rainfall are less regular, however rainfall does tend to decrease with decreasing latitude. The lowest median annual rainfall occurs at Morgan, the highest at Meningie. Temperature and rainfall figures for particular locations on the River and Lakes are presented in Tables 1 and 2.

TABLE 1

Mean annual temperatures of locations along the River Murray in South Australia.

Location	Mean Annual Temps. (°C) Max. temp	Min. temp	Average	Time over which data was collected
Meningie	21.9	9.4	15.2	4 yrs. (to 1971)
Tailem Bend	22.3	9.5	15.9	20 yrs. (to 1964)
Murray Bridge	22.1	9.6	15.9	6 yrs. (to 1972)
Nildottie	23.2	8.9	16.1	6 yrs. (to 1971)
Waikerie	24.1	10.0	17.1	14 yrs. (to 1966)
Loxton	23.3	8.9	16.1	5 yrs. (to 1970)
Renmark	24.2	10.8	17.5	13 yrs. (to 1970)

Compiled from records of the Bureau of Meteorology, Adelaide, S.A.

TABLE 2

Median annual rainfall of locations along the River Murray in South Australia.

Location	Median Annual Rainfall (cm)	Time over which data was collected (to 1973)
Meningie	45.7	109 years
Tailem Bend	39.1	66 years
Murray Bridge	33.3	86 years
Nildottie	26.2	8 years
Morgan	23.3	92 years
Waikerie	24.5	77 years
Loxton	28.0	64 years
Renmark	25.5	84 years

Compiled from records of the Bureau of Meteorology, Adelaide, S.A.

NOTE: Median annual rainfall (as opposed to mean annual rainfall) is used here. Median rainfall figures give a truer impression of rainfall behaviour.

2.1.2 Surface Geology and Soils

The important aspects of the Study Area's soil and geology may be summarised as follows:-

- Lakes Alexandrina and Albert - Much land adjacent to the Lakes consists of alluvial flat deposits laid down during the Recent period. The rest of the land consists of calcareous dunes and sand spreads with areas of calcrete sheets.

- The River valley consists of alluvial flat deposits for the length of the River.

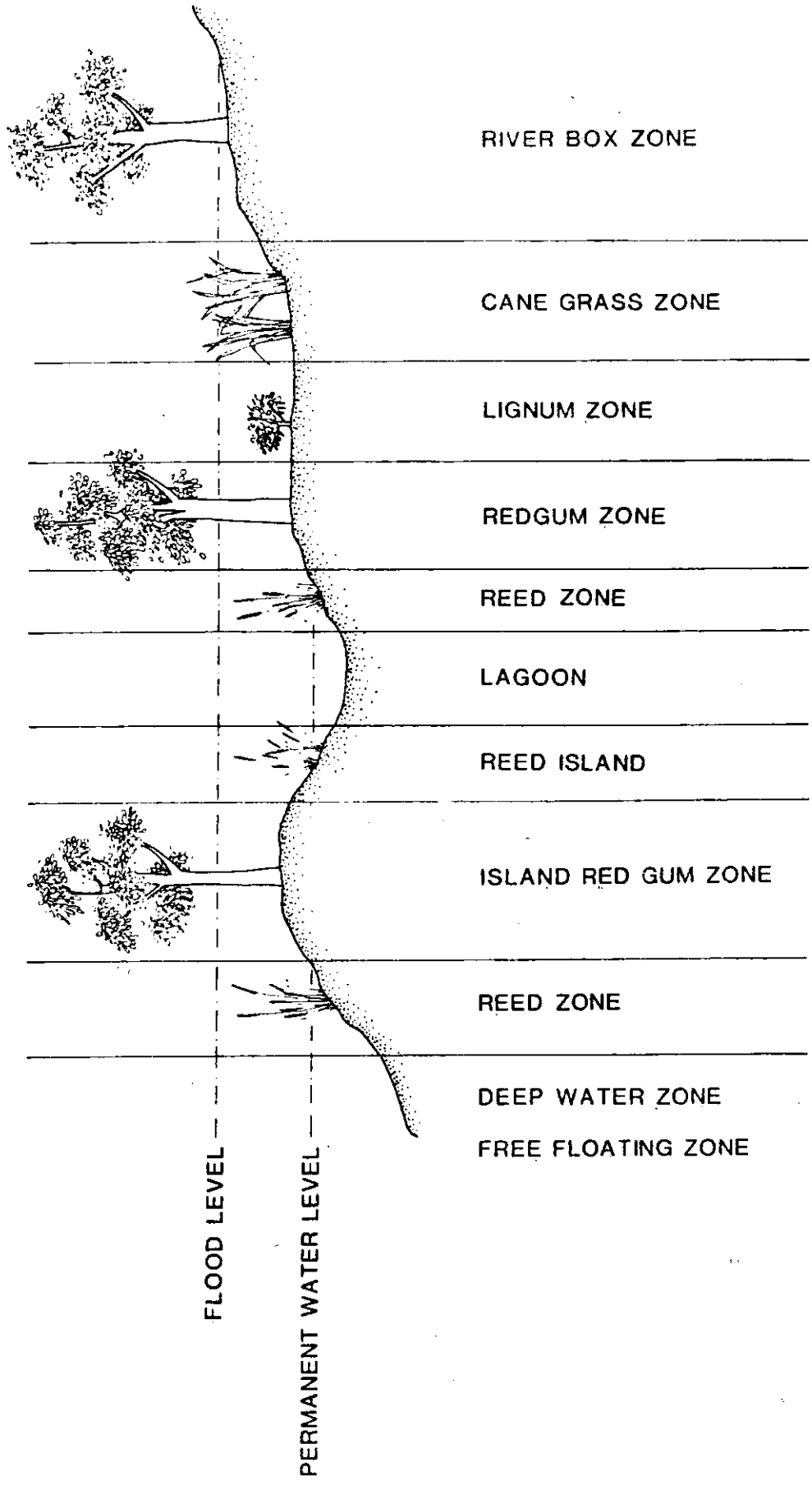


FIGURE 1

Diagramatic Representation of Flood Plain Vegetation

- The valley border (including cliffs) is made up of sandy limestone of Tertiary origin.

- From Teal Flat (west of Bowhill) to the River Marne, areas of red and yellow coarse-grained micaceous quartz sand occur adjacent to the valley border.

- The rest of the Study Area (i.e. excluding the River Valley and its border) consists of quartz sands with colours ranging from grey to reddish-brown; sand and limestone areas from the Lakes to Murray Bridge; and greenish grey sandy clay between the River Marne and Weston Flat.

2.2 Vegetation

2.2.1 Introduction

Very little work has been specifically done on the vegetation along the River Murray. Various studies have been conducted on particular species which grow at the River (especially Eucalyptus camaldulensis, the River Red Gum), but these have been more of a taxonomic or physiological nature. Knowledge of what the relationships are between vegetation and the geography and biology of the River is deficient.

With respect to the surrounding land, the River Murray obviously provides a unique environment. Water is always available, whereas the land adjacent to the River, particularly upstream from Morgan, is arid and therefore places greater water stress on the vegetation which grows there. Consequently, the less hardy species are able to thrive in a region where they would normally not exist. This has a number of important ramifications, one being its effect on the animal life of the region. Away from the effect of the River will be found animals adapted to a warm and dry environment. At the River, where vegetative growth is more lush and diverse, a greater and different range of animal life results. Fish, frogs and water fowl are able to breed and survive here, whereas this would be impossible in the surrounding environment (except of course where streams, ponds and seasonal swamps occur).

Further south along the River conditions are wetter and cooler, but the difference between River vegetation and non-River vegetation is still apparent. The River vegetation here is still similar to that further upstream.

The only major change in the vegetation of the River valley occurs in the Lakes region. Here, due to the change in climatic, topographical and soil conditions, there is a change in both the vegetation type and the range of species present.

Although information is scanty and only general themes can be developed, some notes will be made separately on (i) the vegetation of the River valley, (ii) the vegetation outside the River valley, and (iii) the vegetation of the Lakes region.

2.2.2 Vegetation of the River Valley

An idealised representation of the vegetative structure of the valley area is presented in Figure 1. Although not correct in all situations, this scheme serves as an approximation to generalise about the River environment. This progression of physical structures (i.e. the River, islands, lagoons and flood plain) may often be observed in a cross-sectional view of the River. Hence there are a number of fairly well defined ecological niches with similar environmental conditions, and each of these niches support similar plant associations for the length of the River. It should be noted that soils throughout the River Valley are similar being formed from mud and silt brought down by the River. Soils would therefore not have a very significant bearing on the distribution of plant growth.

In Figure 1 a number of zones have been defined. In the "deep water zone" free floating organisms generally referred to as plankton are found. The plankton consists of unicellular plants and animals, insect, fish, crustacean and frog larvae, and the larger microscopic multicellular plants. Once in shallower water however, more plants with roots may grow, and these form the "reed zone". Numerous species usually occupy this zone, but they are largely reeds and rushes. The vegetation in this zone is nearly always partly submerged.

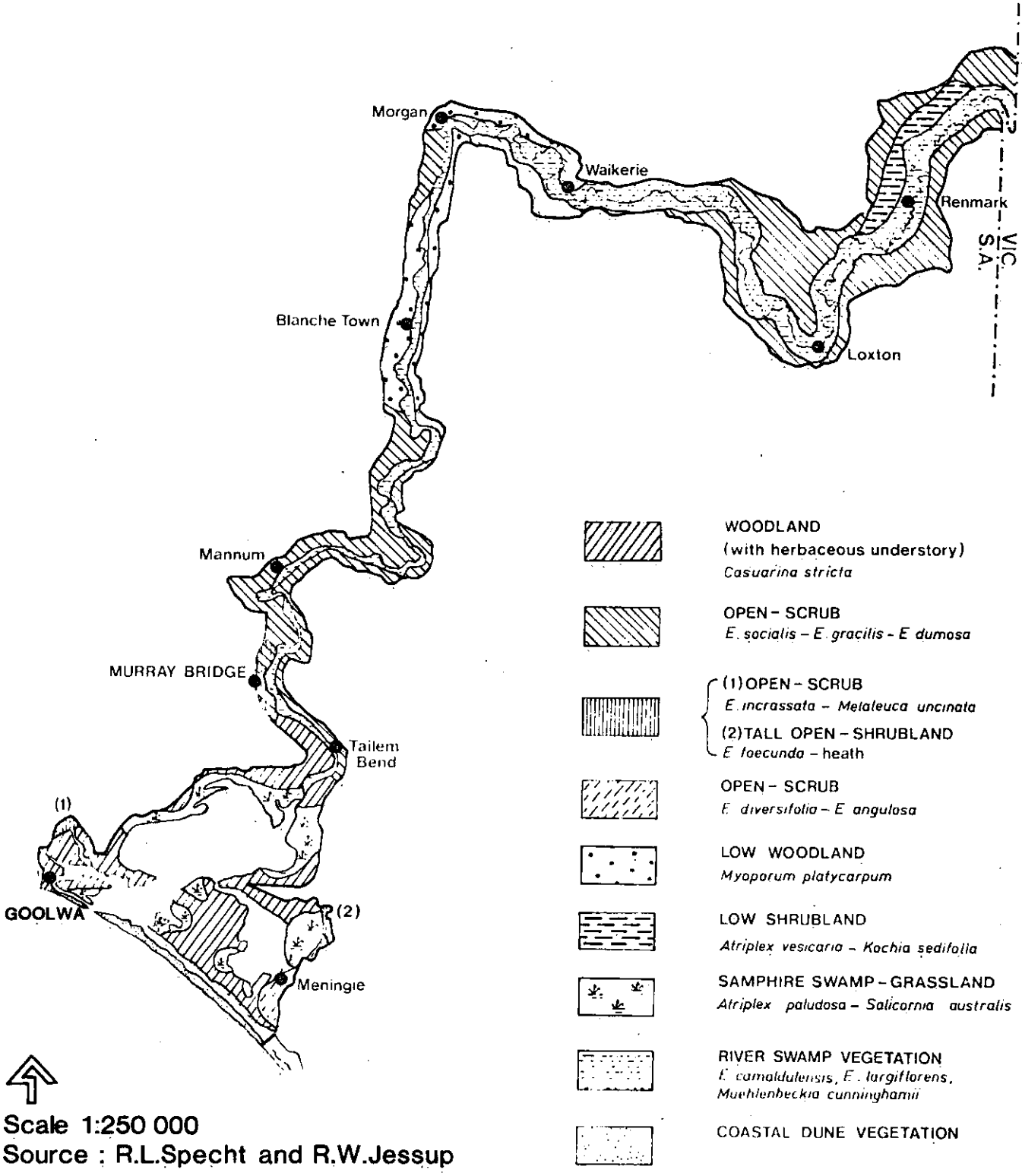
On higher land immediately adjacent to water, the frequency of inundation is less. Such a situation arises on lagoon and River islands and at the water edge of the flood plain. Flooding nevertheless frequently occurs here and therefore makes conditions ideal for the regeneration and growth of the River Red Gum. Grasses and other herbaceous plants also grow in this zone.

On slightly higher land (though this is not necessarily the case), the "lignum zone" occurs. The zone is dominated by lignum (Muehlenbeckia cunninghamii, a woody shrub usually 1 to 2 metres high). It also grows in areas subject to flooding. Again grasses and other herbaceous plants grow here. In association with the lignum zone may be found a "cane grass zone". This is not always present, but may frequently be observed along the River.

On higher land still tends to grow the River Box (Eucalyptus largiflorens). Its region of growth is also subject to flooding, but not so extensively as in the "River Red Gum zone".

A vegetation study (van der Sommen, 1974) of the area between the N.S.W. border and Overland Corner describes the distribution of Red Gum, River Box, Lignum, Samphire and Melaleuca lanceolata. The health of the two Eucalypts is also noted.

A concluding comment should be made about the Willows which frequently border the River. They are an introduced plant of the genus Salix. They were probably planted along the River Murray by paddle-boat operators to act as place and navigation markers. Since then they have proven to be well suited to the River environment, and have spread extensively along the River margin. Some native animal species use the Willows for shelter, breeding (e.g. Darters near Wellington) and perhaps feeding. It is impossible to say what effect the willows have had on the River-side environment, but since they are introduced it is likely that they have contributed to a change in the flora and fauna of the areas in which the Willows grow.



Scale 1:250 000
Source : R.L.Specht and R.W.Jessup

FIGURE 2

River Murray – Vegetation outside River Trench

2.2.3 Vegetation outside the River Valley

The vegetation here is usually away from the direct influence of the River. Around the upper Murray area, mallee scrub and stands of chenopodiaceous plants are the two major formations to be found. The chenopodiaceous areas are made up mainly of Atriplex and Maireana (near the N.S.W. border, A. vesicaria and M. sedifolia). The mallee scrub is usually dominated by Eucalyptus socialis or E. gracilis or both. Extensive growths of saltbush and bluebush do not occur in the more southern vicinity of the River. The less hardy herbaceous plants take their place and form treeless herb and grassland, or more commonly, form the understorey of mallee scrub.

The false Sandalwood (Myoporum platycarpum) may be commonly found north and south of the Blanchetown latitude. This forms a low woodland formation, sometimes in conjunction with mallee scrub.

Much of the vegetation outside the River Valley has been removed or altered due to agricultural activity. Where shrubland exists, the understorey of herbs and grasses has often been heavily grazed and is consequently non-existent, very sparse or changed in character. The amount of natural shrubland left is small compared with how much land is under agricultural management, so it is important that what is left is maintained as such. If the livelihood and continued existence of our native fauna and flora is considered to be important, then those areas which have suffered the least from Man's activities must be conserved and aided if necessary to provide the necessary biological habitat.

Figure 2 has been prepared to give an outline of what has been discussed. It has been adapted from Jessup (1946) and Specht (1971), and since these maps did not have the River Murray specifically in mind, this figure is quite inadequate. However, until a more detailed study of the environment adjacent to the River Murray is carried out, Figure 2 will have to suffice.

What has been discussed here only touches lightly on the vegetation outside the River valley. The range of species to be found is really quite diverse. Some collections have been made in the vicinity of the River, and two collection lists are given in Appendices 6.1 and 6.2. Although the lists include plants found on the flood plain, they serve to indicate the range of species that do inhabit the area.

Legend

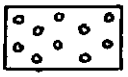

Seral area of Samphire Swamp and Grassland.

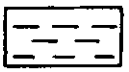

Casuarina stricta association.

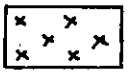

Eucalyptus odorata - E. leucoxylon - E. fasciculosa association.

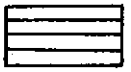

E. Oleosa - E. dumosa association.


E. diversifolia - E. angulosa and E. Oleosa - E. dumosa associations.


E. diversifolia - E. angulosa association.


Mallee Heath.


Samphire (Arthrocnemum spp. and Salicornia spp)


Alternating E. oleosa - E. dumosa and E. angulosa - E. unginata associations.

M — Denotes Eucalypt association is predominantly Mallee form.

T — Denotes Eucalypt association is predominantly form

Source : Jessup, 1946. Specht, 1971

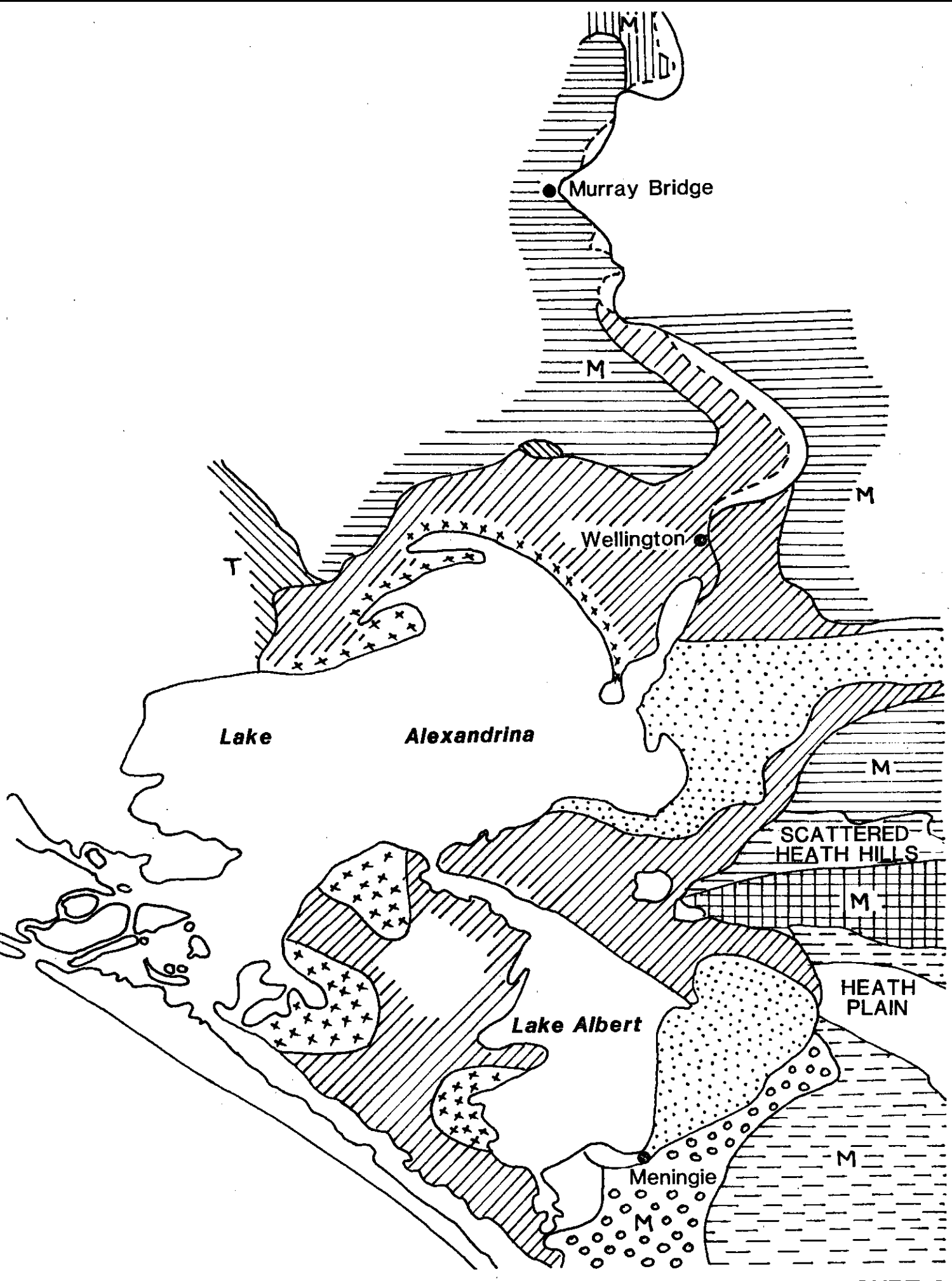


FIGURE 3

Vegetation around
Lakes Alexandrina and Albert

2.2.4 Vegetation of the Lakes Region

A vegetation map produced by Jessup (1946) is reproduced in Figure 3. The most obvious feature of this region is that the vegetation in the immediate vicinity of water is made up of samphire or sheoak associations. The River Red Gum is not common at all in the area. Further away from water will be found eucalypt associations consisting of various species, most of which are mallee. In this respect, the vegetation away from the influence of the Lakes and the River is similar, though this is not very surprising since the soils are still quite sandy, and sandy conditions are often conducive to producing the mallee habit.

Figure 3 can be a little misleading if one does not keep in mind the effect which Man has had on the Lakes region. The samphire plains do still exist, though a number have been heavily grazed or otherwise affected by agriculture, but the amount of Sheoak (Casuarina spp.) which still remains is very small. A large amount of it has been cleared to make room for the needs of Man. It is simply good fortune that the samphire still remains in its present quantity. Samphire grows in soil with a high salt content which is therefore not suitable for cropping.

2.3 Fauna

2.3.1 Introduction

It is difficult to determine where the line should be drawn when deciding which animals do or do not inhabit a river system. Some groups of animals, such as the fish and to a lesser degree the amphibians, are obviously localised to such an environment. However, the majority of animal groups as a whole are not restricted to this one type of situation. Difficulties arise when individual species are considered. For instance, the Wedge-Tailed Eagle is commonly seen near and over the River Murray, either on the wing or perched in trees. However, it is even more frequently seen in the interior of the State. So, should the Wedge-Tailed Eagle be included in a list of River fauna or not?

This sort of problem arises most acutely with the birds. The same problem exists with the mammals and reptiles. Therefore, the following criteria to determine whether a species is included or not in a list of species occurring in the Study Area have been chosen:-

- Only those birds which use the River, or its immediate environment for breeding purposes are included in the bird-list.

TABLE 3

An analysis of fauna species composition along the River Murray in South Australia with respect to the total State fauna.

Animal Group	No. species In S.A. (Introduced and Native)	No. native Species at River Murray	No. introduced Species at River Murray	Total No. Species at River Murray	A	B	C
CRUSTACEANS	Many Marine Species	4	0	4	-	-	-
INSECTS	Large	-	-	Large	-	-	-
FISH	33	21	5	26	5	4	79
AMPHIBIANS	17	8	0	8	2	1	47
REPTILES	155	62	0	62	22	9	40
BIRDS	409	53	1	54	57	8	13
MAMMALS	100+	18	9	27	14	4	27
TOTAL (ANIMALS) (Excluding crustaceans and insects)	714	171	15	177	100	25	-

A - % value of this fraction: $\frac{\text{No. Species in each group for whole State}}{\text{Total No. Species in the State (714)}}$

B - % value of this fraction: $\frac{\text{No. Species per group occurring at River Murray}}{\text{Total No. Species in the State (714)}}$

C - % value of this fraction: $\frac{\text{No. Species per group occurring at River Murray}}{\text{Total No. Species for that group in the State.}}$

Note - These calculations are only based on fish, amphibians, reptiles, birds and mammals.

- Only the mammals, reptiles, fish and amphibians which have been recorded in the Study Area are included in the appropriate list.

Where some doubt exists around a particular species, it is included in the list and its doubtful nature is indicated. It has not been possible to compile a list for the insects, spiders and allied groups due to the lack of data available.

From an educational point of view it is most worthwhile to consider the fauna of a river system on the basis of different habitat types. This is attempted to some extent, but such a treatment is quite difficult with most of the land animals, since habitat records for a large number of individual species are simply not available, or at the best, rudimentary.

2.3.2 Aspects of the Composition of River Fauna

The approximate numbers of species in each faunistic group have been determined. An analysis of species composition and diversity along the River compared with diversity and composition for South Australia as a whole has been made. All data are presented in Table 3.

The methods of calculation of the percentages A, B and C are given in Table 3. The significance of each value is as follows:

- A. This value gives an overall picture of the importance of each animal group in the State. The A column shows clearly that as far as species numbers are concerned, the birds represent the group of greatest diversity in South Australia. The fish and amphibians (i.e. frogs) are groups of least diversity. It is interesting to note that fish and amphibians are also the groups most restricted to a particular environment (water and water's edge respectively).

- B. This value shows what proportion of the State's fauna occurs within the Study Area. The B values indicate to some extent the general habitat preferences of each group, but this indication may be masked by the relative species diversity of each group in the State (which itself has been determined in the A column).

C. The C values give a truer indication of habitat preferences. Calculations are not based on all species in South Australia, but only on the species of each group under consideration. The highest value of 79% for fish is hardly unexpected, since the fish are totally restricted to rivers, lakes and other such environments. The other 21% is accounted for by the fresh water fish which occur in the interior of the State. The lowest value of 13% for the birds is partly due to the fact that only species breeding on the River are taken into account. However, it also indicates the great mobility of birds, which allows them to extend their ranges over quite large areas.

The calculation and analysis of these values are not intended to uncover anything new. The percentages simply illustrate the difference between River and non-River faunistic compositions. A comparison of these percentages between animal groups enables one to see in general terms which animals inhabit the River Murray and in what proportion they do this. To make this a full assessment of River fauna, actual population numbers must be known, but it would be difficult to even make reasonable estimates of this.

2.3.3 Animal Life in the Deep Water Zone

There are basically three animal groups which inhabit the deep water zone of the River Murray. These are the invertebrate species (i.e. crustaceans, aquatic insects, insect larvae and molluscs), the fish and the tortoises. Five invertebrate species are known to occur in the River Murray:

Murray Mussel	-	*Velesunic ambiguus*
Yabbie	-	*Parachaeraps bicarinatus*
Murray Lobster	-	*Astacopsis serratus*
Long-clawed Prawn	-	*Palaemon australis*
Freshwater Shrimp	-	*Paratya australiense*

All are bottom feeders and inhabit the bottom mud of the River and Lakes.

The development of the four crustacean species from egg to adult is similar in each case. The eggs of each species contain relatively large amounts of yolk, hence development can proceed to a fairly advanced stage before hatching occurs. The creatures which emerge on hatching are miniature immature adults.

Newly hatched yabbies and lobsters remain with their mothers for about one week by holding on with their pincers. After this time they become independent and shortly take up life in the bottom mud. Once hatched, young prawns and shrimps are developed well enough to fend for themselves in quiet backwater environments.

The invertebrates are food for a number of organisms. The smaller invertebrates are eaten by birds, crustaceans and young stages of fish. The crustaceans, which generally constitute the larger invertebrates, are eaten by fish and birds. Crustaceans are also a food supply for humans. They are of some economic importance and of recreational use.

Tortoises are, of course, reptiles. All of the three species present in the River Murray are carnivorous. The female lays her eggs in holes which she digs in the ground a short distance from the River bank. The eggs are fairly well concealed, but would undoubtedly suffer from predation by land reptiles and mammals, particularly foxes. Further information on the biology of tortoises is presented in Appendix 6.3.4., (species nos. 52-54).

Fish constitute the most obvious component of the aquatic section of a river environment. Their main predators are birds, though tortoises also feed on them.

On the whole however, fish have less to fear from predation than they have from changes to their environment. There is an intimate relationship between the livelihood and breeding of fish and the physico-chemical conditions in which they live. The biological data on River Murray fish presented in Appendix 6.3.1. shows clearly that the breeding processes of a number of species require quite specific environmental conditions. It is often the case that a water temperature increase plus flooding must occur before reproduction and spawning will occur. In addition to this, since fish are confined to the water environment which itself is closed and spatially restrictive, they are more susceptible to the results of environmental change. Fish eggs are

particularly susceptible, being sensitive to changes in salinity and temperature, and being in danger of dehydration should they be stranded on dry ground. Flooding is often a prerequisite for breeding because these species must breed in shallow waters, e.g. flooded river flats. The required shallow waters may therefore not be available unless enough minor flooding occurs to cover these low lying lands next to the River.

Since the fish are restricted to the River proper, their food supply must also be found there. Food preferences range from plankton and algae, through aquatic plants to small crustaceans.

Any environmental change which alters the balance of available food may in turn have significant effects on fish numbers. This is particularly true of the microscopic and planktonic fauna and flora present in River and lagoon waters, for it is this component which sustains the fish larvae and fry.

The fish are also of some economic importance. In pre-World War II times, the River fish supported about 300 professional fishermen. Today there are perhaps 70 part-time professional fishermen working from the Murray. A number of factors may account for this decrease, one suggestion being that the numbers of fish in the River have themselves decreased. Whether this is so or not is difficult to say as there is very little accumulated data on which to base opinions (see 3.3.8 The Fish of the River Murray). Catching techniques are also more efficient allowing fewer fishermen to catch more fish individually.

Finally it should be noted that some of the larger fish will feed on smaller fish species. Additionally the fry, as well as feeding on plankton and larvae, will also consume unhatched fish eggs. This would be of importance if for instance two species of fish spawning at different times occupied the same locality. The earlier spawning fish (which therefore probably hatches first), may have drastic effects on the other species through its predation of the other's eggs.

2.3.4 The Lagoon Environment

The animals occupying the waters of lagoons are basically the same as those occupying the River. However, the lagoon environment is in most cases different from the River in that water circulation and movement is usually much slower. The temperature of lagoon water is often a little higher than that of the River, due to the difference in water depths and volumes, and because of the slower circulation.

Hence, some fish species may be more likely found in lagoons than in the River because they are adapted to sluggish waters for instance, (e.g. Freshwater Catfish and Golden Perch). The number of insect larvae and aquatic insects per unit volume of water is probably greater in lagoons than in the River. This would result from the confined and slowly circulating nature of lagoons and suggests that such areas would be extremely good feeding grounds for those animals which feed on insects and larvae. The fact that a diversity of water birds is easily observed around lagoons is evidence for this. Crustaceans, particularly prawns and shrimps, may be found in the bottom mud of lagoons, and it will be remembered that these too are food for other River animals. The presence of larvae and plankton in a sluggish and confined area of water make lagoons ideal sites for the development of fish larvae and fry. Obviously then, the lagoon as an ecological unit serves an extremely important function as a feeding area for developing and adult organisms.

2.3.5 River and Lagoon Islands and the River Bank

The vegetation of these areas provide shelter and food for birds and frogs, and nesting materials for the birds.

Frogs, due to their susceptibility to dehydration, must be in damp surroundings at all times. Therefore those frogs which are found along the River and Lakes are rarely found outside the River valley, unless there are areas of a damp nature extending away from it, (e.g. other inflowing rivers and streams). All aspects of the frog life-cycle are adapted to the conditions found adjacent to the River and its lagoons. The vegetation there (reeds, rushes, sedges, grasses, etc.) is used as food, cover, and a medium within which dehydration may be combatted. The water-side vegetation is also used for egg attachment, as the aquatic vegetation is used by some fish. The frogs appear to be well established and as yet unaffected by Man. Notes on the biology of River Murray frogs are given in Appendix 6.3.2.

Birds appear to interact much more closely with Man. Human activities such as building and agriculture can have drastic effects on a localised bird population. Whenever scrubland is cleared, large numbers of woodland birds are deprived of feeding, nesting and shelter habitats. Whenever a swamp is drained, water birds are deprived of the aquatic fauna on which they feed and the swamp vegetation in which they find shelter

and build nests, as well as feed on. Even superficially harmless activities such as bushwalking and other outdoor pastimes may affect individual birds detrimentally. With respect to the birds listed in Appendix 6.3.3. (those which breed on the River or Lakes), about 36% of them may nest on the ground, and about 14% nest in bushes. Obviously then, unless one is careful when walking through shrubland, one could easily disturb or destroy nests. About 40% of the birds nest amongst aquatic vegetation, so even canoers and fishermen are a possible threat to successful breeding of these birds.

2.3.6 The Flood Plain and Cliffs of the River Valley

Representatives of most animal groups will be found in this region. Various bird species nest in the trees or in the understorey of herbs and grasses. Some mammals and reptiles also occupy the flood plain, the mammals usually being small (e.g. possums and rats).

Since the River passes through arid country, a number of arid-land reptiles may be found in the River valley. Other species are apparently restricted to the River valley and areas immediately adjacent to it. An obvious example are the tortoises, but there are others, for instance the Water Skink (Sphenomorphys quoyii).

Very few mammal species, if any, restrict themselves exclusively to the River valley. Most of those mammals found within the Study Area would spend the majority of their time outside the valley. These mammals are mostly herbivorous, but insects constitute a supplementary diet for some species. The smaller mammals such as rodents and small marsupials are food for lizards, snakes, birds of prey and the carnivorous mammals. It is almost certain that the introduced carnivores (e.g. fox and cat) have reduced the numbers of small native mammals (especially marsupials).

There is usually a carnivorous component in reptile diets, though a number of species will also feed on vegetation. Only the larger animals, particularly birds, constitute a natural threat to individual reptiles. Reptile eggs or newly-born individuals may suffer from predation to a greater extent, but there are no data available with respect to this.

The cliffs bordering the River valley provide very little food, but they are used by a small number of animals as nesting or shelter sites. Snakes and lizards may often be found on the cliff face, and the White Cockatoo (Cacatua galerita rosinae) commonly nests in the cliffs (especially in the section of the River between Swan Reach and Morgan).

Additional information on the biology of River Murray reptiles and mammals may be found in Appendices 6.3.4 and 6.3.5. respectively.

3. INTERACTIONS ON THE RIVER MURRAY

3.1 Introduction

Now that a general outline of the biota of the River Murray has been given, it is possible to look more closely at the dynamics and interrelationships which exist here. This will be done in two stages. Firstly, the ecology of the River's biota will be discussed without reference to Man. The interaction between plant and animal will be the focus of this section. Secondly, the ecology of the River with respect of Man's manipulation of, and effect upon, its biota will be discussed.

3.2 Excluding Man

Discussion here rests mainly on the ecology of the flood plain. The scheme and constitution of the vegetation has been considered. It has been shown that the animals which use the flood plain most intensely are the fish, aquatic invertebrates, insects, frogs and water fowl. To a lesser degree and in lesser numbers, the reptiles use the River as habitat as well. Only a few mammal species (e.g. some of the rats and possums) frequent the flood plain.

In Table 4, a summary of the interactions which occur between plant, animal and environment is given. In virtually all cases, there is some dependence on vegetation, either as food or a medium for some aspect of breeding behaviour. Needless to say, the vegetation also provides shelter and protection from predators and the physical environment.

The relationships existing on the Murray are of course not just plant-animal, but this relationship is one of the most important. Ultimately, all animals must depend on plant or planktonic material for their survival, including the carnivorous mammals. These, such as the fox or cat, will feed on birds, reptiles or other mammals, but the latter species themselves must feed on plant material or on other animals which feed on plant material. As in all ecosystems, there exists an intricate hierarchy of what feeds on what, the plants and plankton forming its "foundation" and the carnivores forming its "summit".

The trophic situation which exists on the Murray is diagrammatically represented in Figure 4. When shown this way, it is obvious just what an important role the primary producers (plants ad plankton) play in this ecosystem. The figure also makes apparent the food relationships which

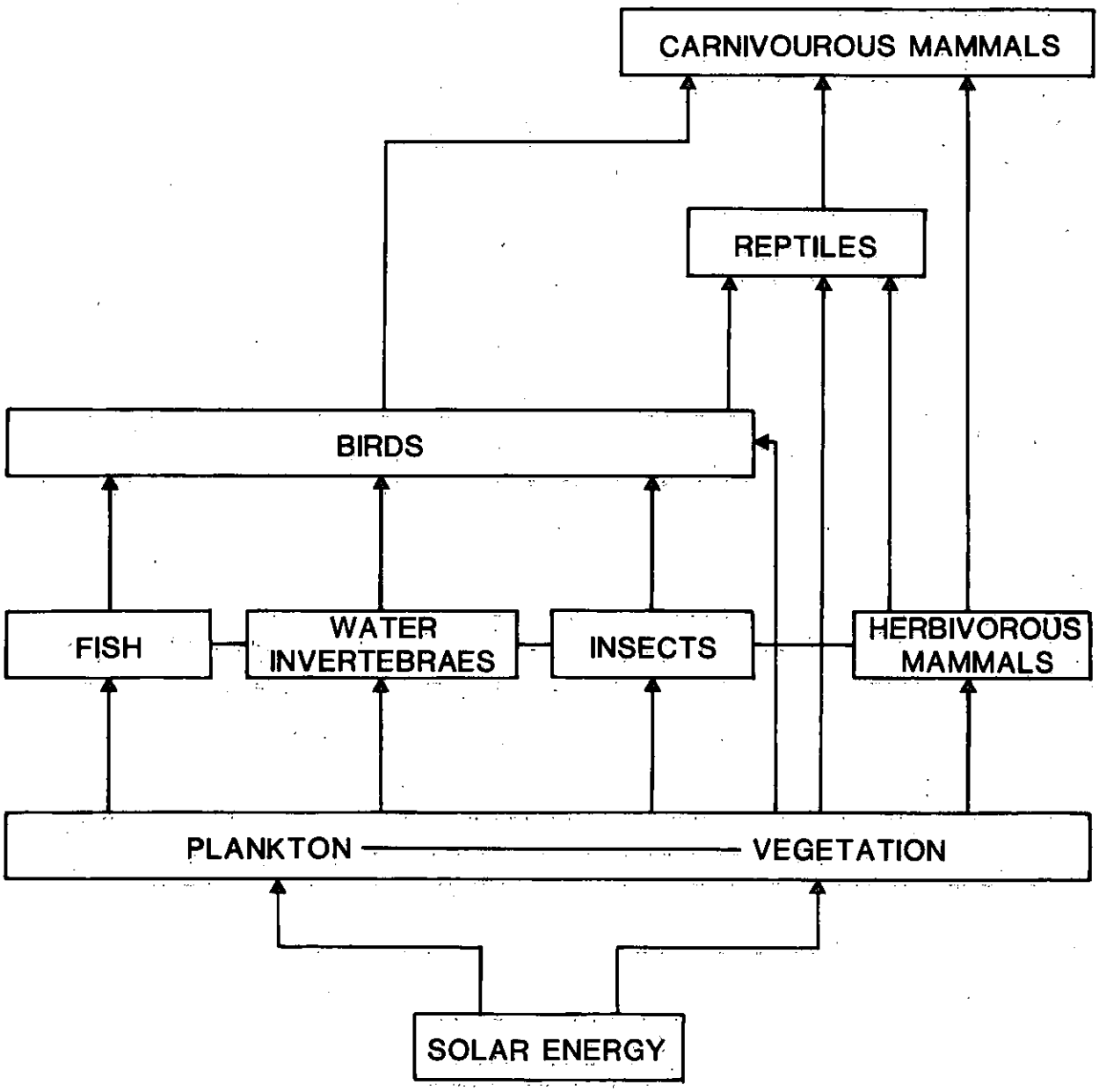


FIGURE 4

Simplified Trophic Structure –
Food Relationships of Animals on the River Murray

TABLE 4

Summary of Breeding and Feeding behaviour
of the major animal groups in the River Murray Valley.

BREEDING

FISH	-	Dependancy on water level and temperature. River vegetation used, also rocks and snags. Salinity an important consideration, especially with respect to egg development and survival.
FROGS	-	River vegetation used. Salinity important to eggs.
BIRDS	-	River vegetation used for shelter and nesting. Shallow water (e.g. lagoons and swamps) often used.
REPTILES	-	River and non-river vegetation used. Various geographical conditions required, depending on species characteristics.
MAMMALS	-	Various geographical conditions.

FEEDING

FISH	-	Plankton, mud-dwellers, small crustaceans, other fish.
FROG	-	Insects, vegetation.
BIRDS	-	Insects, small invertebrates in water, fish, seed some vegetation.
REPTILES	-	Insects, birds, mammals, vegetation, other reptiles.
MAMMALS	-	Seed, vegetation, other animals.

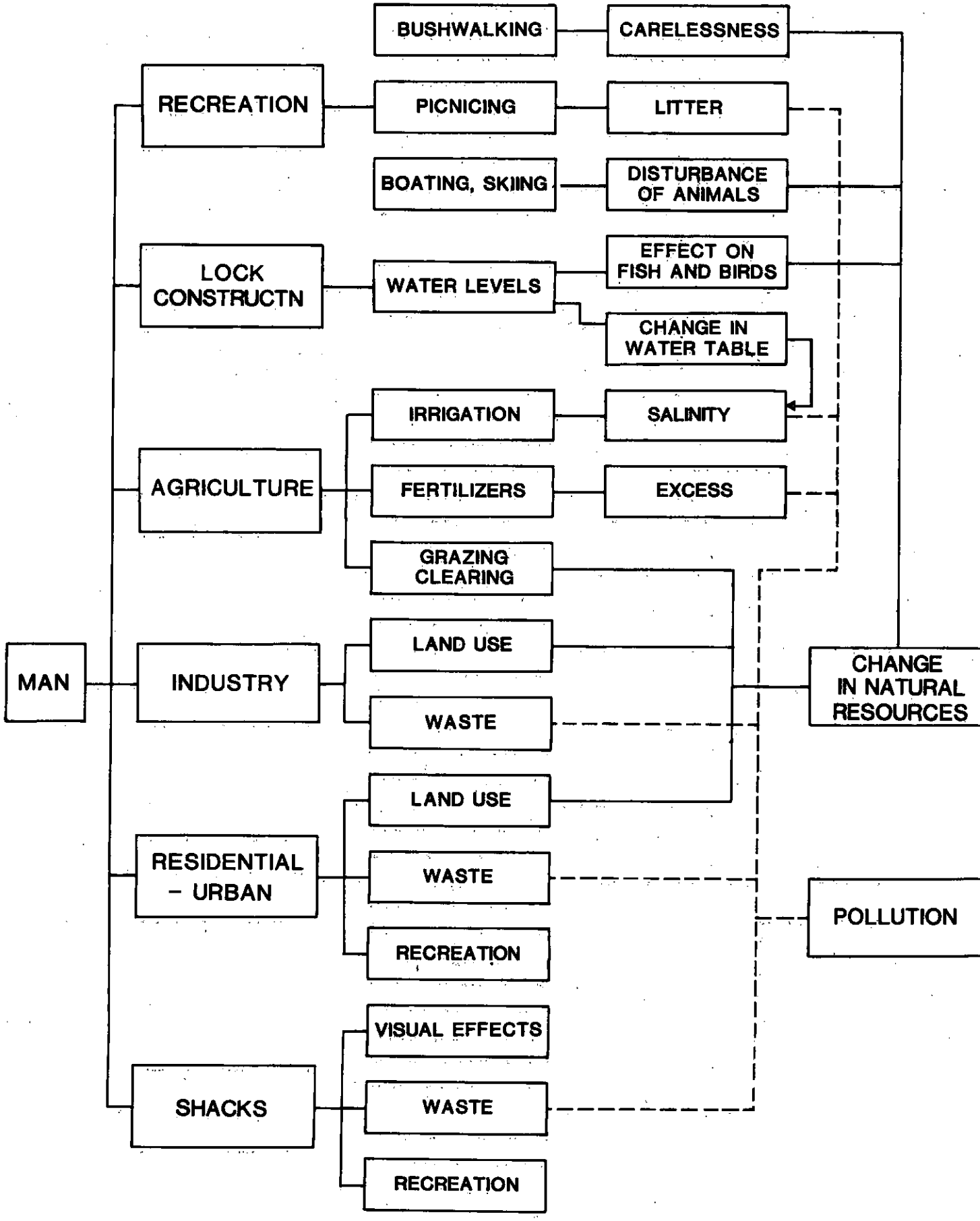


FIGURE 5
Effect of Man
on the River Murray Environment

animals have with each other. There is virtually no animal group which is not associated in some way with the other animal groups. A corollary to this therefore, is that if something drastic happens to one animal group (or the vegetation or plankton), such as a reducation or increase in numbers, this will have repercussions on a number of other groups. This point must be borne in mind when considering the effects of Man in the next section.

Besides animals of different groups feeding on each other, we also have a number of situations where different species of the same group may feed on each other. The larger fish of the River feed on smaller fish or the fry and larvae of other species. Some reptiles will feed exclusively within their group, an excellent example being Burton's Legless Lizard Lialis burtonis, which feed on small skinks and geckos,. The frogs and water birds feed outside their group, the former on vegetation and insect, and the latter on vegetation, insect, fish and aquatic invertebrates.

In addition to the above forms of interrelationship, we must also consider competition between individuals of the same or different species for food, breeding sites and shelter. Wherever two or more species having similar requirements overlap in their distributions, competition for the use of the environment will occur. All birds which nest in reeds will compete for reed-space if in the same locality. Small marsupials, if feeding on similar foods, may compete for that food. Competition between animals will be seen to be particularly important in the effect of introduced species on the native fauna of the River.

3.3 Man and the River Environment

3.3.1 Introduction

Man's effect on the environment is diverse to say the least. An attempt has been made to summarise this effect in Figure 5. Six major activities conducted on the River are listed here, each one is then broken up into constituent activities and the effect that each has on the environment. The end result of most of Man's endevours, and certainly these six, ultimately fall into one or both of two categories: pollution or a change in natural resources. The end result of each human activity is therefore indicated as being one of these two categories.

Since Man's effect on the environment is so diverse, it is best to consider each factor separately.

3.3.2 Recreation

Involved in this category are bushwalking, picnicking, the motorised activities and any other activity which is normally done during leisure time. Many are apparently harmless (e.g. things which an amateur naturalist may do), but even these have their inherent dangers. It has already been pointed out that a careless naturalist for instance is likely to crush eggs, destroy nests and unduly disturb wildlife whilst visiting an area of interest. With enough careless people in one area, a significant and detrimental effect on that area will result. It is important therefore to restrict recreational use of any area which should be conserved.

Boating and skiing have often come under criticism for their potential effect of disturbing wildlife. To what degree it does this is not at all clear, but it can be envisaged that too much noise and too great a wash from moving boats will disturb the activites and nests of water fowl.

The problem of littering is always present where people are involved. In a biological sense, the presence of litter need not be detrimental to all the fauna of the area. Numerous invertebrate species use human litter as habitat and food. However, litter is visually displeasing, and may cause some chemical pollution. Besides this, littering is in fact adding new variables to the ecosystem concerned, and from a biological point of view this is highly undesirable. The introduction of human litter, if in great enough quantity, will create an imbalance within that ecosystem. Consider a hypothetical example where litter allowed the proliferation of a particular insect. This could in turn allow an increase in the population of animals which feed on the insect. In this way, the repercussions of litter pollution could spread throughout the ecosystem.

3.3.3 Weir Construction

Some of the effects of weir construction on the dynamics of the River are quite apparent. Water levels have been kept relatively constant, an area of permanently deep water has been produced immediately upstream from weirs, and the rate of water flow has probably been decreased. The water immediately downstream from weirs is in a more natural state since water levels fluctuate to a greater extent.

The crucial point to consider here is the regulation of water level. It has been pointed out in the section dealing with fish that a number of species require flooding before the breeding process begins. Ideal sites for fish breeding are flats, which in the event of minor flooding are covered with shallow water. Since the water over these flooded flats is shallow, the heating of the water by the sun becomes more efficient and the water temperature often increases a few degrees. This increase in water temperature may trigger breeding in some species. Since the water immediately upstream from weirs is deep, the lower layers of this water will be cold compared with water downstream from the weirs. Hence, even though water levels downstream of weirs may be conducive to fish breeding, this may be off-set by an overflow of water too cold to allow breeding. The weirs have also reduced the amount of minor flooding which occurs over low-lying land. This has probably decreased the effective area of water in which fish breeding occurs.

The regulation of minor flooding not only affects spawning behaviour, but may also affect the survival of newly hatched fish larvae. Lake (1966) has this to say with respect to the Golden Perch Plectroplites ambiguus:

> "The survival of young appears to be dependent mainly on the extent, duration and type of flooding which influences the production of plankton, which is the food of the larval fish".

The weirs not only affect the behaviour and livelihood of fish directly, but also affect their food supply.

Weir construction has also caused an increase in the salinity of River Murray water. Any significant change in the physico-chemical regime of the River may have marked effects on the life of the River. The fish have evolved to live in particular environmental conditions, and therefore increases in salinity or more constant salinity levels may eventually render that environment unfit for the fish. Salinity requirements are probably more crucial with respect to the survival of eggs (fish and frog varieties). The more saline the medium, the greater the tendency for eggs in this medium to dehydrate the egg, and this may eventually lead to irreparable damage of the egg. Note that fish and frog eggs are found often in areas of relatively shallow water, and it is these areas which are most susceptible to increases in salt concentration.

The reduction in the rate of flow because of the weirs has increased silt deposition, particularly upstream from weirs. With more silt on the River bottom, a greater turbidity of the water results when this silt is stirred. In times of flood, the flow of water over weirs may disturb the bottom mud, again increasing the turbidity of the water. An increase in turbidity may have a number of important consequences. It may assist in the increase of salinity, and if the turbidity becomes too great, the amount of sunlight which can penetrate the water is reduced. This would result in a decrease in photosynthesis and the growth of aquatic plants, and since the plants partly form the basis of the trophic structure of the River Murray, such an event would be environmentally undesirable.

3.3.4 Agriculture

Irrigation has contributed to increasing the salinity of the River Murray. In addition to this the use of fertilisers, pesticides, and insecticides for agricultural purposes, may become a pollution problem. If these chemicals are applied to ground near enough to the River, they will inevitably leach into the River. The potential consequences of this are obvious, for if these pollutants attained a high enough level of concentration in the River, the death of aquatic vegetation and perhaps aquatic animal life could result. Concentration of fertilizer material may have a reversed effect by promoting excessive growth. A good example of this is the so called "algal bloom" which results in response to an excessive concentration of nitrogen in a confined body of water such as a lagoon or swamp. Such an event involves rapid and concentrated algal growth, gradually depleting the oxygen in the water, and therefore eventually rendering that environment unfit for the habituation of oxygen dependent organisms.

It is difficult to say whether agricultural chemicals have had an effect on the River environment. Perhaps the effects have been insignificant so far, but it must be remembered that an ecosystem involves a complicated web of interrelationships, and that such an effect may be easily masked by this complexity. Even if pollution effects have been insignificant, the continual influx of foreign chemicals must eventually be detrimental to the biota of the Murray.

There are two effects which can definitely be ascribed to agricultural practices: the drainage of swamps and the clearing or use of scrubland. The drainage of swamps has not occurred to a very great extent upstream from Mannum, though a sizeable portion of swampland has been reclaimed in the major irrigation areas. Below Mannum however, very little natural swampland remains. These areas have been drained, and in most instances, subsequently used for the grazing of livestock (especially dairy cows). The significance of swamp drainage should be obvious. Such action has deprived River Waterbirds of nesting, breeding, feeding and shelter grounds. It had probably reduced the number of fish breeding sites, and has certainly reduced the amount of still water habitat for fish (e.g. lagoons). The drainage of swamps has also reduced the amount of insect breeding waters, though the insects breed so profusely, swamp drainage has probably not affected them on a large scale. Note that if insect numbers do significantly decrease, this will have drastic repercussions on the growth and livelihood of fish, frogs and water fowl, since insects form a large part of their diet, at least in the early stages of development. It is true that the amount of drained swamps is still small relative to the total amount of extent swampland in the River Valley, but it is biologically significant that there is so little of this habitat remaining between Mannum and Wellington. This represents a discontinuity in habitat availability along the River, and this is a highly unnatural situation in view of the structure of the River as a whole.

Away from the River itself, the second obvious effect of agriculture is the clearing of natural scrub, and the use of scrub for the grazing of livestock. The present lack of substantial areas of natural scrubland is a testimony to what Man's activities can and have done. Where scrubland does still exist, it is invariably limited in extent, and its understorey has often suffered from the grazing of

livestock. In many localities this has led to erosion. The list of the effects which may be attributed to scrub clearing and use is quite long. We need only recall what the biological role of scrubland is - it provides habitat for tree and ground nesting birds, it is a habitat for a wide range of mammals and reptiles, and it comprises of a huge diversity of herbaceous and other small plants, some quite rare.

3.3.5 Industry

One of the main problems of industry anywhere is what to do with waste. The main industries along the River are those more closely allied with agriculture (wineries and fruit processors) and it is almost inevitable that some sort of pollution will occur.

What effect this type of pollution will have or has had on the River environment is very difficult to define, but it is unlikely to be beneficial. Besides the fact that an unnatural organic or non-organic component is added to the River, the heavier waste will settle to the bottom. If this material is organic, and if deposition of it is conducted in the same locality of the River for a number of times, a relatively concentrated pocket of decomposition will result. This introduces a whole new aspect to the ecosystem of that part of the River, and would probably create a state of imbalance in that system.

If the pollutant is non-organic (chemical waste, or thermal pollution), then the physical-chemical conditions in the River would be changed. On the other hand, the chemicals may have a direct effect on the biota of the River. Either way, any pollution of the River is unnecessary and must be prevented if we are at all concerned with the life of the River Murray.

3.3.6 Residential-Urban Uses

The presence of a relatively high concentration of people in one area has a number of consequences. Land is used up, human waste such as refuse and sewage must be dealt with, and the activities of these people during their leisure time interact closely with the environment. The latter point has already been dealt with under the heading "Recreation", and the resultant problems have been discussed. The uptake of land, although small compared with agriculture, is still significant and increases every year. The effects which this land-loss has on the biology of the River has also been discussed.

At present, sewage is either pumped to a locality away from the River after treatment, or it is dealt with through the use of septic tanks. The problems with septic tanks is that if a flood occurs which extends over these tanks, all efforts to keep the pollutant away from River waters have been in vain. The influx of this waste matter is not only biologically harmful, it is unsafe to humans, and is aesthetically displeasing. Home refuse is usually collected and placed in particular areas set aside for this purpose. If the rubbish dump is located so that it is likely to be innundated at times of flood, pollution of the River will once more occur.

3.3.7 Shacks

Only a few comments will be made on shack development along the Murray, since this will have been adequately covered as part of the River Murray Planning Study.

The effects of shacks are the same as those discussed under the previous heading "Residential-Urban Uses". However shack development does have its exceptional points. Firstly, shack development has tended to occur in areas of natural beauty and importance, away from the usual residential growth areas. Hence, not only do we have the influence of human habitation in these central areas, but Man's influence is also spread along the whole of the River Murray. This therefore has the effect of placing a greater stress on the River's natural resources. As with the Residential-Urban situation, shacks pose the problem of recreation, waste disposal and an imparement of visual attractiveness. The visual aspect is particularly relevant to shack development since many shacks are shoddily built and lack maintenance, and are therefore visually displeasing. More importantly, shacks are usually not built to complement their surroundings.

The biological problems created by shacks are the same as those discussed under "Residential-Urban Uses" and "Recreation". It is probably true to say that the people occupying the shacks are more harmful to the environment than are the shacks themselves, since the main reason for owning a shack is to enjoy a different environment from what one is used to. This usually means to have physical experience of the surrounding, and in this way damage may occur.

In view of the close interaction of shack development and the environment, it is important that this development be strictly controlled and supervised. The suggestion that shacks should be located in clusters at carefully planned and chosen localities has definite merits. Such action would not eliminate the above problems, but these problems would be much more easily tackled in a cluster situation.

3.3.8 Other Factors - The Fish of the River Murray

The physiological and behaviourable aspects of the River fish have been discussed. It is important now to discuss what is presently happening to the fish populations of the Murray. Many interested parties have expressed concern over what they claim to be a decrease in the numbers of native fish.

Unfortunately, population studies of River Murray fish, especially in South Australia, have been virtually non-existent, and because of this there is no accummulated data on which to base opinions. Since we have no idea of the abundance of fish say 20 years ago, no comparisons can be made between now and the past. Even if full scale studies were commenced now, it would be many years before a discernable trends in fish population levels could be found (if a trend does exist). Hence, all opinions on the state of population levels must be based on circumstantial and cursory evidence.

Some facts may be stated however. It is true that in recent years the Murray Cod could be caught downstream from Morgan. Now it appears that the usual extent of the Cod stops at around Morgan. This could indicate that the Cod now restricts itself to areas more upstream than previously, but it could also indicate a general decrease in Cod numbers within the River Murray. This circumstantial indication of a drop in fish numbers has been suggested for other species as well, e.g. the Australian Perch.

It does appear that with respect to some species, their frequency of occurence may have decreased in recent years. A number of explanations may be suggested. One obvious explanation is that locking has caused a decrease in the amount of breeding in the Murray. Some people are of the opinion that very little breeding occurs in South Australian Waters, and that most of the fish found here come from the upper reaches of the Murray. Again, it is impossible to say how correct

this is. A second suggestion is that over-fishing has occured, hence depleting the number of breeding adults. This would be a highly likely explanation if fishing along the Murray were of a high intensity, but the fact is that the amount of fishing which does occur is of a low order. Even if high itensity fishing had occured in the past, causing a depletion of numbers, the low intensity of today would probably allow numbers to normalise.

One of the more popular explanations of this proposed decrease in fish numbers is that of the effects which introduced fish have had on native species. The European Carp (Cyprinus carpio) has exhibited a pehnomenal increase in abundance and range since its introduction, now occupying most of the River. The native and introduced species must interact and this interaction may be to the disadvantage of the native species. One direct interaction is that of competition for the use of the environment. It is arguable that some of the native species, e.g. the Cod and Australian Perch, are being displaced in the face of competition from the introduced species. The European Carp, the Tench (Tinca tinca) and the Redfin Perch (Perca fluviatilis) all tend to occupy the sluggish waters of lagoons and backwaters, and may therefore oust native species from this environment. Less directly, the introduced species may cause particular environments to be less suitable for habitation by native species. For instance, the Carp, Tench and Golden Carp (Wild Goldfish, Carassius auratus) tend to create turbid conditions by stirring up the bottom mud during their feeding behaviour. If this were to occur in a localised environment such as a lagoon, conditions may become unsuitable for the native fish. Additionally, the Carp tend to destroy significant amounts of riverside vegetation. This may hinder the propagation of some native species in that the amount of vegetation may also contribute to a decrease in the amount of food for some species.

Hence arguments may be developed to explain a decrease in fish numbers, if such a decrease is occuring. It has been pointed out that evidence for this depletion is only circumstantial. Much more work needs to be done to ascertain the true situation.

4. CONSERVATION OF THE RIVER ENVIRONMENT

4.1 Introduction

The preceeding sections on the vegetation, fauna and ecology of the River Murray may form a basis for the selection of sites for the conservation of wildlife and vegetation. Entailed in this section are a list of sites proposed for reservation, a description of each site, and the relevant proposals concerning each site.

For the purposes of this report, to conserve some natural resource is meant to imply the prevention of loss and damage to that resource. Therefore, on no account should any activitiy occur within a proposed conservation site which may be detrimental to the natural state of that site.

Before each proposed conservation site is discussed, it is necessary to define what criteria were used in the selection of these sites. The following is a list of these criteria, not necessarilly in any order of importance.

- What physical features are involved in the site - e.g. does the site involve lagoons, flats, cliffs; is it flat or hilly; etc.

- The location of the site - e.g. its proximity in relation to other proposed sites, towns, agricultural or industrial enterprises; etc.

- The biological constitution of the site - e.g. the range of plant and animal species; the presence of rare or endangered species or associations, population levels in the area; the presence of particular plant associations; etc.

- The site's importance with respect to the fauna and flora there - e.g. is it an area in which breeding occurs; are there organisms present which have adapted specifically to that type of environment?

- How unique is the site - e.g. Swampland in the Lakes region is not particularly unique since most of the shoreline there is swamp, but swampland in the River area between Wellington and Mannum is comparatively unique.

- The geology of the site - i.e. is it of any particular geological interest.

- The archaeology of the site - i.e. are there any important archaeological artifacts present.

- The current state of the site - i.e. has the site been damaged already, and if so, would it be worthwhile to reserve the area.

- The size of the site.

Included in the proposals for each site are suggestions on the type and degree of human usage which could be allowed, and what measures should be taken to allow the most effective retention of the identity of the site.

It must be stressed that the information entailed in the following pages is largely aquired from submissions to the Government and discussions with people who had opinions and facts to offer. Each site has been visited at least once by the author, but only general impressions and cursory observations can be gained from such a small amount of field work. It should be remembered that the total amount of knowledge on each site is usually quite small. The information which should be known for a fair and accurate assessment of the conservational value of each site is usually not known.

The site descriptions and proposals are given in the following pages.

4.2 LIST OF PROPOSED CONSERVATION SITES.

1. Yalkuri Sanctuary
2. Waltowa Swamp
3. Narrung Narrows
4. Marnoo Swamp
5. Alexandrina Swamps
6. Mosquito and Tolderol Points
7. Pelican Lagoon Area
8. "Cooronga" Scrub
9. Finniss River Complex
10. Reedy Point
11. Murray Mouth Region
12. Tailem Bend Forest Reseve
13. Murtho Forest Reserve
14. Long Island
15. River Glades
16. Sunnyside Swamp
17. "Peramangk"
18. Mannum Swamps
19. Lake Carlet Area
20. Marne River Area
21. Swan Reach Lagoons
22. "Blanchetown Island"
23. Reedy Island Area
24. Wombat Rest
25. Island Reach
26. Overland Corner
27. Moorook Complex
28. Pyap Lagoon Area
29. Gurra Gurra Lakes Area
30. Pike River Area
31. Lake Woolpolool
32. Lakes Merreti and Clover
33. Chowilla

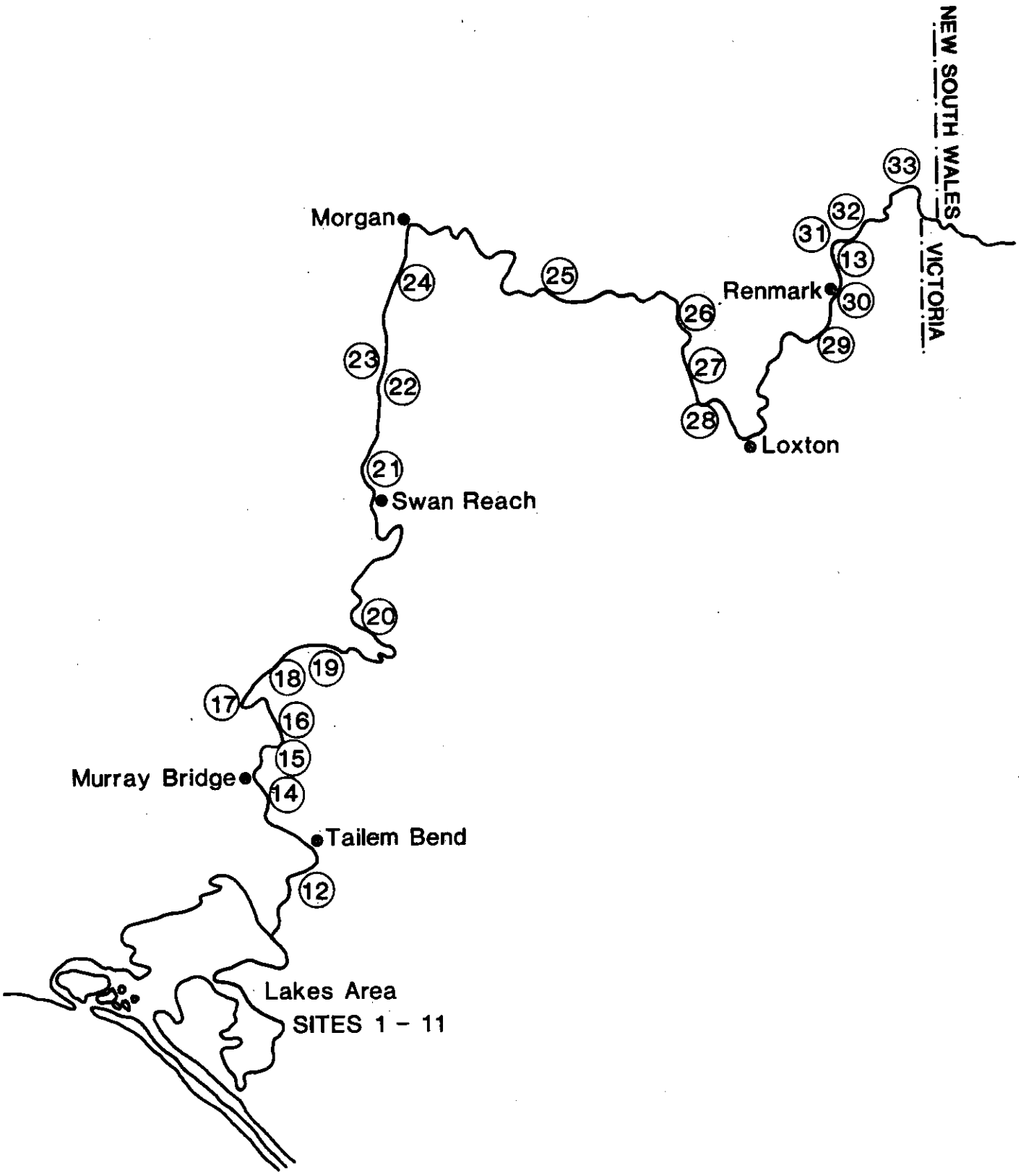
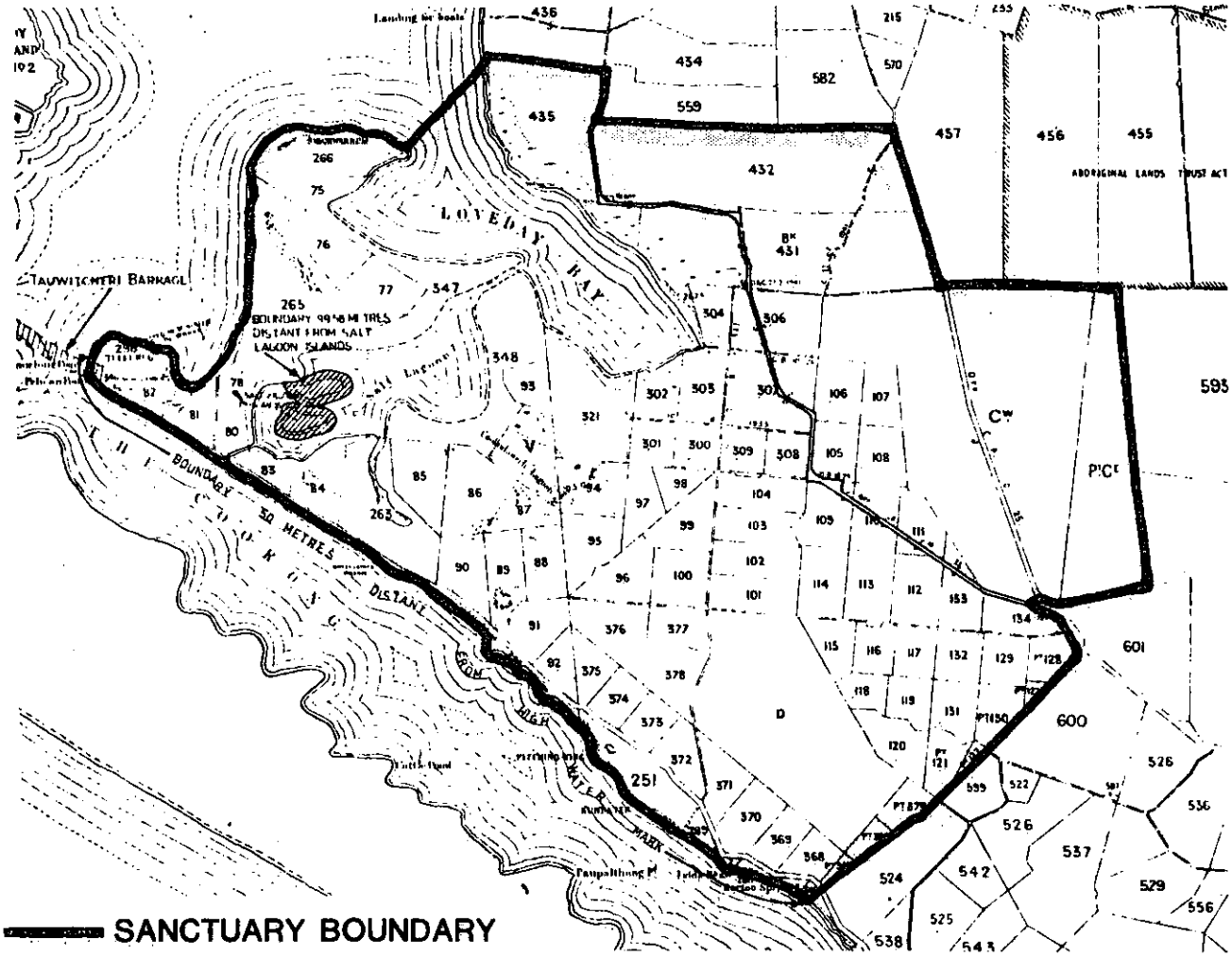


FIGURE 6

Location of Proposed Conservation Areas



Scale 1:100 000
Source : South Australian 1:100 000 Cadastral Series, Sheet 6726

FIGURE 7
Yalkuri Sanctuary

4.3 Yalkuri Sanctuary

[Note: Plate numbers given for proposed sites refer to plates appearing with Krastins' original report. These plates are held with the draft report in the Department of Environment and Planning Library. For the following figures, * indicates map was not included in the original report. Approximate area shown has been interpreted from observation of aerial photographs and reference to the text.]

Figure 7; Plates 1a, 1b, 1c.

Description - The Yalkuri Sanctuary region is flat, sandy and in parts stony. On drier land the vegetation consists of grasses and other small herbaceous plants, whereas the water's edge is more thickly vegetated and is often defined by areas of reeds.

Although private land, the public is allowed access to the area via a track leading from the Narrung-Meningie road to Pelican Point. The track passes close to swamp and open water. A good view of the Younghusband Peninsula sand dunes may be gained from a number of locations nearer Pelican Point.

Significance - The main attribute of this area lies in its bird life. It is particularly important for Ducks, Pelicans, Ibis, and in summer, Cape Barren Geese. Numerous Terns and Egrets may also be observed in the area.

Proposal - This area should be acquired and declared a Conservation Park. The section of particular interest is detailed in Figure 7.

Management - The access which the public is presently allowed should be continued, but any improvements which may be made with respect to human use should be kept at a minimum.

Status - The area as shown in Figure 7 has been declared a sanctuary under the National Parks and Wildlife Act 1972 (Gazetted 14/2/74).*

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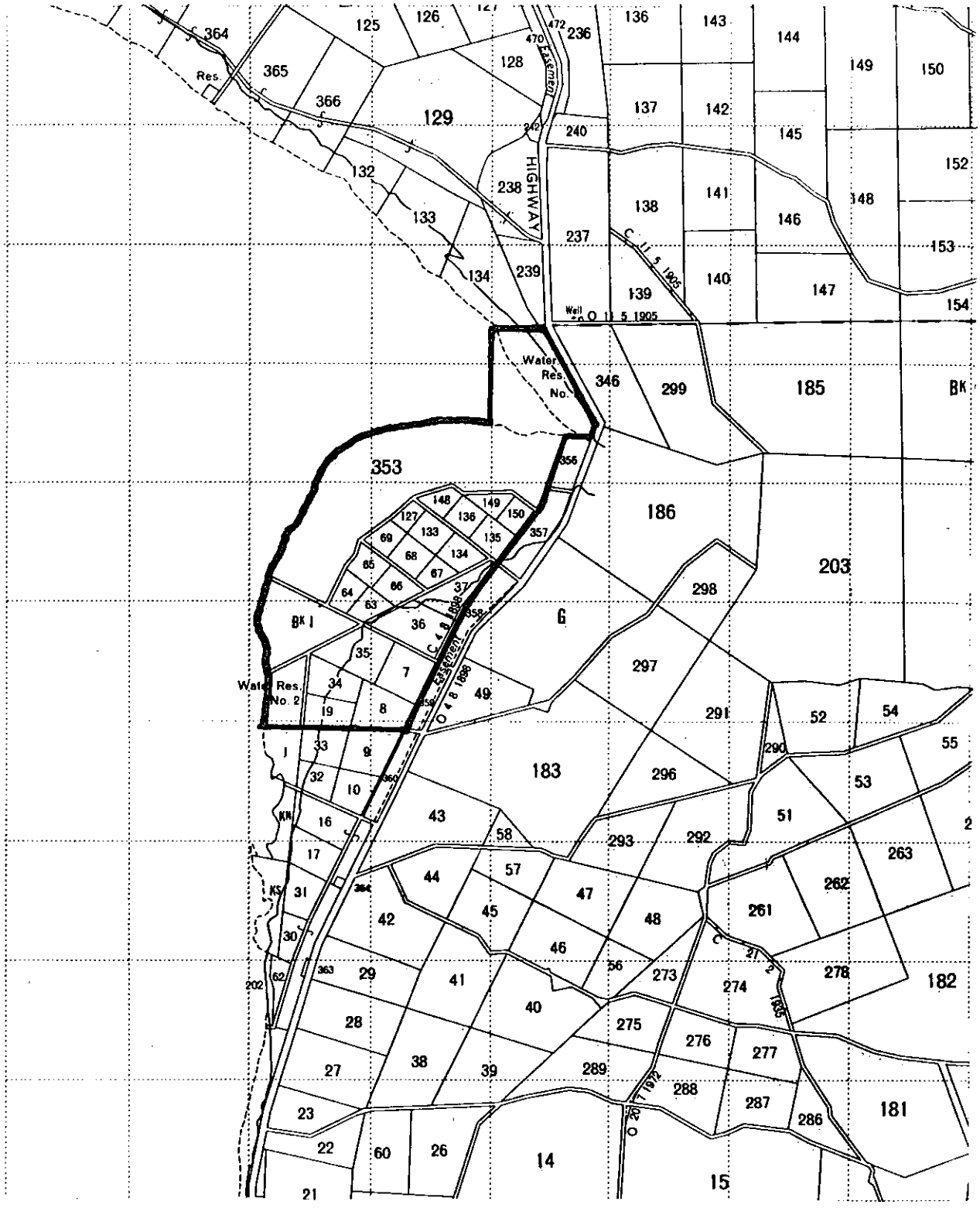
*The sanctuary system has been abolished since 1974 and the area under discussion currently has no legal status for conservation purposes.



BOUNDARY OF PROPOSED CONSERVATION AREA

Scale 1:50 000
Source : South Australian 1:50 000 Cadastral Series, Sheet 6726-I

FIGURE 8
Waltowa Swamp

4.4 Waltowa Swamp

Figure 8.

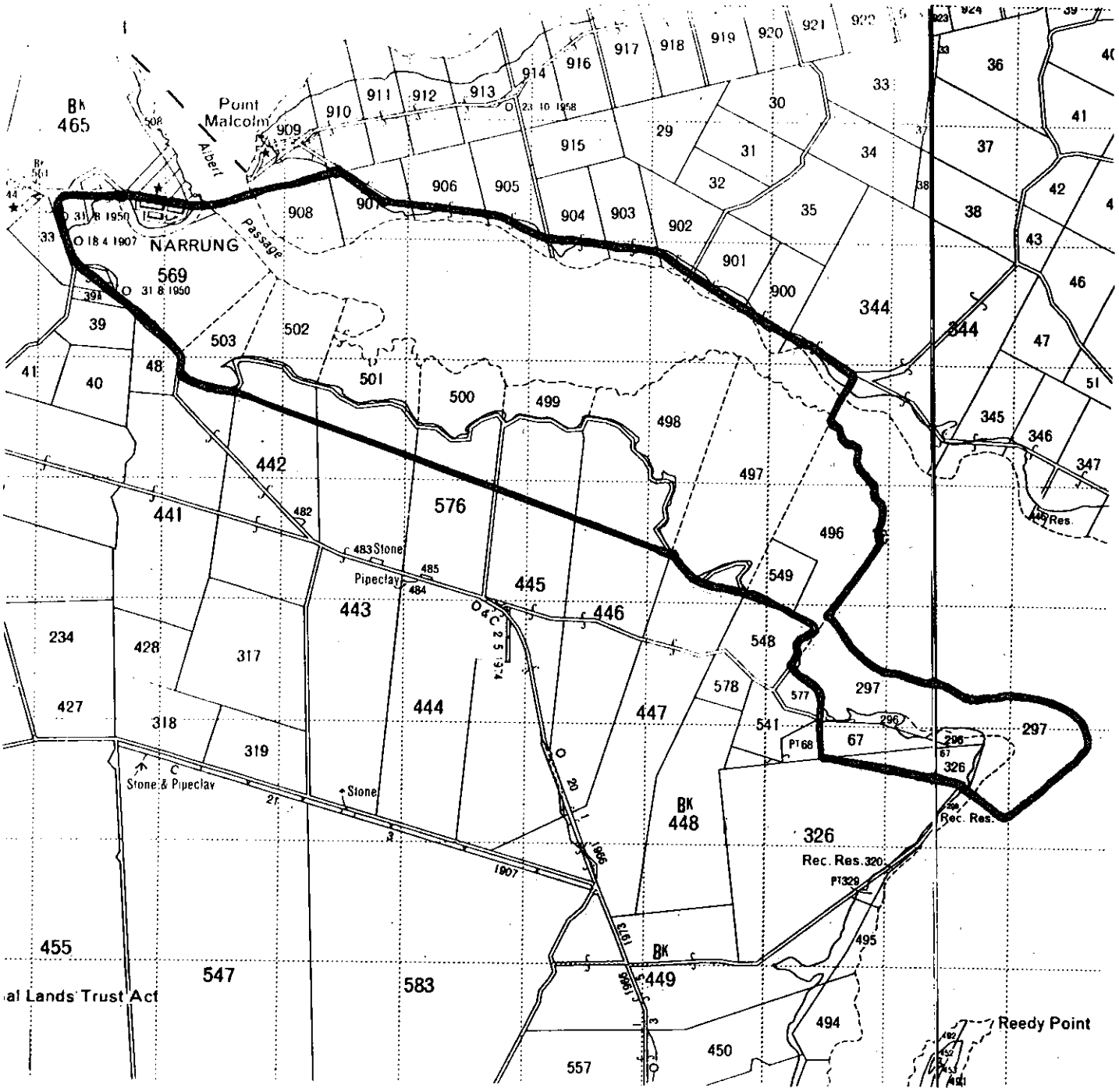
Description - The shore of Waltowa Swamp is reed lined. Away from water the land is composed of samphire and grasses.

The sanctuary system has been abolished since 1974 and area under discussion currently has no legal status for conservation purposes.

Significance - The importance of the area stems mainly from its population of Cape Barren Geese. In summer they may be found in particularly large numbers. The area is probably one of the most important in the State for Cape Barren Geese. Besides the Geese, other water birds may readily be seen in the area.

Proposal - The area should be acquired and declared a Conservation Park.

Management - Drive-through access could be made possible with the construction of tracks. If this is done however, measures must be taken to prevent damage of the foliage, and more particularly, disturbance of Cape Barren Geese which lay their eggs in nests constructed on the ground (see Appendix 6.3.3. No. 28). In view of this danger, it is recommended that no public access be allowed unless confined to board walks with railings.



BOUNDARY OF PROPOSED CONSERVATION PARK AREA

Scale 1:50 000

Source : South Australian 1:50 000 Cadastral Series, Sheets 6726-I, IV

FIGURE 9

Narrung Narrows

4.5 Narrung Narrows

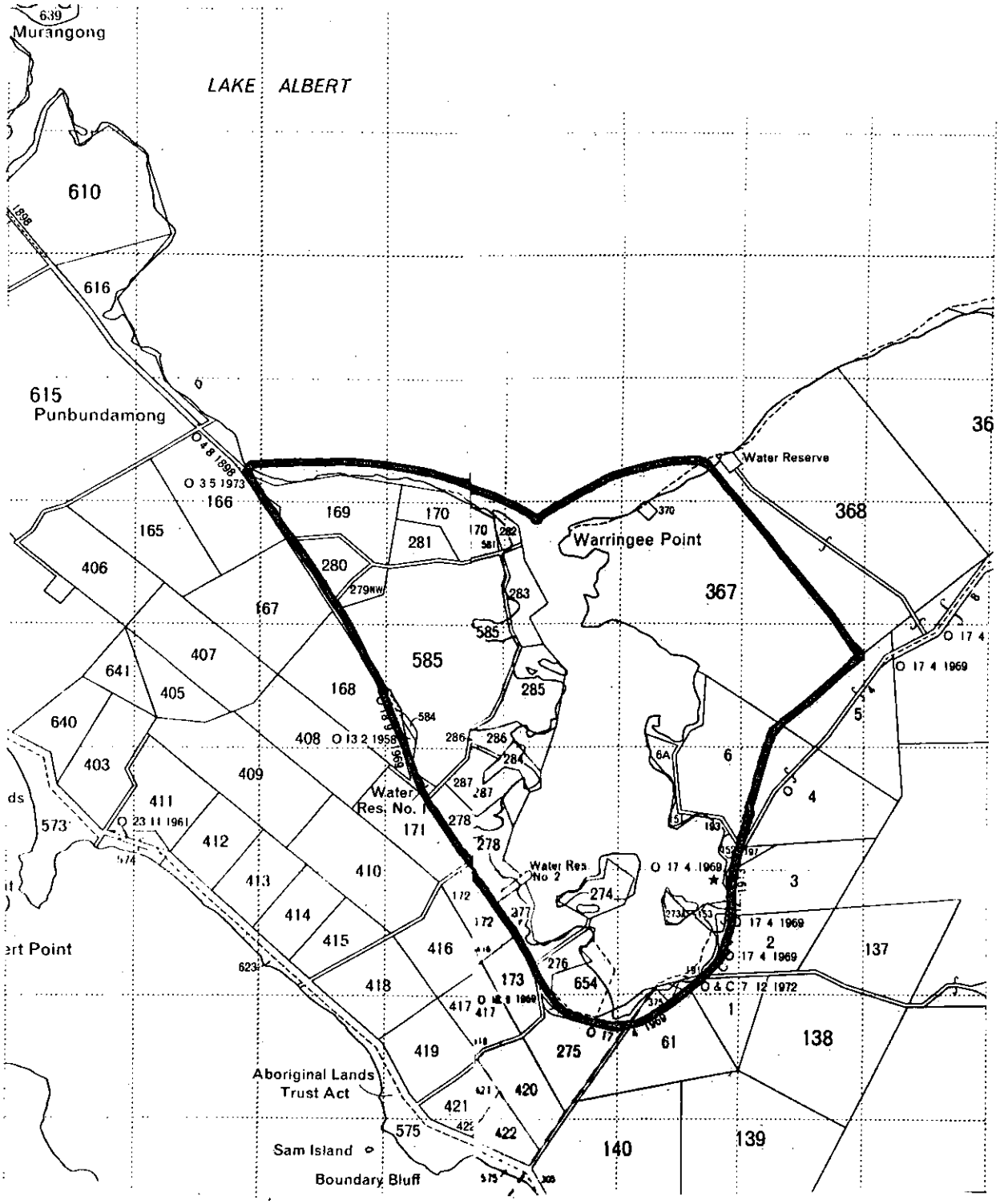
Figure 9; Plates 2a, 2b.

Description - This area forms the connexion between Lakes Albert and Alexandrina. It is a narrow stretch of water consisting of dense growths of reeds along the bank.

Significance - The area is mainly important to Duck (White-eyed and Mountain Duck), and supports breeding colonies of Ibis. Pelicans, Swans, Chestnut Teal and Grey Teal also frequent the area.

Proposal - This area should be acquired and declared a Conservation Park.

Management - Tracks could be constructed bordering the area to allow the public controlled visual access. Some form of boating restriction should also be enforced in the proposed area. Boating speed should be minimal and within defined areas away from the shore.



BOUNDARY OF PROPOSED CONSERVATION AREA

Scale 1:50 000
Source : South Australian 1:50 000 Cadastral Series, Sheets 6726-I, IV

FIGURE 10
Marnoo Swamp

4.6 Marnoo Swamp

Figure 10; Plates 3a, 3b.

Description - This area consists of a cove off Lake Albert containing reeds and Reed Island.

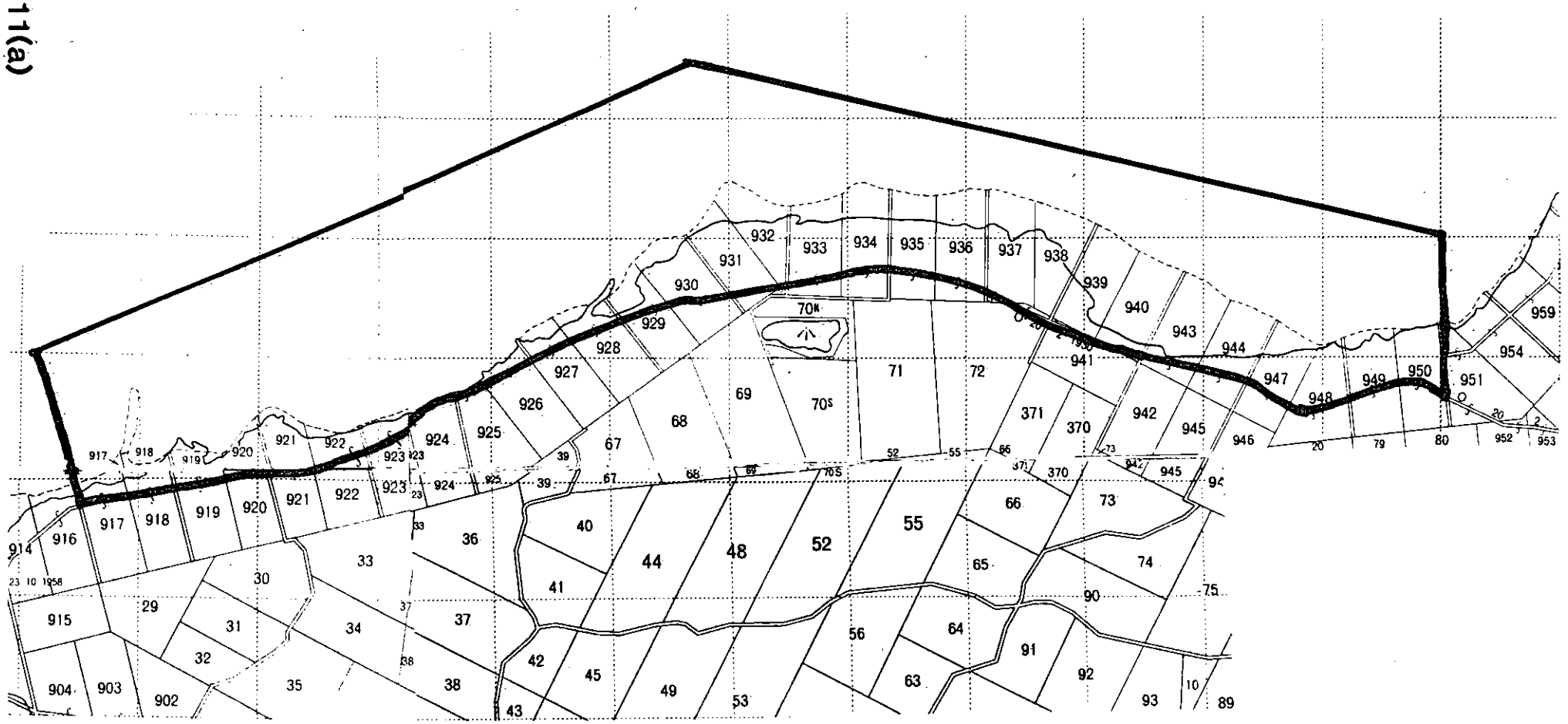
Significance - Marnoo Swamp is frequented by various water fowl species. Being close to Meningie, it is ideally located for recreational purposes.

Proposal - This area should be acquired and declared a Recreation Park. Marnoo Swamp does not appear to be a very important locality in a biological sense, particularly when compared with other areas in the Lakes region. However, it is an attractive area and would probably be useful as a recreation centre.

Management - Motor boating should not be allowed within the proposed area, since this may unduly disturb the water fowl usually present there. Other human activities such as picnicing, canoeing and rowing could be allowed.

FIGURE 11(a)

Alexandrina Swamps



BOUNDARY OF PROPOSED CONSERVATION AREA

Scale 1:50 000

Source : South Australian 1:50 000 Cadastral Series, Sheets 6727–II, III, 6726–I, IV

4.7 Alexandrina Swamps

Figures 11a, 11b; Plates 4a, 4b.

Description - This is a long stretch of shoreline bordering Lake Alexandrina between the Narrung Narrows and Poltalloch Bluff. Figure 11b shows diagrammatically and in detail the vegetation structure of one part of the area. Adjacent to the lake the vegetation consists of reeds and a thick growth of herbaceous plants. Inland from the Lake the growth is mainly samphire, and further inland yet open growths of herbs and grasses predominate. This scheme represents the average vegetation structure for the length of the swamps area.

Significance - As is the case with all Lakes swamps, the Alexandrina swamps provide habitat for water birds. Swans occur in large numbers, as do Ibis and Duck (probably Black and Mountain Duck). Cormorants, Pelicans and Coots may also be seen in the area.

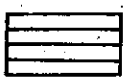
An additional important factor is the presence of middens (shown in Figure 11b). These are food refuse mounds mainly composed of shell and bone, created by the Aboriginals of the area in the past. The continued existence of these middens is important, not simply because they are artifacts of the Aboriginal culture, but becauce they are also of archaeological importance. It is from studies of the composition of middens that a greater knowledge of the Aboriginal relationship with the environment may be gained.

Proposal - This area should be acquired and declared a Conservation Park. The southern boundary of the area is defined by a road from which adequate views may be gained.

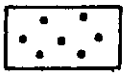
Management - The Alexandrina Swamps should be left untouched except perhaps for the removal of some agricultural artifacts (e.g. fencing and troughs). Boating adjacent to the swamps should be restricted in speed and proximity to the shore.

Legend

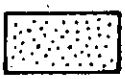
Thick scrub vegetation.



Medium density scrub vegetation.



Salsola kali and Heliotropium sapinum with grassy understorey.



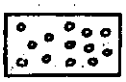
Samphire

Thickly herbaceous, mainly grasses, to 3 cm high.

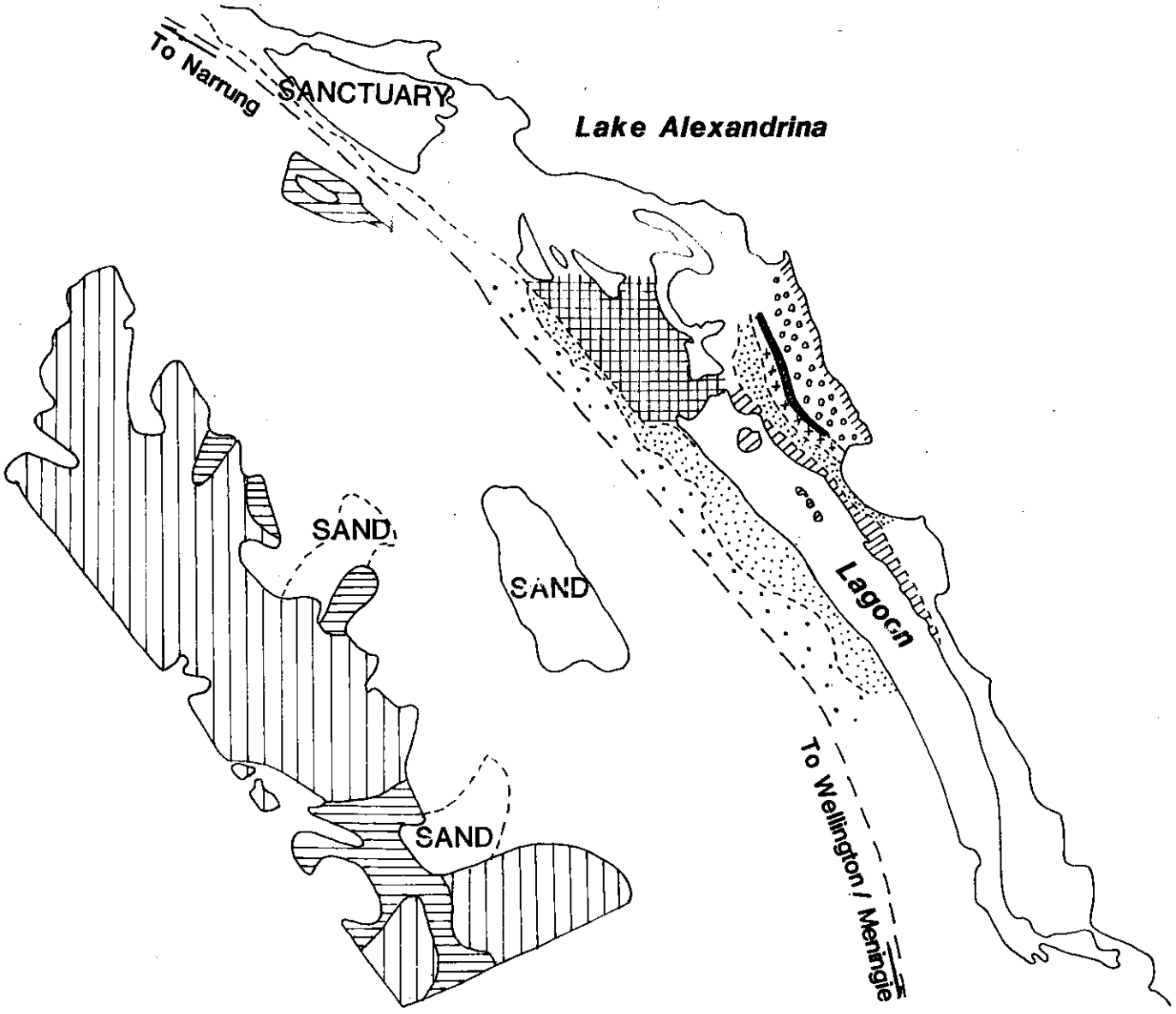
Mainly reeds.

Middens - covered with samphire.

Band of thick bushy vegetation, 3m high.



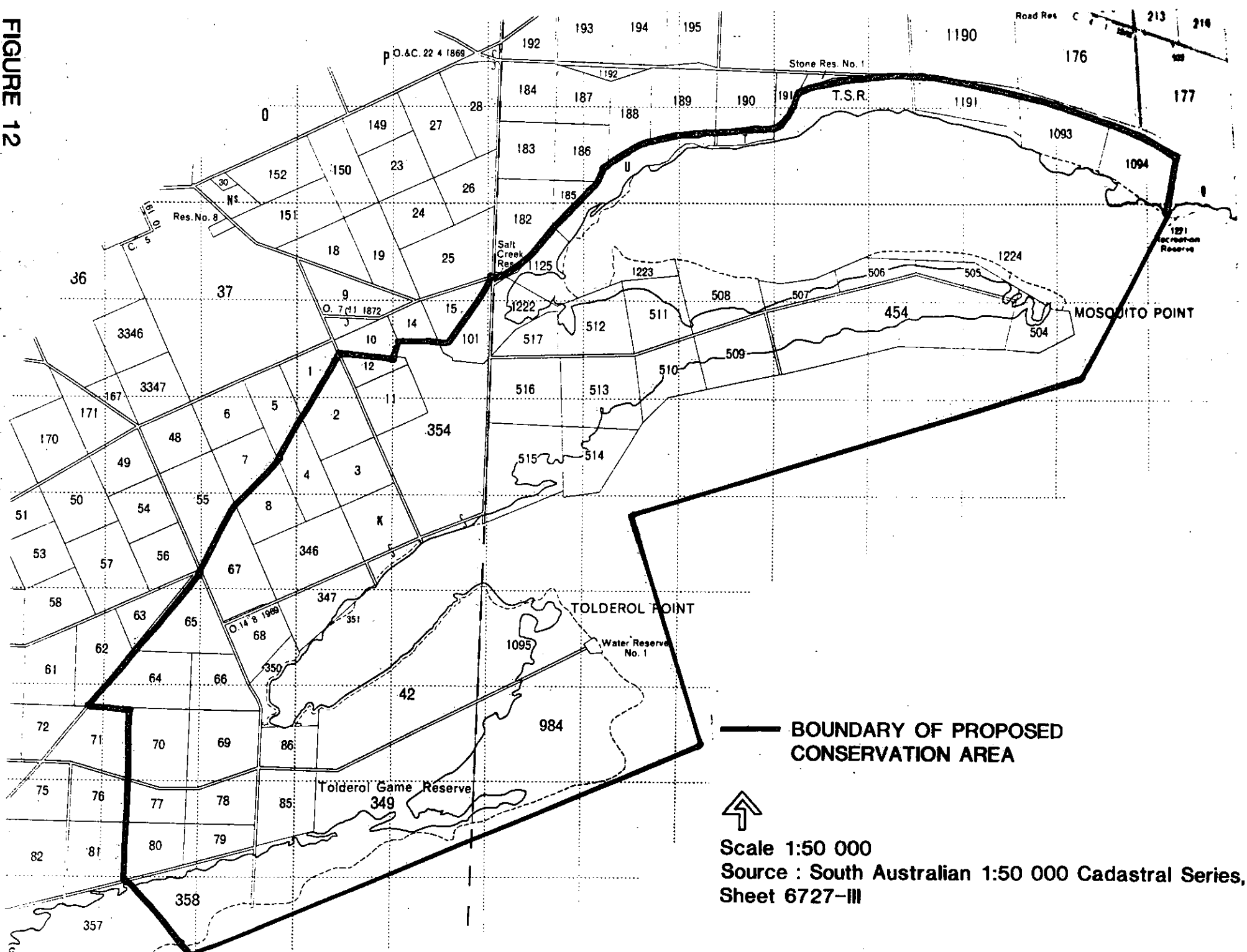
Thickly herbaceous, high species diversity, to 1m high.



Scale 1:20 000
Source : Compiled by I. Krastins, 1974.

FIGURE 11(b)
Vegetation Structure
of part of Alexandrina Swamp

FIGURE 12
Mosquito and Tolderol Points



Scale 1:50 000
Source : South Australian 1:50 000 Cadastral Series, Sheet 6727-III

4.8 Mosquito and Tolderol Points

Figure 12.

Description - Mosquito Point has been declared a sanctuary under the National Parks and Wildlife Act 1972 (Gazetted 14/2/74).* The southern half of the Tolderol Point peninsular is a Game Reserve.

The area consists of two mud peninsulas extending into Lake Alexandrina. Their edges are thickly lined with reeds.

Under the direction of the National Parks and Wildlife Service, a programme is in progress at the Tolderol Point Game Reserve which involves the planting of feed crops appropriate to the game species present there. The present reed growth is being cut and the cleared area then replanted with Scirpus (a sedge).

Significance - The main attribute of this locality is its water birds. Mountain Duck, Black Duck, Swans and Pelicans may all be found in large numbers. White-eyed Duck, Cormorants and Grey Teal are seen in slightly lesser numbers. During summer, the area supports a good population of Cape Barren Geese, and throughout the year numerous Terns, Coots and various waders may be observed. Straw-necked and White Ibis are known to frequently breed in the area, while Glossy Ibis and the Royal Spoonbill breed here occasionally.

The Mosquito-Tolderol Points area is probably the best water bird locality in South Australia, and for this reason should be conserved.

Proposal - At present, the proposed reserve area is being used for cattle grazing. It is envisaged that an ideal usage of Mosquito and Tolderol Points would be the following. The Tolderol Game Reserve should be kept as such and extended northwards to include more of the peninsula. The Mosquite Point Sanctuary and land north, west and south-west of the sanctuary should be acquired and declared a Conservation Park. Having an area of conservation adjacent to an area of gaming would aid the continued existence of the birds of that area.

Management - Access to the proposed area by land should not be allowed. Picnic facilities could be constructed on the shore opposite Mosquito Point and boat tours could be organised to allow people to sight-see the area. Private boating should be kept well away from the proposed area.

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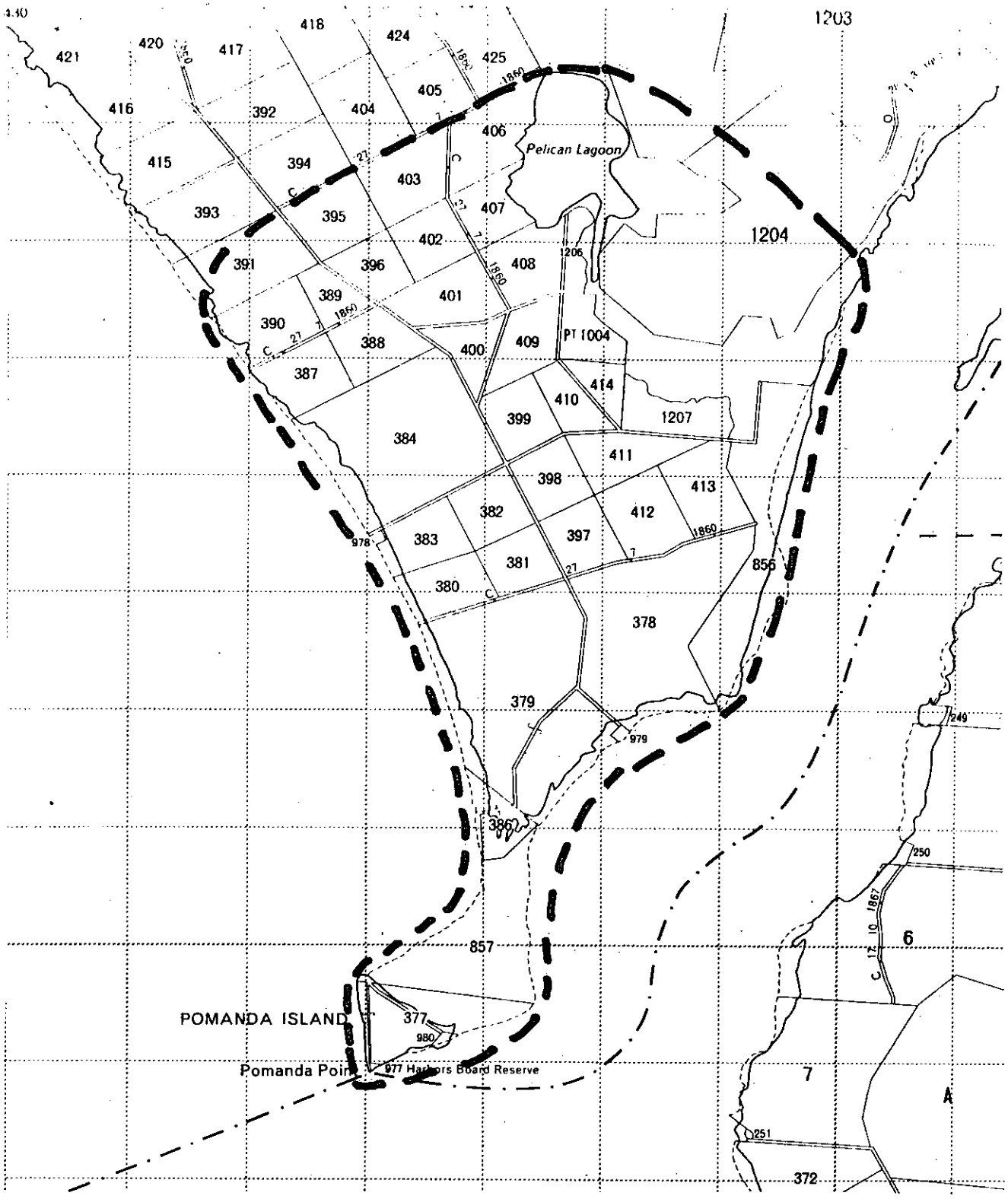
*The sanctuary system has been abolished since 1974 and the area under discussion currently has no legal status for conservation purposes.



---- APPROXIMATE BOUNDARY OF PROPOSED CONSERVATION AREA

Scale 1:50 000
Source : South Australian 1:50 000 Cadastral Series, Sheet 6727-II

FIGURE 13
Pelican Lagoon Area

4.9 Pelican Lagoon Area

Figure 13.

Description - This area consists of most of Pelican Lagoon itself plus the land and swamp south to Pomanda Point.

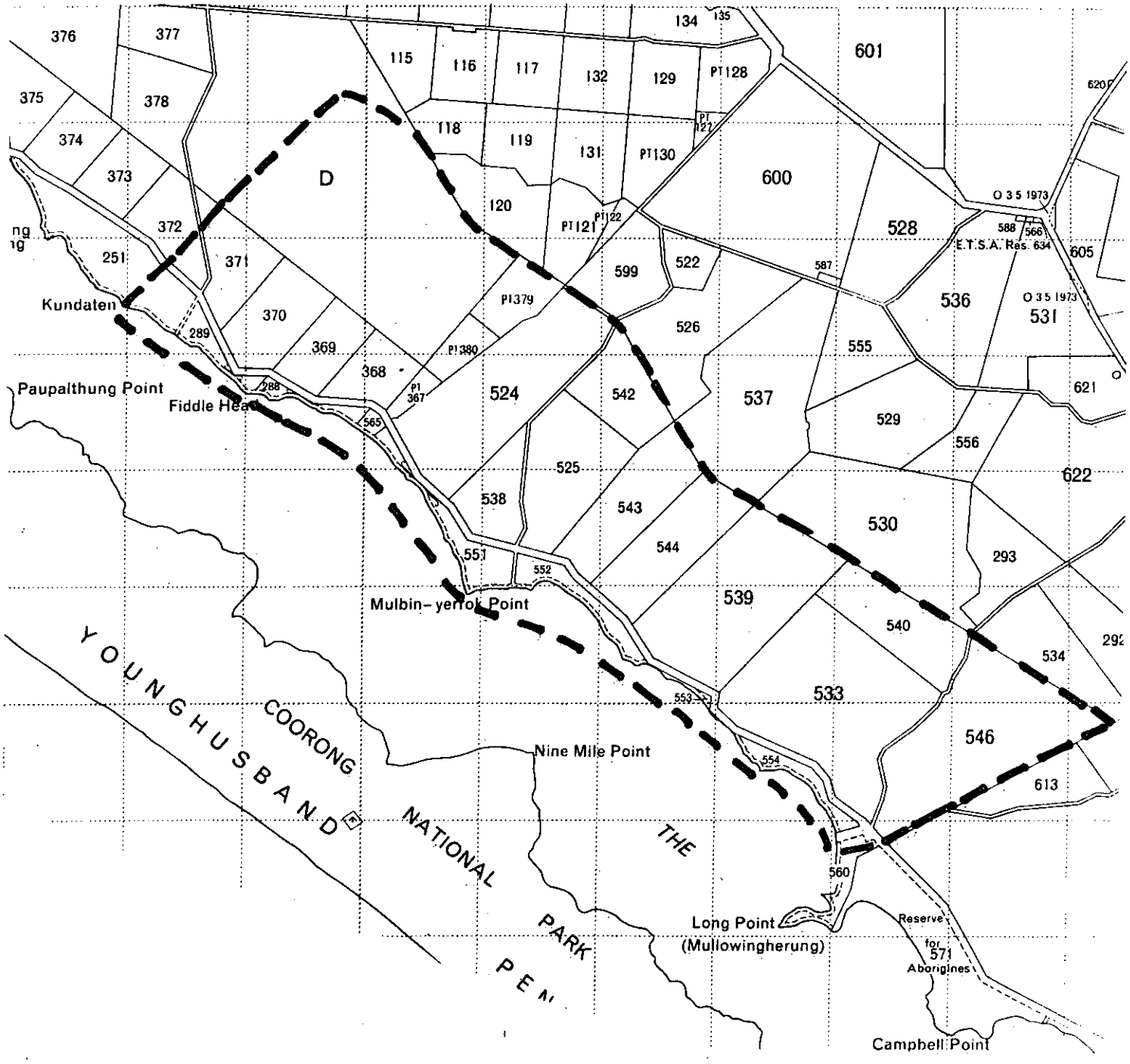
Pelican Lagoon is only watered during times of flood, and otherwise consists of samphire plains. It has been suggested that this type of samphire plain (i.e. subject to flooding) may constitute a breeding site for fish and invertebrates, and therefore Pelican Lagoon may be imporotant in this respect.

South of Pelican Lagoon lies Pomanda Island. The island lies very close to the mainland, but it is distinguishable as an island since an area of reed and cane-grass swamp separates it from the mainland. The island itself is vegetated by grasses and other herbaceous plants; however, the western portion of the island is vegetated by a pure stand of the noxious weed African Boxthorn (Lycium ferocissimum). It is unusual that there is no understorey to speak of. The large amount of cow dung present on the ground indicates that the lack of understorey may have been due to overgrazing. At the time of the last visit (late February 1974) there were apparently no cattle on the island, at least not in the Boxthorn area. Such a situation may provide an ideal setting for understorey regeneration studies if these were commenced early enough.

Significance - As mentioned, the samphire plain around Pelican Lagoon may be important to the breeding of aquatic organisms. Darters have been reported to breed in the willows adjacent to the River Murray east of Pelican Lagoon. A number of water bird species have been observed on Pomanda Island and around the reed connection with the mainland, the most prominent being Swans and Pelicans. Pomanda Island may also be scientifically important with respect to studies in the regeneration of overgrazed understoreys. The island may also be of geological interest since one of its shores consists of limestone cliffs.

Proposal - The above area should be acquired and declared a Conservation Park.

Management - Any agricultural activity occurring in the area should be discontinued and weed control instigated. Since Pomanda Island is small, it probably could not sustain frequent human activity and use, and should therefore be simply set aside for the purposes of research and as a protected habitat for the wildlife of the area.



▬▬ APPROXIMATE BOUNDARY OF PROPOSED CONSERVATION AREA

Scale 1:50 000
Source : South Australian 1:50 000 Cadastral Series, Sheet 6726-I

FIGURE 14
'Cooronga' Scrub

4.10 Cooronga Scrub

Figure 14; Plates 6a, 6b.

Description - Cooronga scrub is located south of Lake Albert and covers an elongated area, 8km by 1.25km. 60% of the area is covered by mallee scrubland. The scrub itself is frequently interrupted by treeless pockets of land, usually possessing very little vegetative cover. The whole area is particularly sandy.

The dominant plant species making up the scrub are Eucalyptus oleosa (Red Mallee), the noxious weed Asclepias rotundifolia (Broad-leaved Cotton Bush) and Xanthorrhoea australis (Yacca species). The mallee forms particularly dense, almost impassable stands approximately 3 to 4 metres high, with an understorey of grasses, mosses and very dense growths of the creeper Asparagus medeoloides. A. rotundifolia is most readily found in areas of lesser density, but may be found in the scrub proper. Large specimens of Casuarina stricta form an open woodland formation amongst the thick mallee growth. The Australian Boxthorn (Lycium australe) and a rush, Juncus polyanthemos are found at the northern edge of the mallee scrub.

Significance - Being a natural forest area surrounded by cleared land to the east, north and west, and the Coorong to the south, the Cooronga Scrub must be considered particularly important with respect to the fauna of the Lakes area. It is especially of significance to birds which frequent wooded areas, since there is no other scrub of this extent for many miles around Cooronga Scrub.

No observations were made on the native mammal and reptile species of the area, but its nature suggests that the scrub would probably support a reasonably diverse land fauna. Research needs to be done on the area to ascertain just what is its faunistic content.

Proposal - This area should be acquired and declared a Conservation Park.

Management - At present the scrub is being used for sheep grazing. This should be ceased. The scrub harbours an excessively large rabbit population, and all efforts should be made to exclude the rabbits from the area. The scrub would be appropriate for bush-walking and trails may be constructed with this end in view. However, it is recommended that the area be kept solely for the purposes of research and "restoration" (i.e. getting rid of the rabbits and weeds), for an adequate period of time before human usage is allowed.

4.11 Finnis River Complex

Figure 15; Plates 5a, 5b, 5c.

Description - The area consists of swamp and swamp-edge vegetation along the Finniss River and Black Swamp valleys, plus areas of uncleared and semi-cleared scrub in the fork between the Finniss and Black Swamp and immediately south of Black Swamp.

Significance - The Black Swamp area has been reported to possess the following attributes (Field Naturalist Society of S.A. 1965).

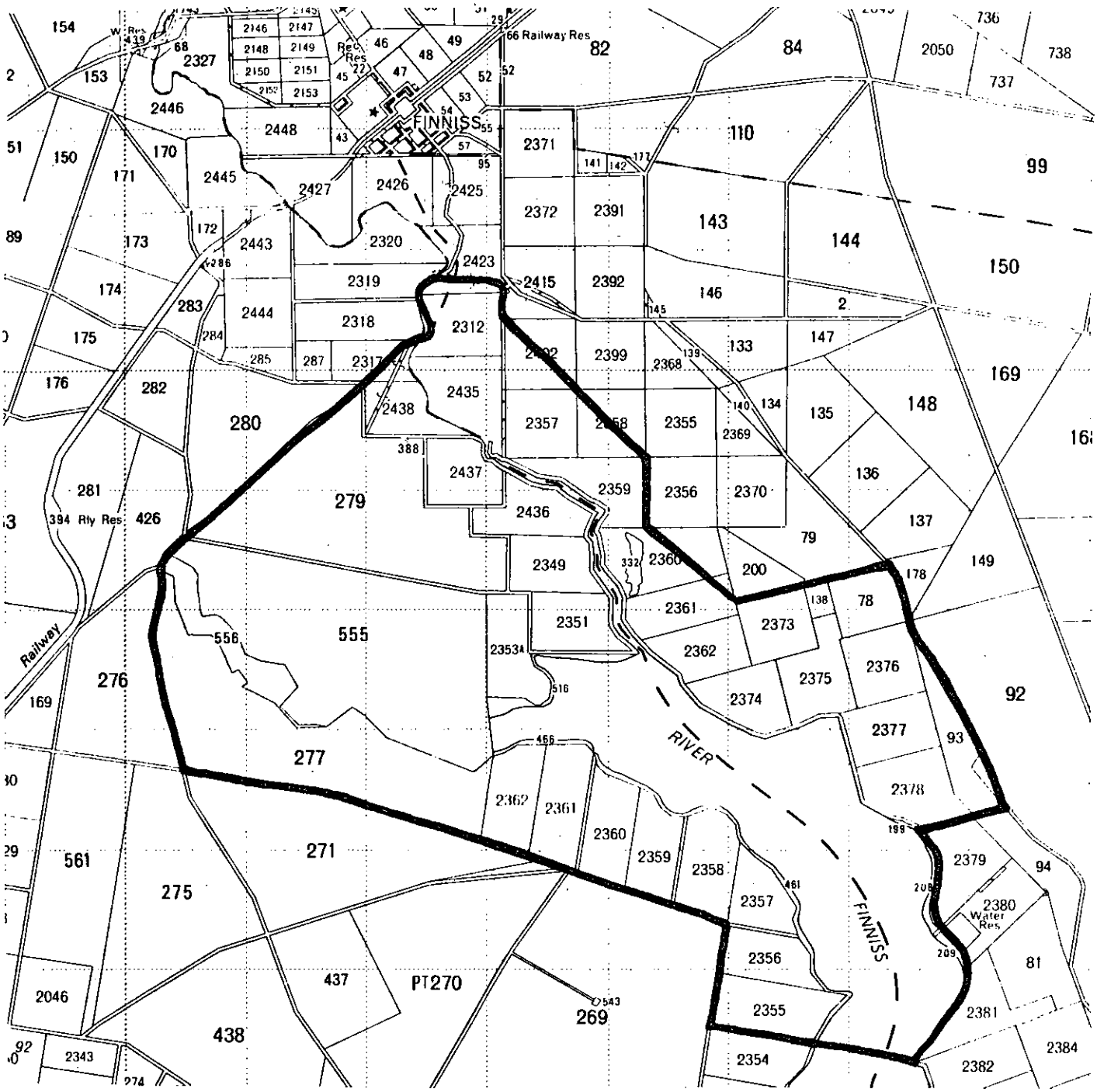
- The presence of an orchid Leptoceras fimbriatum near the edge of the swamp. This species is not common in South Australia.

- Populations of the Grey Kangaroo (Macropus major) and the Echidna (Tachyglossus aculeatus) have inhabited the more scrubby areas. In 1965, the Grey Kangaroo was described as numerous around Black Swamp. The Pigmy Possum (Cercartetus concinnus), Ring-tailed Possum (Pseudocheirus laniginosus), Brush-tailed Possum (Trichosurus vulpecula), Water Rat (Hydromys chrysogaster), Grey's Rat (Rattus greyi), and possibly Bandicoots (Isoodon sp.) also inhabit the swamp or its surrounding environment.

- Amongst other reptiles, the Red-bellied Black Snake (Pseudechis porphyriacus) was noted to occupy the margins of Black Swamp. This is particularly important in view of the misguided destruction of "dangerous" snakes in populated areas. It is only in natural refuges such as the Finniss Complex that these creatures can safety continue their life processes and perpetuate the species.

The Finniss Complex supports a reasonable range of bird life. A number of water birds have been observed, particularly Swans, Ibis and Swamp Hens. The wooded areas provide habitat for tree nesting birds.

Being a swampy, enclosed and slowly circulating environment, the Finniss and Black Swamp may be important fish breeding sites. Although this cannot be said for certain, two points are of note. Firstly the



BOUNDARY OF PROPOSED CONSERVATION AREA

Scale 1:50 000

Source : South Australian 1:50 000 Cadastral Series, Sheet 6627-II

FIGURE 15

Finniss River Complex

structural qualities of this area would seem to be right for fish breeding, and secondly a number of fish species are known to inhabit these waters.

Proposal - This locality should be acquired and declared a Conservation Park.

Management - In view of the area's good scenic qualities, the public should be allowed limited access, probably along tracks. There are a few localities where look-outs could be ideally placed. From these vantage points a good view of the bird life, scrub and general structure of the swamp areas would be gained.

4.12 Reedy Point

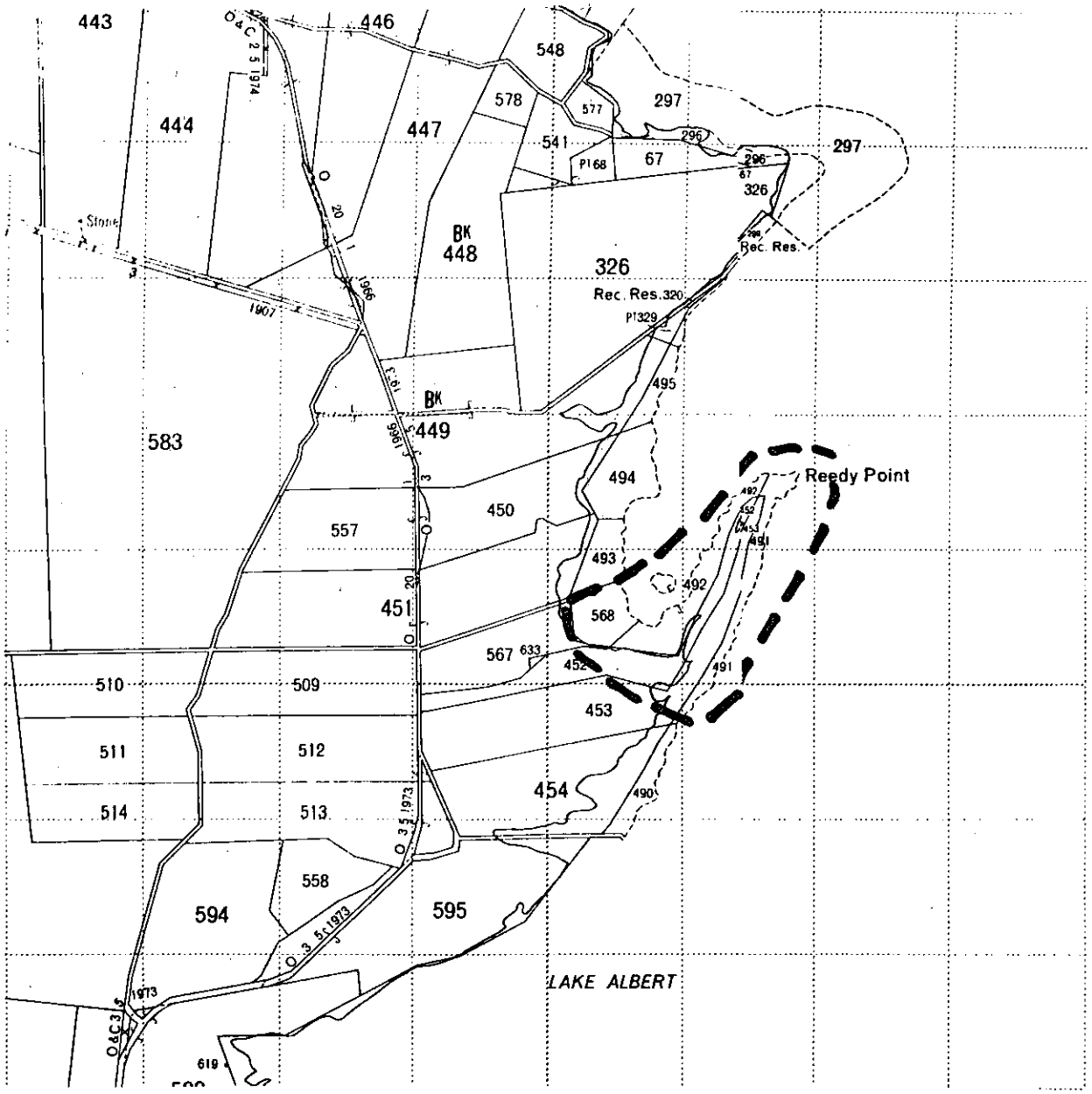
Figure 16.

Description - This is basically a swampy extension similar in structure to Mosquito and Tolderol Points, except on a smaller scale.

Significance - Although not as important as Mosquito and Tolderol Points, Reedy Point supports a similar range of water birds, and is therefore a significant locality in the Lakes region.

Proposal - Reedy Point should be acquired and declared a Conservation Park. The area west of the main road which passes adjacent to the Reedy Point peninsula is included since at times of flooding this section is usually inundated, and therefore produces an additional area of swamp.

Management - Boating near the swamp should be restricted in speed and proximity to the shore of the peninsula.



APPROXIMATE BOUNDARY OF PROPOSED CONSERVATION AREA

Scale 1:50 000

Source : South Australian 1:50 000 Cadastral Series, Sheets 6726-I, 6726-IV

FIGURE 16

Reedy Point

4.13 Murray Mouth Region

Figure 17.

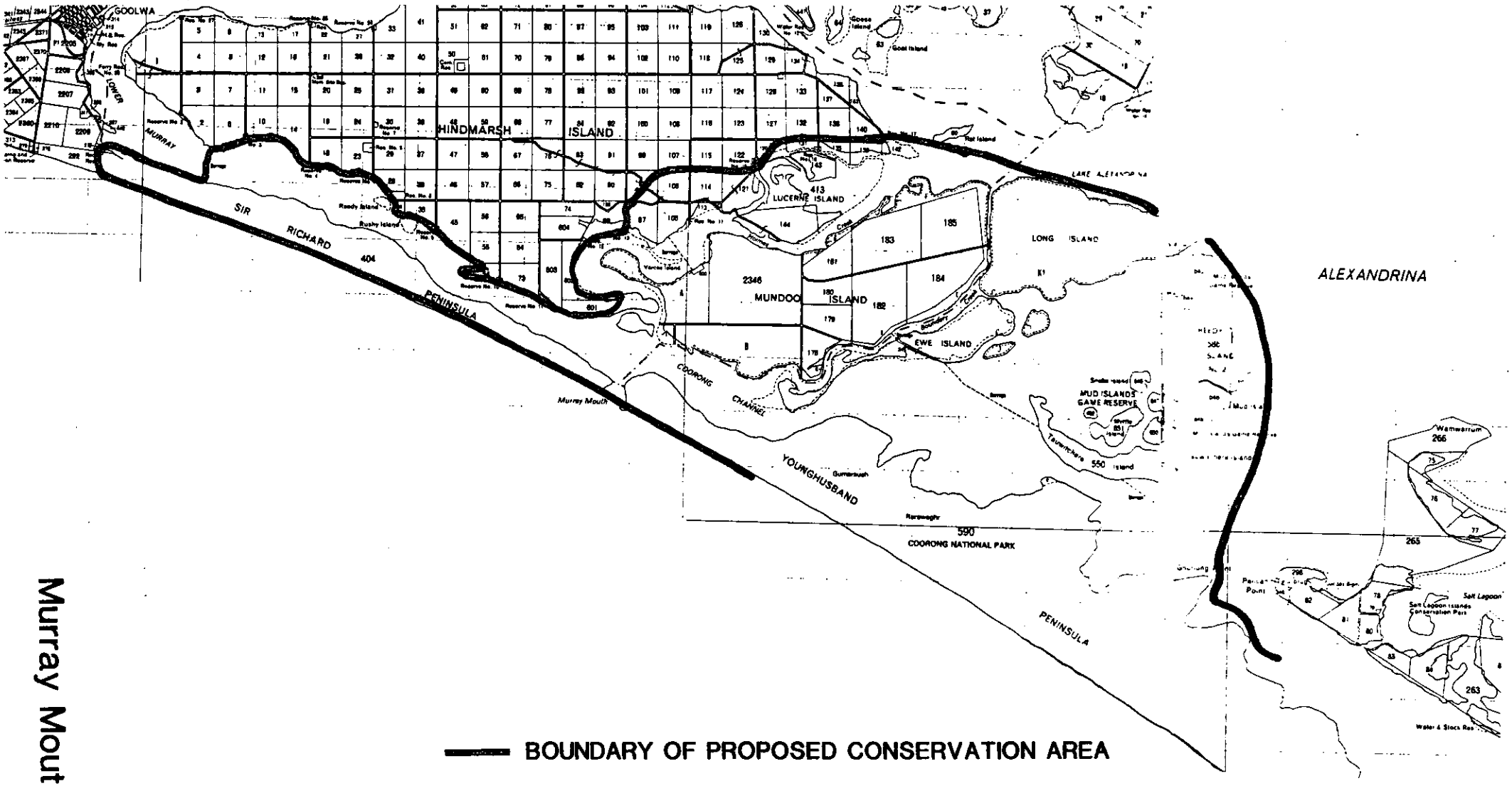
Description - The vicinity of the Murray Mouth consists of salt water, sand banks and sand dunes. The area includes the whole of Sir Richard Peninsula (which is Crown Land), Ewe, Long, Reedy and Myrtle Islands (all privately leased), Mud Island (a game reserve), and Tauwitchere Island, held by the Engineering and Water Supply Department.

Significance - The Murray Mouth Region involves both fresh and salt water, and subsequently supports a diverse range of bird life. Numerous straying, migratory, and resident oceanic birds may be found on the peninsula and around the Mouth, whereas Ducks, Waders and other water birds are found further away from the Mouth.

The Murray Mouth is also a geographically important locality being the common boundary of ocean and River.

Proposal - All land not held by the Crown in this region should be acquired. The whole region should be declared a Conservation Park.

Management - Human impact on the area should be minimised, and motor boating should be restricted in speed and proximity to the shoreline. Public access should also be limited.



BOUNDARY OF PROPOSED CONSERVATION AREA

Scale 1:100 000

Source : South Australian 1:100 000 Cadastral Series, Sheets 6726, 6626

FIGURE 17

Murray Mouth Region

4.14 Tailem Bend Forest Reserve and Murtho Forest Reserve

These two areas are included simply to recommend a change in their status. They are declared Forest Reserves under Section 5 of the Crown Lands Act, (1926-1966), controlled by the Woods and Forests Department which leaves management to the discretion of Minister concerned, i.e. technically they need not be preserved. Both Murtho and Tailem Bend Forest Reserves are being managed with conservation in mind; however, to be totally sure of their continued conservation, these areas should be declared Conservation Parks.

Both areas are of scientific and aesthetic importance. The Tailem Bend Forest Reserve is one of the few extensive stands of native pine (Callitris spp.) in the Lakes region, and Murtho (near Paringa) constitutes a well-wooded stand of River Red Gum and River Box. Both areas would support a good range of forest bird life and land fauna. The Tailem Bend Forest Reserve is of particular scientific interest since it undoubtedly possesses its own pecularities compared with introduced-pine forests.

4.15 Long Island

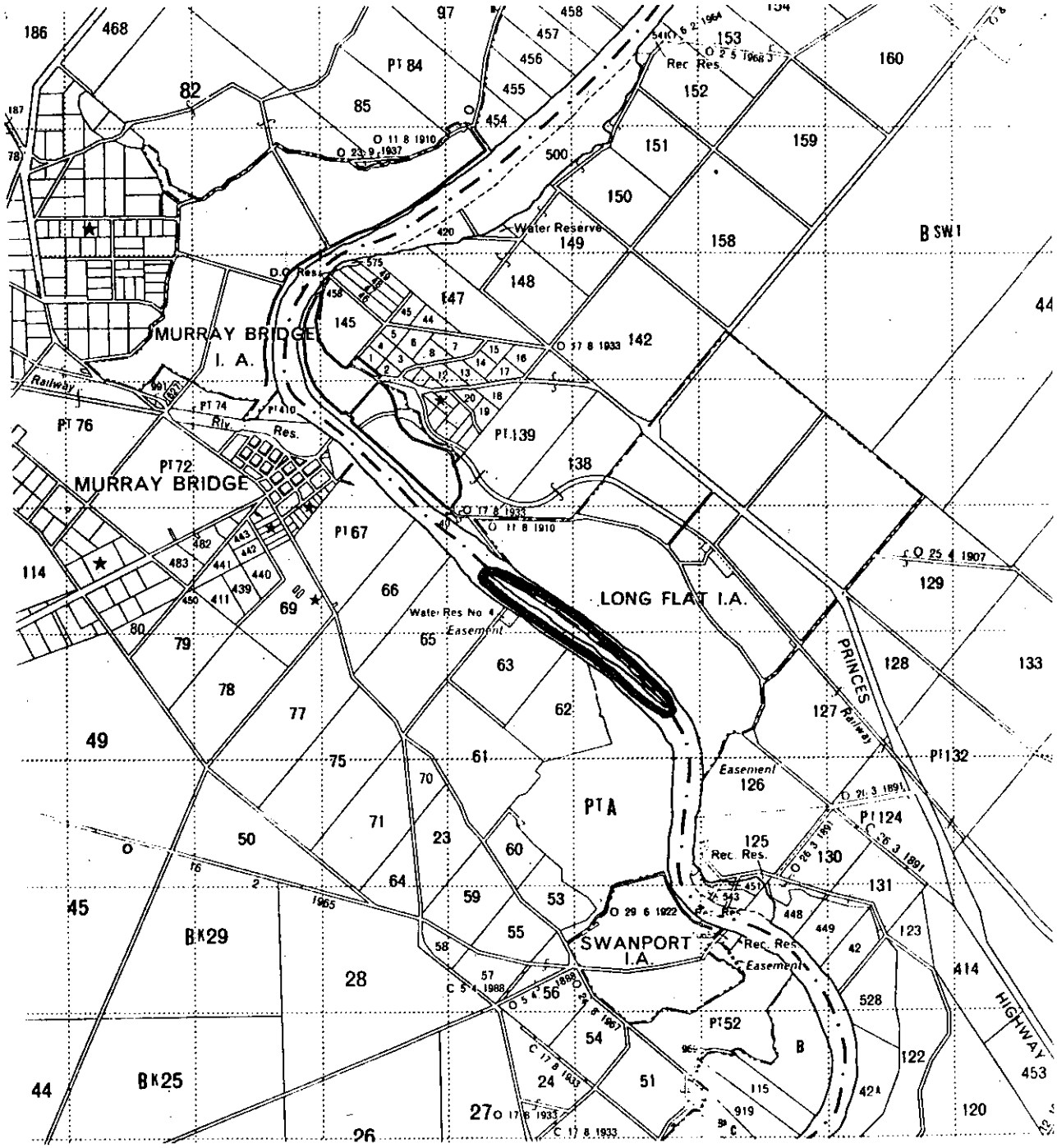
Figure 18.

Description - Long Island is located at Murray Bridge, and is a little more than 1 mile long. It is vegetated with River Red Gum and some River Box, plus reeds and herbaceous plants. There are a few Willow Trees present on the island as well.

Significance - The major natural use of the island is made by birds which feed and shelter amongst the trees and reeds. The vegetation of the island is representative of the water's edge and has been left reasonably untouched.

Proposal - Long Island should be acquired and declared a Conservation Park.

Management - Due to its limited size and thick vegetation, human access to and use of the island should be prevented. There are some human materials on the island (e.g. sheets of metal), and these should be removed.



BOUNDARY OF PROPOSED CONSERVATION AREA

Scale 1:50 000

Source : South Australian 1:50 000 Cadastral Series, Sheet 6727-I

FIGURE 18

Long Island

4.16 River Glades

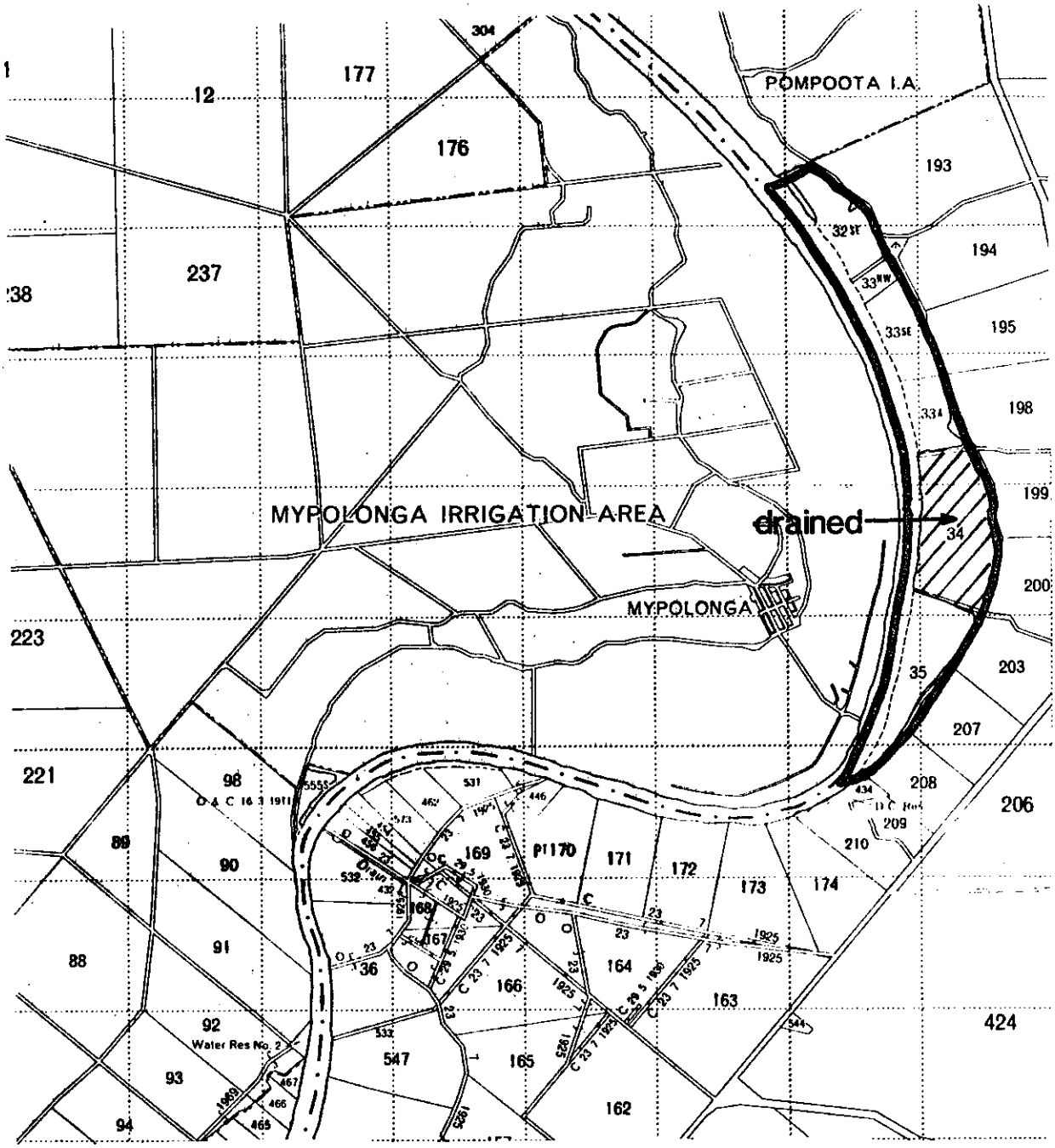
Figure 19.

Description - This is an isolated swamp of the River Valley just north of Murray Bridge. It is bordered to the east by cliffs and to the west by the River Murray. Reeds grow at the periphery and in the centre of the swamp.

Significance - Although small and limited, the River Glades are important by virtue of their locality. It will be recalled that the section of River between Wellington and Mannum has very few swamps left. Besides this, the River Glades support quite a large population of Swans, as well as other water birds. This swamp may also be of importance to fish breeding, though this is by no means established.

Proposal - The River Glades should be acquired and declared a Conservation Park.

Management - Since the swamp is limited, human access into the area should not be allowed.



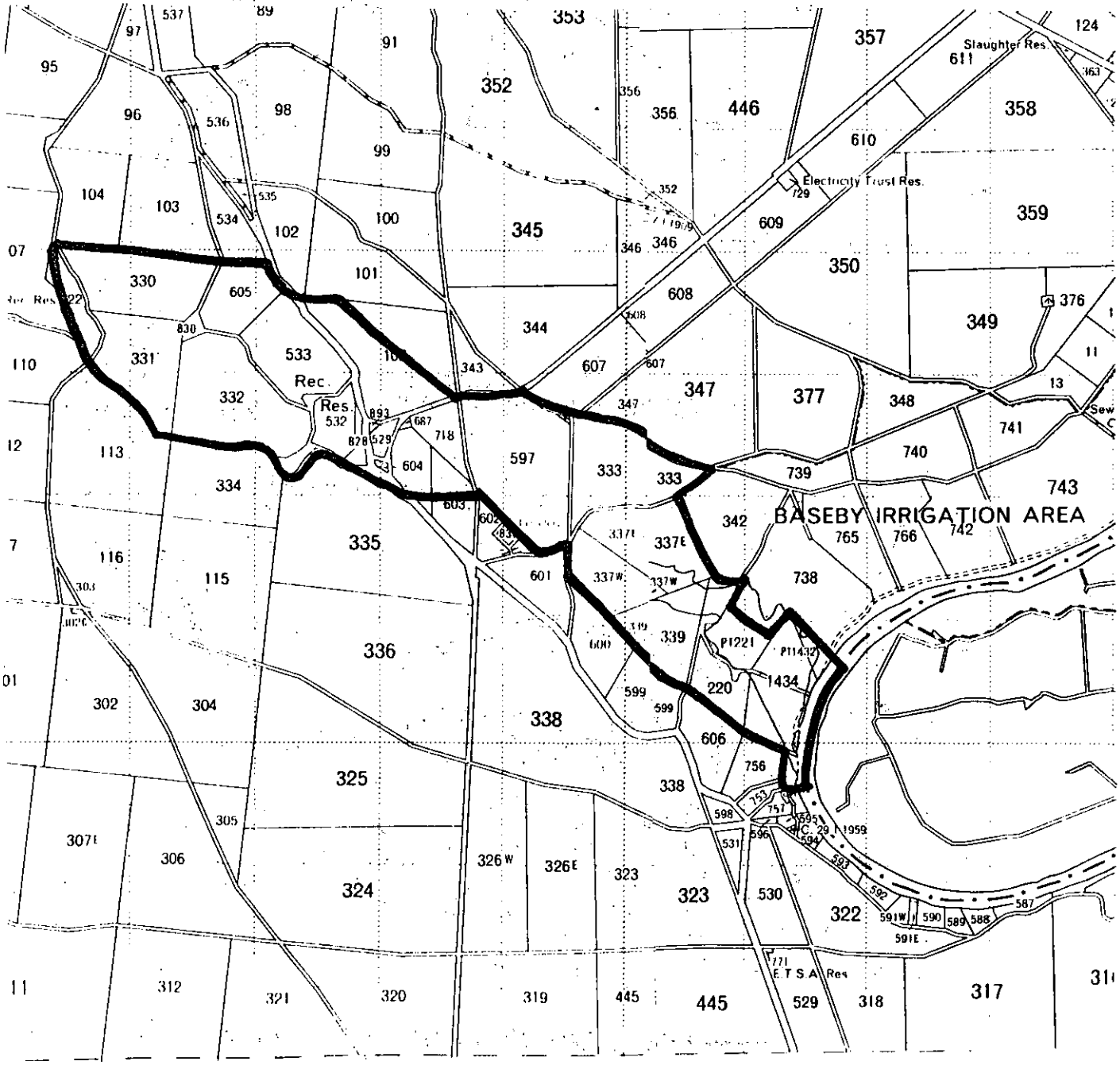
BOUNDARY OF PROPOSED CONSERVATION AREA

Scale 1:50 000

Source : South Australian 1:50 000 Cadastral Series, Sheet 6727-I

FIGURE 20

Sunnyside Swamp



BOUNDARY OF PROPOSED CONSERVATION AREA

Scale 1:50 000

Source : South Australian 1:50 000 Cadastral Series, Sheets 6728–II, III

FIGURE 21

'Peramangk'

4.18 "Peramangk" (Reedy Creek and Caloote Swamp)

Figure 21; Plate 7.

The name "Peramangk" is used for this area on the recommendation of R.I. Thomas (see Bibliography, Conservation section). The name is that of the Aboriginal tribe which inhabited this area.

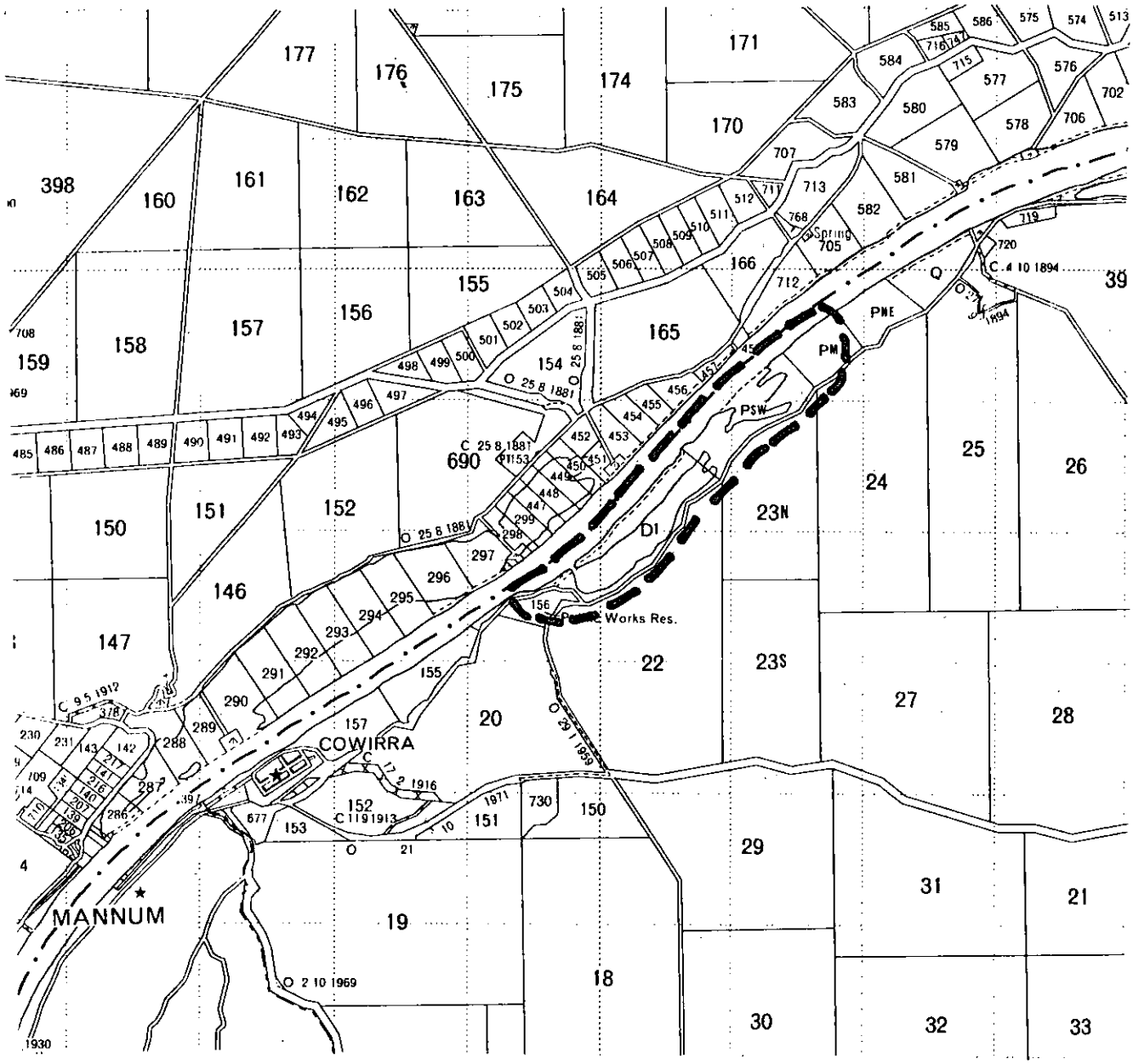
Description - The Peramangk area consists of two distinct area types - the Reedy Creek area, which is sparsely vegetated and is basically of geological interest, and the Caloote Swamp area, which consists of swamp and a small patch of scrubland.

Both areas have been heavily grazed in the past, and the vegetation has consequently suffered from this. The Reedy Creek area possesses very little undergrowth, and the wooded areas simply consist of limited stands of pine (Callitris spp.) and mallee (Eucalyptus spp.). The lack of surface vegetation at Reedy Creek has caused a significant amount of erosion. On the south-eastern edge of Caloote Swamp exists a small patch of scrub. The dominant species here are Acacia oswaldii, Pittosporum phillyreoides and Casuarina spp.

The main attributes of the Reedy Creek area are its scenic and geological properties. The area has been popular for sight-seeing and picnicking purposes for a number of years, the waterfalls being particularly attractive to visitors. The geology of the area is considered scientifically interesting and important.

The Caloote Swamp derives its importance as a habitat for birds. Clumps of reeds in the swamp provide shelter for Ducks and Water Hens. Amongst other species, the swamp supports Pelicans, Swans, Ibis, Herons, and Spoonbills, and these may be observed feeding at the swamp at most times.

Proposal - Peramangk, as defined in Figure 21, should be acquired and declared a Conservation Park. The Reedy Creek area should be continued as a predominantly recreational area, though access within this locality should be reduced, since the numerous tracks already present are constituting an erosion hazard. The Caloote Swamp locality should be reserved from general access. A look-out could be constructed on the cliffs overlooking the swamp, since adequate views of the area may be gained from here.



▬▬▬ APPROXIMATE BOUNDARY OF PROPOSED CONSERVATION AREA

Scale 1:50 000
Source : South Australian 1:50 000 Cadastral Series, Sheet 6728-II

FIGURE 22
Mannum Swamps

4.19 Mannum Swamps

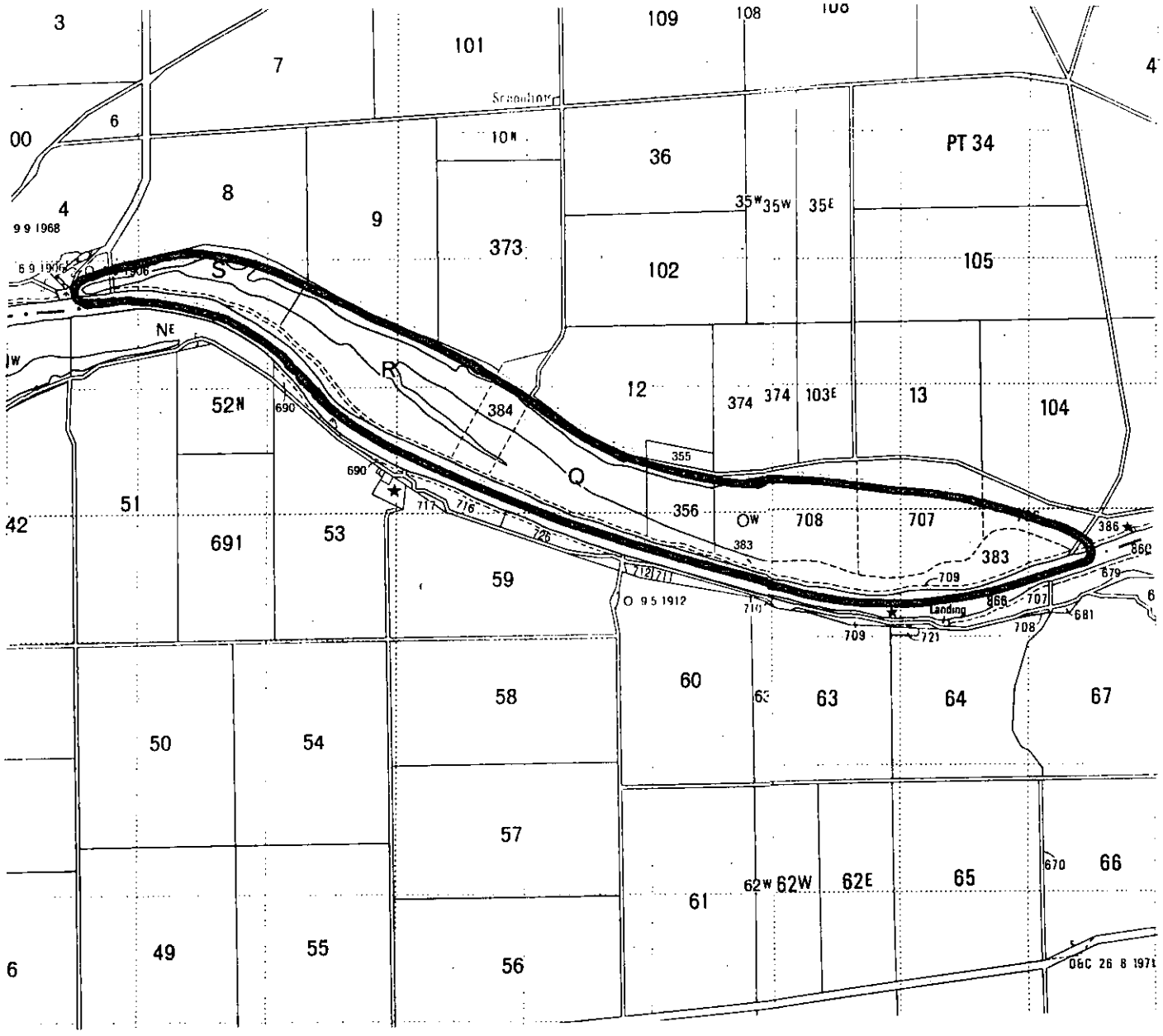
Figure 22; Plates 8a, 8b.

Description - These swamp areas are located in the River valley between Mannum and Lake Carlet. They border the eastern and southern boundary of the valley. The swamps appear shallow, and consist of reed islands and grassy flats. Both River Red Gum and River Box are found adjacent to the swamps. Some dead trees (probably River Red Gum) are present in the swamp area.

Significance - The Mannum Swamps are an excellent habitat for water birds, particularly Ducks, Swans and Coots. They are also the furthest downstream major swampland to be found in the River Valley until the Lakes, and are therefore important by virtue of their location.

Proposal - The Mannum Swamps should be acquired and declared a Conservation Park.

Management - A scenic drive route flanks the swamps for almost their whole length, so it is not necessary to assist in the presentation of the area. The public should not be allowed into the swamps either on foot or by boat. Speed boating should be kept well away from the swamps.



BOUNDARY OF PROPOSED CONSERVATION AREA

Scale 1:50 000
Source : South Australian 1:50 000 Cadastral Series, Sheets 6728-II, 6828-III

FIGURE 23
Lake Carlet Area

4.20 Lake Carlet Area

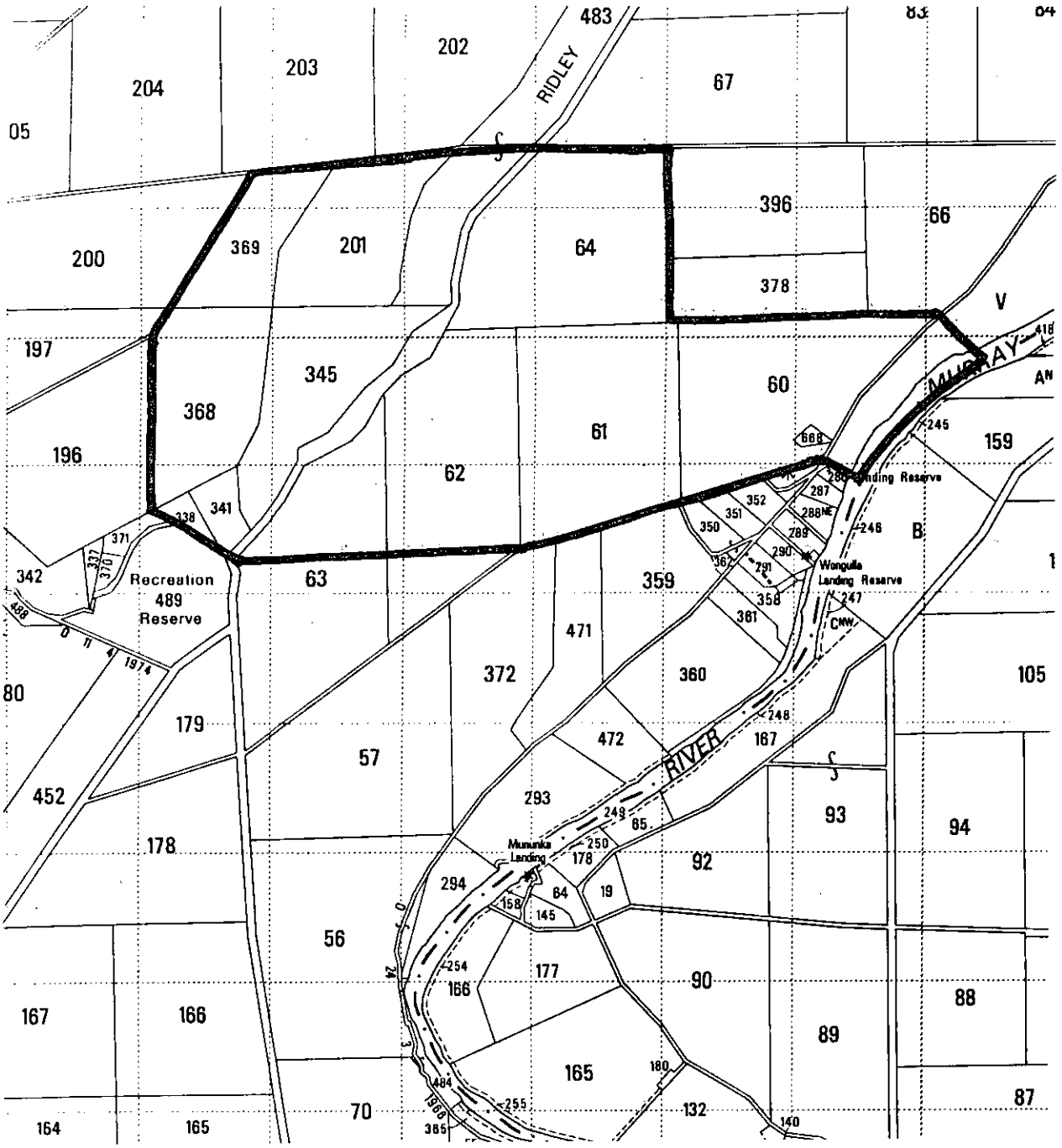
Figure 23.

Description - Lake Carlet is a relatively large expanse of water, very sparsely wooded at its edges, bordered to the north by steep cliffs and to the south by a narrow strip of land separating the lake from the River Murray.

Significance - The Lake supports populations of Swan and Ducks (e.g. Black Duck). It is probably important as an intermediate habitat between the upper and lower reaches of the Lower Murray.

Proposal - This area should be acquired and declared a Conservation Park.

Management - Scenic look-outs could be prepared along the cliff edge as extremely good views of the lake and the River Murray may be gained from here. There are some shacks present near the lake, but with co-operation from the shack owners to treat the environment with care, there should be no objection to their remaining in that locality. Rowing and canoeing could be allowed in the lake if it was assured in some way that this would not disturb the water birds unduly.



BOUNDARY OF PROPOSED CONSERVATION AREA

Scale 1:50 000
Source : South Australian 1:50 000 Cadastral Series, Sheet 6828-IV

FIGURE 24

Marne River Area

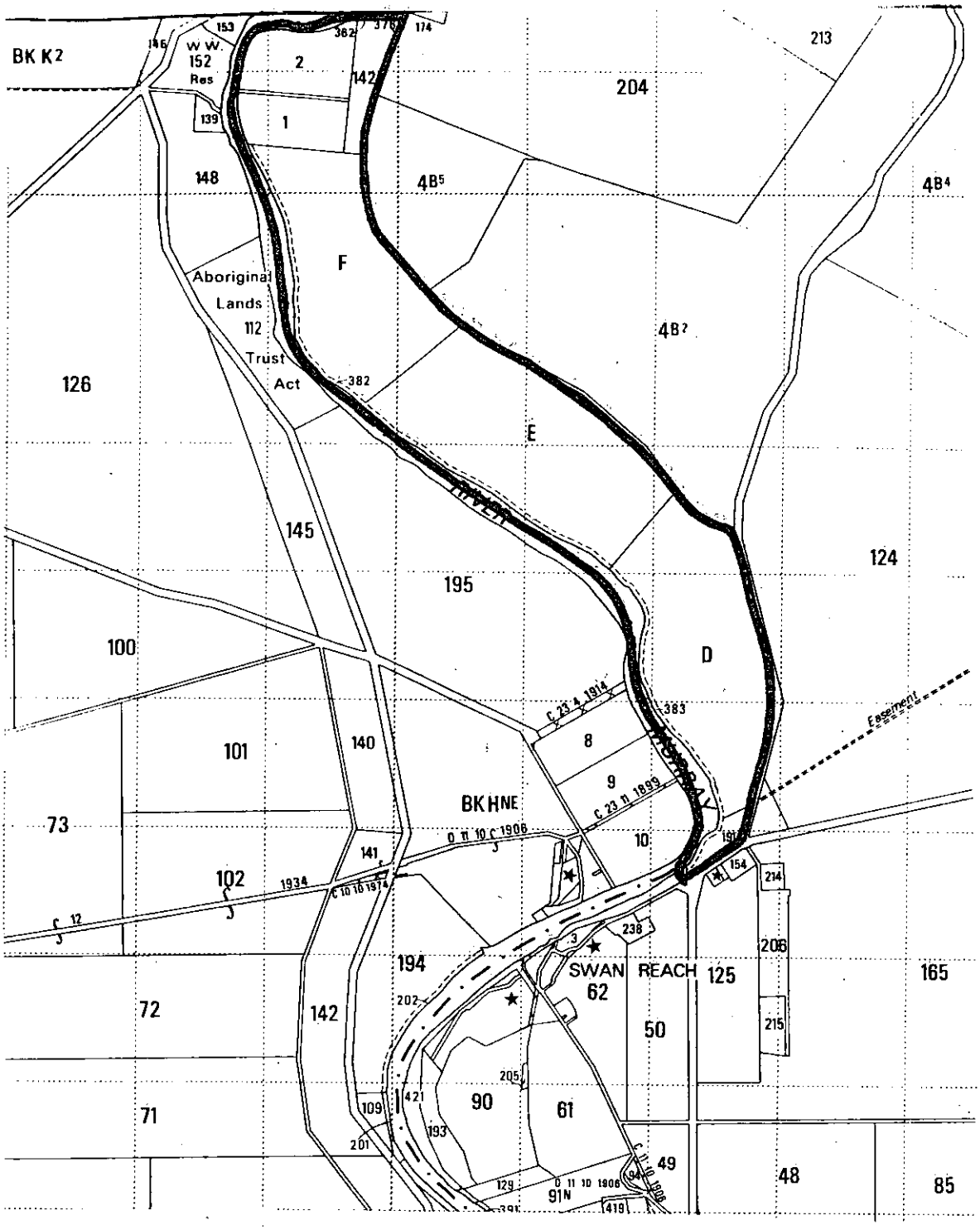
4.21 Marne River Area

Figure 24.

Description - The Marne River area consists of some swamp, but predominantly of mallee scrub and herbland. The scrub is situated in large patches within and around the borders of the Marne River Valley. Along the Marne itself may be found River Red Gums. No observations have been made with respect to what animal life resides in the area, but the presence of water and scrub suggests that a reasonably wide range of bird and mammal types would be found here. The gecko is known to inhabit areas near the Marne.

Significance - Besides its importance as a natural resource, the Marne River plays a particularly significant ecological role. It is virtually the only reasonably well watered watercourse which flows eastward into the River Murray. As the Murray is a connection between eastern Australia and mid-southern Australia, the Marne forms a link between the Mt. Lofty Ranges and the River Murray. This fact has been found to be scientifically interesting. A Ph.D. student, Mr. Dale Roberts, at the Department of Zoology, Adelaide University, in 1974, conducted research on a frog species found along the River Marne. He has defined subspecies of the frog Lymnodynastes tasmaniensis based on the difference in their call structures. In the Marne region near the Murray a hybrid form of these subspecies has been produced. Presumably then, individuals of this species which inhabited localities away from the Murray and those which lived at the Murray, have evolved in such a way that their calls are different. It is near the mouth of the Marne that there is an overlap in the distribution of the subspecies, and hence hybrids of the subspecies occur.

Proposal - In view of its scientific and biological importance, the Marne River area should be acquired and declared a Conservation Park. The Ridley Reserve (set aside mainly for wombats) runs into the proposed Park area, and could therefore be amalgamated with the Marne area. Part of the Marne area could be used for bushwalking, but it should be noted that the scrubland is scenically uninteresting, and in any case, is relatively limited.



BOUNDARY OF PROPOSED CONSERVATION AREA

Scale 1:50 000
Source : South Australian 1:50 000 Cadastral Series, Sheet 6828-IV

FIGURE 25

Swan Reach Lagoons

4.22 Swan Reach Lagoons

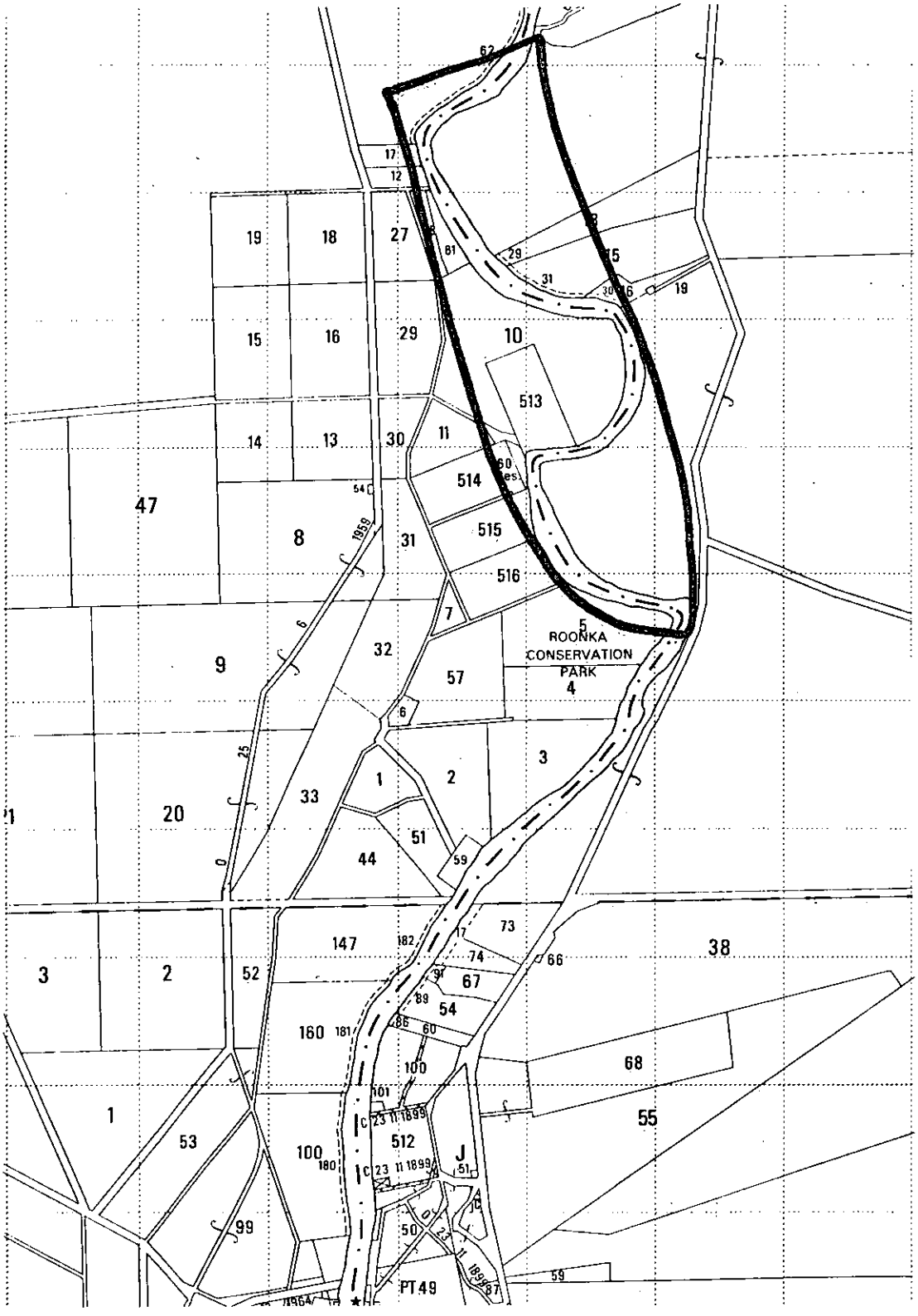
Figure 25.

Description - This is a particularly attractive area bounded to the east by cliffs and to the west by the River Murray. It consists of numerous lagoons and small streams. The vegetation is typically riverine, that is River Red Gum and River Box.

Significance - This area's main attribute is its bird life. Swans and Ducks may be commonly found in the area, and White Cockatoos and Galahs are usually seen in large numbers. The Cockatoos make their nests in the cliffs bordering the lagoons. The Swan Reach Lagoons may also be important to fish breeding since the area consists of a number of islands and flats.

Proposal - This area should be acquired and declared a Conservation Park.

Management - Human activity in the lagoons area should be kept at a minimum. Motor boating along the River past the lagoons should be restricted in speed and nearness to the lagoons.



BOUNDARY OF PROPOSED CONSERVATION AREA

Scale 1:50 000
Source : South Australian 1:50 000 Cadastral Series, Sheet 6829-III

FIGURE 26
Reedy Island Area

4.23 "Blanchetown Island"

Description - As far as can be ascertained, this island has no name. The island is a small area of high land immediately adjacent to the eastern cliffs of the Murray. It is located just south of Blanchetown. The vegetation is predominantly River Red Gum.

Significance - Being an island only accessible by boat, the island is in a more or less untouched state. Its vegetation provides shelter for a number of birds.

Proposal - The island should be acquired and declared a Conservation Park.

Management - Human access onto the island should not be allowed since it is so limited in size.

4.24 Reedy Island Area

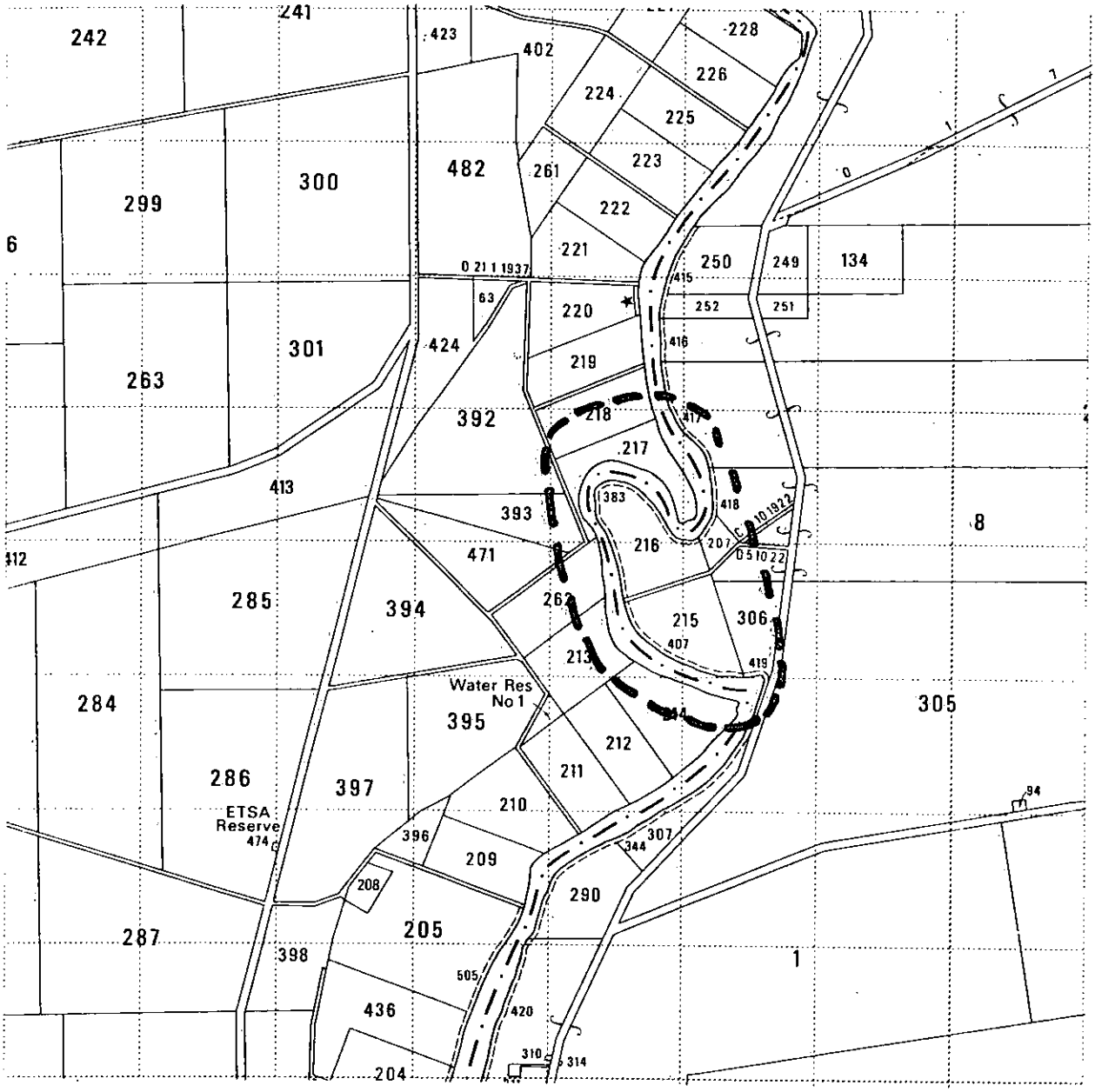
Figure 26; Plate 9a, 9b, 9c.

Description - The Reedy Island Area consists of swamps and lagoons. It is located just north of Blanchetown and involves Donald Flat Lagoon, Sinclair Flat, Reedy Island, McBeans Pound and Roonka Flat. The vegetation consists of River Red Gum, reeds, grasses and some shrubs on higher land. On the east it is bordered by cliffs, and on the west by the River Murray.

Significance - The area supports quite a number of water birds. It may also be important to fish breeding. McBeans Pound involves a particularly important archaeological site.

Proposal - The Reedy Island area should be acquired and declared a Conservation Site.

Management - Human use of this area should be limited to canoeing and rowing. Access on foot should not be allowed. Good views of the area may be gained from the Murbko Road on the eastern bank of the River Valley, and look-outs could therefore be constructed along this road.



▬▬▬ APPROXIMATE BOUNDARY OF PROPOSED CONSERVATION AREA

Scale 1:50 000
Source : South Australian 1:50 000 Cadastral Series, Sheet 6829-IV

FIGURE 27
Wombat Rest

4.25 Wombat Rest

Figure 27; Plate 10.

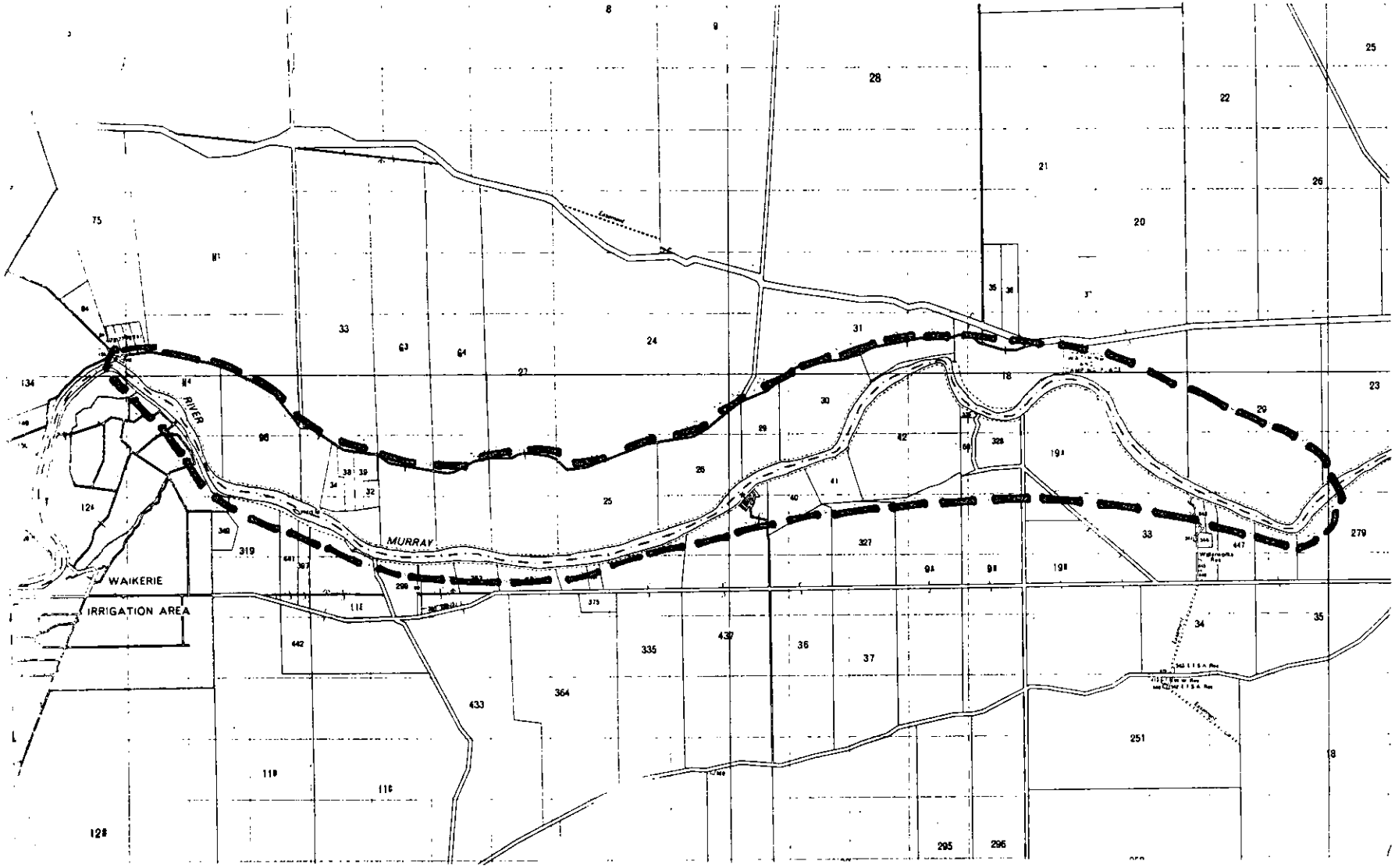
Description - This is structurally similar to the Reedy Island Area. It consists of swamp and lagoons, and is vegetated by River Red Gum, some River Box, reeds and grasses.

Significance - Wombat Rest supports numerous birds, particularly Galahs and Cockatoos which may be seen perched in the River Red Gums. A number of flats are also involved in the area, and it may therefore rate some importance to fish breeding.

Proposal - The Reedy Island Area and Wombat Rest are similar areas, however, Reedy Island is the more important of the two, particularly in view of that area's archaeological importance. Both areas need not be acquired, but Wombat Rest is proposed as an alternative to the Reedy Island Area should something prevent the latter area from being acquired.

Management - What is said in reference to the Reedy Island Area applies equally here.

FIGURE 28
Island Reach



APPROXIMATE BOUNDARY OF PROPOSED CONSERVATION AREA

Scale 1:100 000

Source : South Australian 1:100 000 Cadastral Series, Sheet 6929

4.26 Island Reach

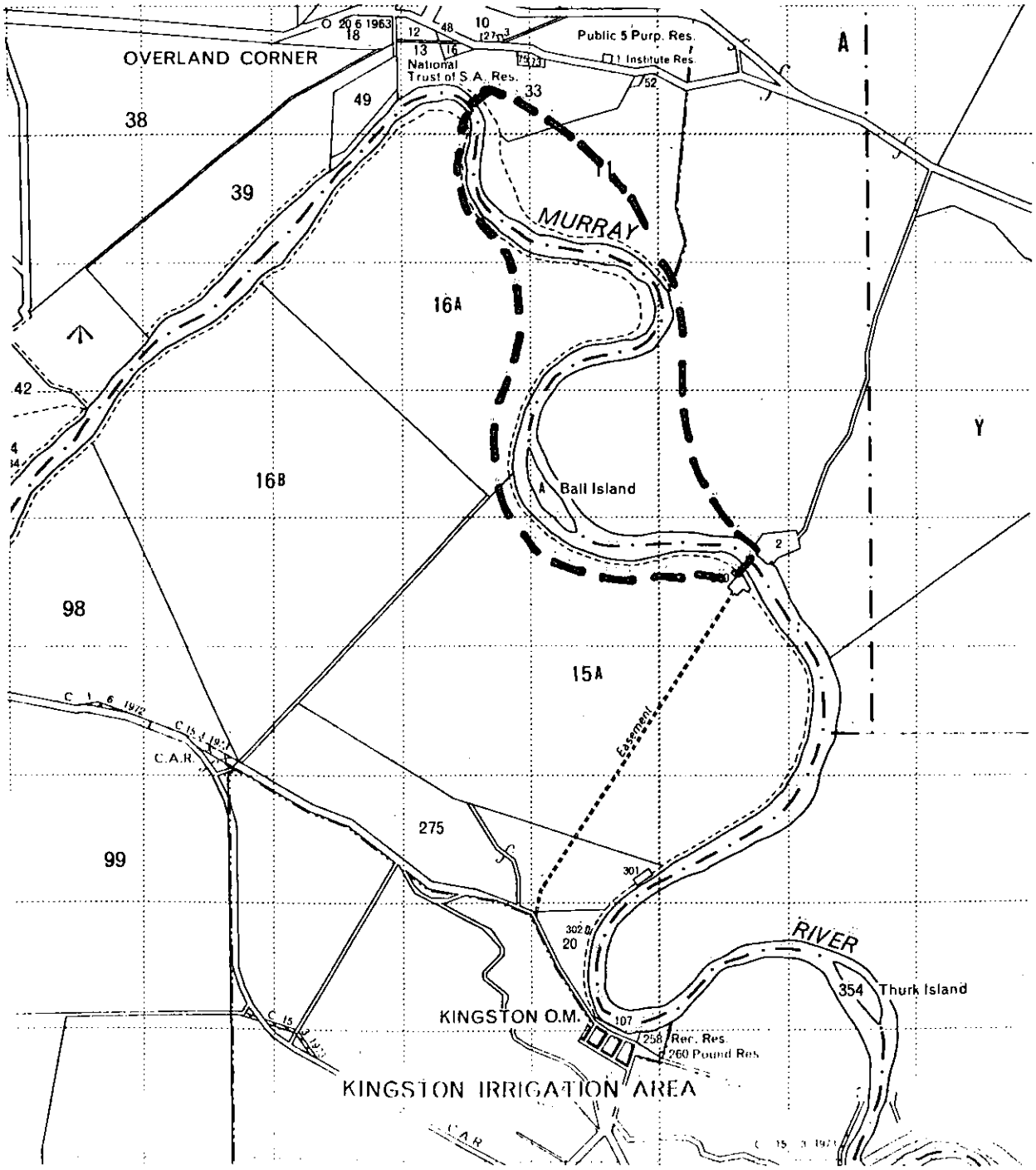
Figure 28; Plates 11a, 11b, 11c.

Description - This is a reasonably well-wooded stretch of River consisting of numerous small islands and flats. The vegetation is predominantly River Red Gum, River Box, Lignum and reeds. Cliffs define the northern and southern boundaries of the area.

Significance - The presence of islands and flats make it possible that fish breeding occurs here. Cockatoos may be found in large numbers, and Swans, Coots and Ducks may also be seen.

Proposal - This area should be acquired and declared a Conservation Park.

Management - The scenic route on top of the northern cliffs afford extremely good views of the area, and look-outs should therefore be prepared here. Boating through the area should be restricted in speed and proximity to islands and the shoreline.



APPROXIMATE BOUNDARY OF PROPOSED CONSERVATION AREA

Scale 1:50 000
Source : South Australian 1:50 000 Cadastral Series, Sheet 6929–I

FIGURE 29
Overland Corner

4.27 Overland Corner

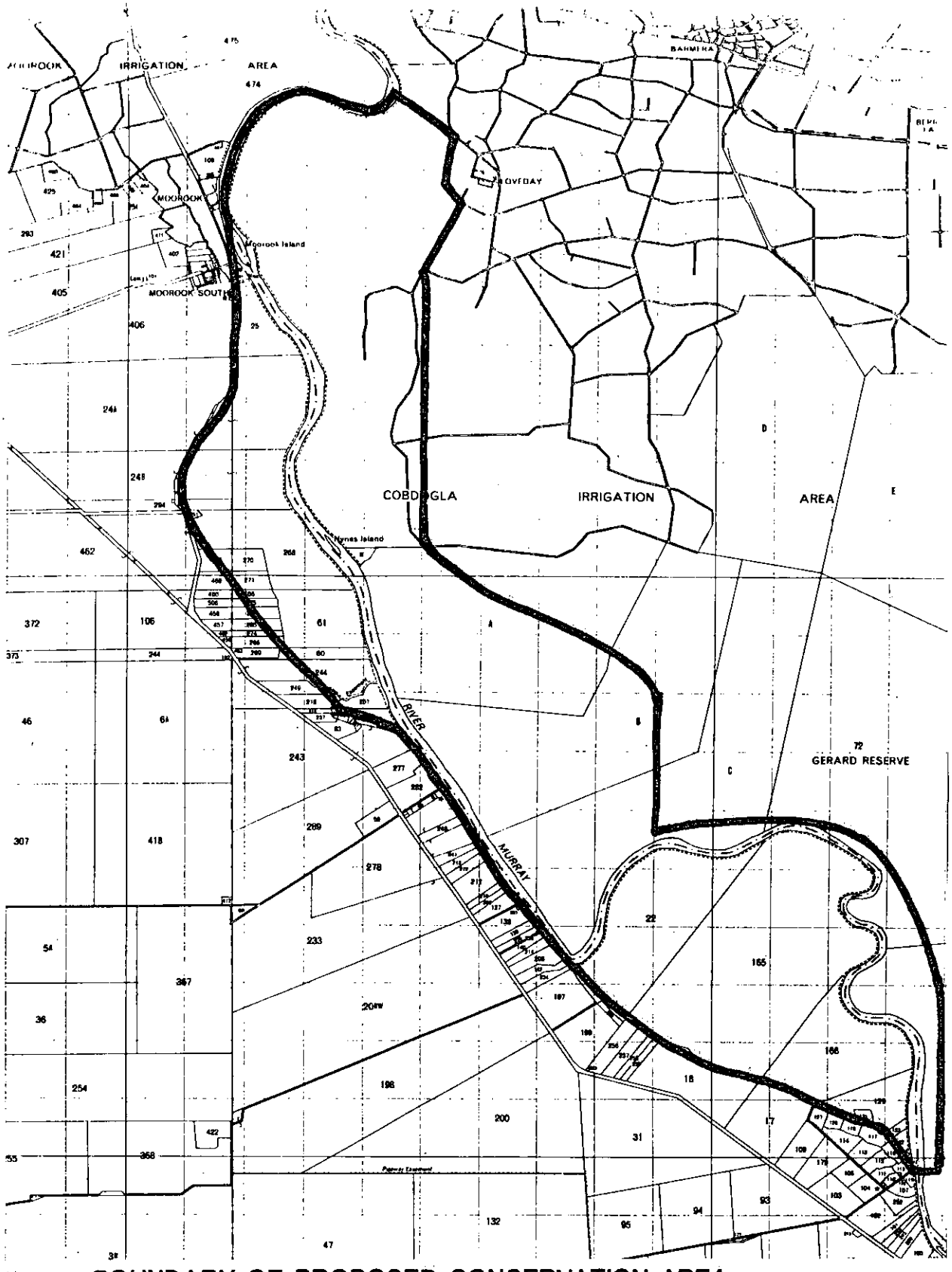
Figure 29.

Description - This area is located immediately downstream from a weir. It involves some islands and a number of flats. River Red Gums, River Box, Lignum and grasses grow on the banks of the River in this area.

Significance - It will be recalled that the waters downstream from weirs are considered to be in a more natural state than those upstream from weirs. Variation in water levels is more pronounced and frequent, and therefore such an environment may be conducive to fish breeding. The Overland Corner area is also frequented by numerous bird species. A hotel at Overland Corner is of historical importance.

Proposal - This area should be acquired and declared a Conservation Park.

Management - Motor boating through this area should be restricted in speed and in closeness to the River banks. Canoeing and rowing however, should be permitted. The restoration of the Overland Hotel should also be completed.



BOUNDARY OF PROPOSED CONSERVATION AREA

Scale 1:100 000
Source : South Australian 1:100 000 Cadastral Series, Sheet 6929

FIGURE 30

Moorook Complex

4.28 Moorook Complex

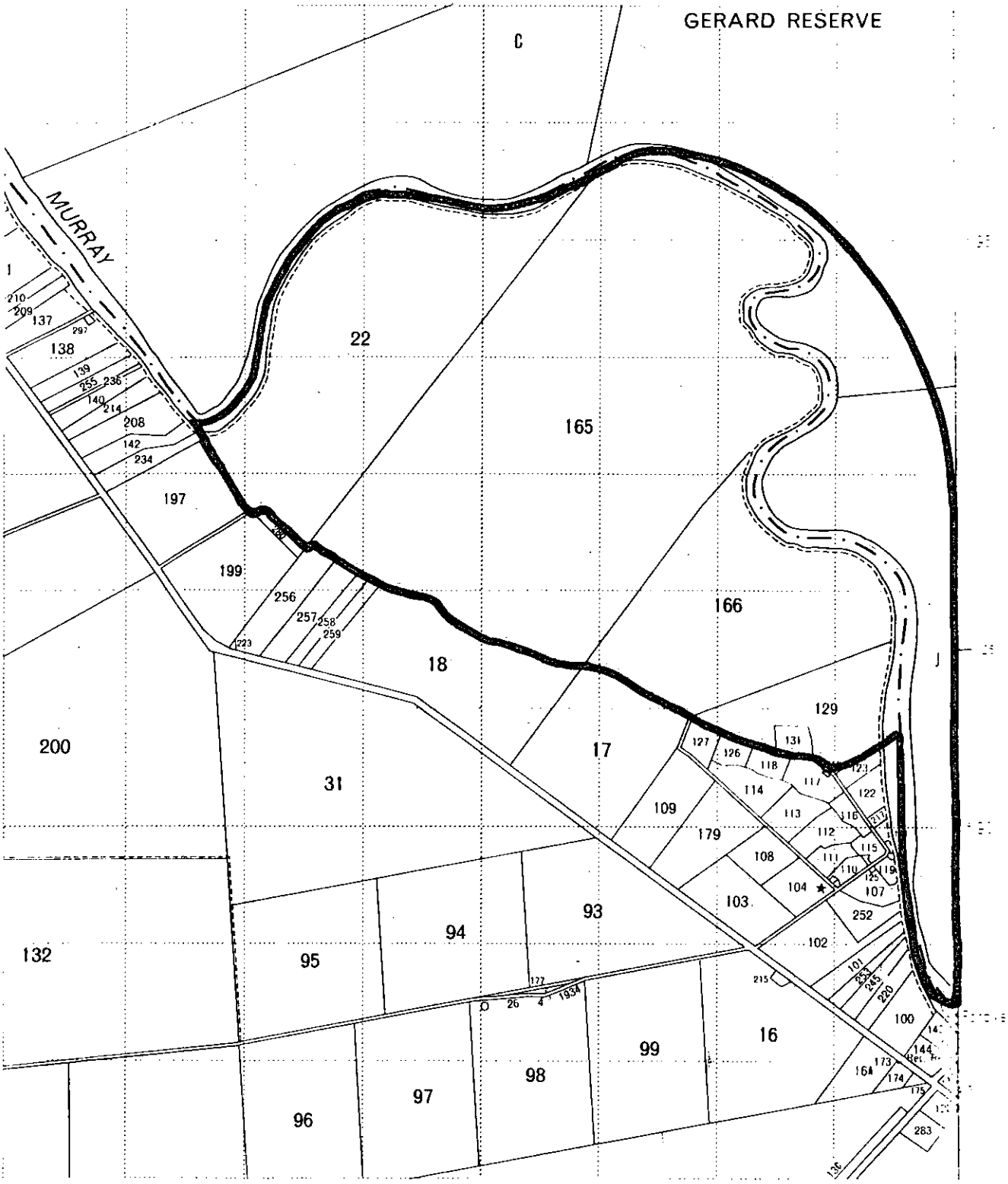
Figure 30; Plates 12a, 12b, 12c.

Description - Basically, the Moorook complex involves most of the flood plain from just north of Moorook Island to the Spectacle Lakes. Numerous flats and lagoons are present in the area. The vegetation consists largely of River Red Gum found on the banks of the River and on Moorook and Nynes Islands. The River Box, reeds and grasses are also present.

Significance - Particular areas of the Moorook Complex are probably of importance to fish breeding. Being well wooded in parts, the Complex may also provide habitat for possums and particular species of birds (e.g. Wedge-tailed eagle Aquila audax audax). Water birds may frequently be seen amongst the aquatic vegetation on the banks of the River or at the shore of islands.

Proposal - The Moorook Complex should be acquired and declared a Conservation Park.

Management - Since this is such a large area, a few short trails could be constructed in a particular section of the complex (e.g. around the Spectacle Lakes). Information, refreshment and picnicking facilities could be constructed on the high land overlooking the Lakes. Elsewhere in the complex, bushwalking should be disallowed. A particular area in which canoeing and rowing is allowed could also be defined, perhaps on the Spectacle Lakes themselves.



BOUNDARY OF PROPOSED CONSERVATION AREA

Scale 1:50 000
Source: South Australian 1:50 000 Cadastral Series, Sheet 6929-II

FIGURE 31

Pyap Lagoon Area

4.29 Pyap Lagoon Area

Figure 31; Plates 13a, 13b, 13c.

Description - The Pyap Lagoon Area is a naturally well defined region of the flood plain. It is bordered by cliffs to the east, the River Murray to the north and west, and Pyap Lagoon and high land to the south. Pyap Lagoon is the only major body fo water in the area, however the whole site is transected by small streams. Along these streams grow River Red Gums, while the intervening land is mainly covered by River Box and Lignum.

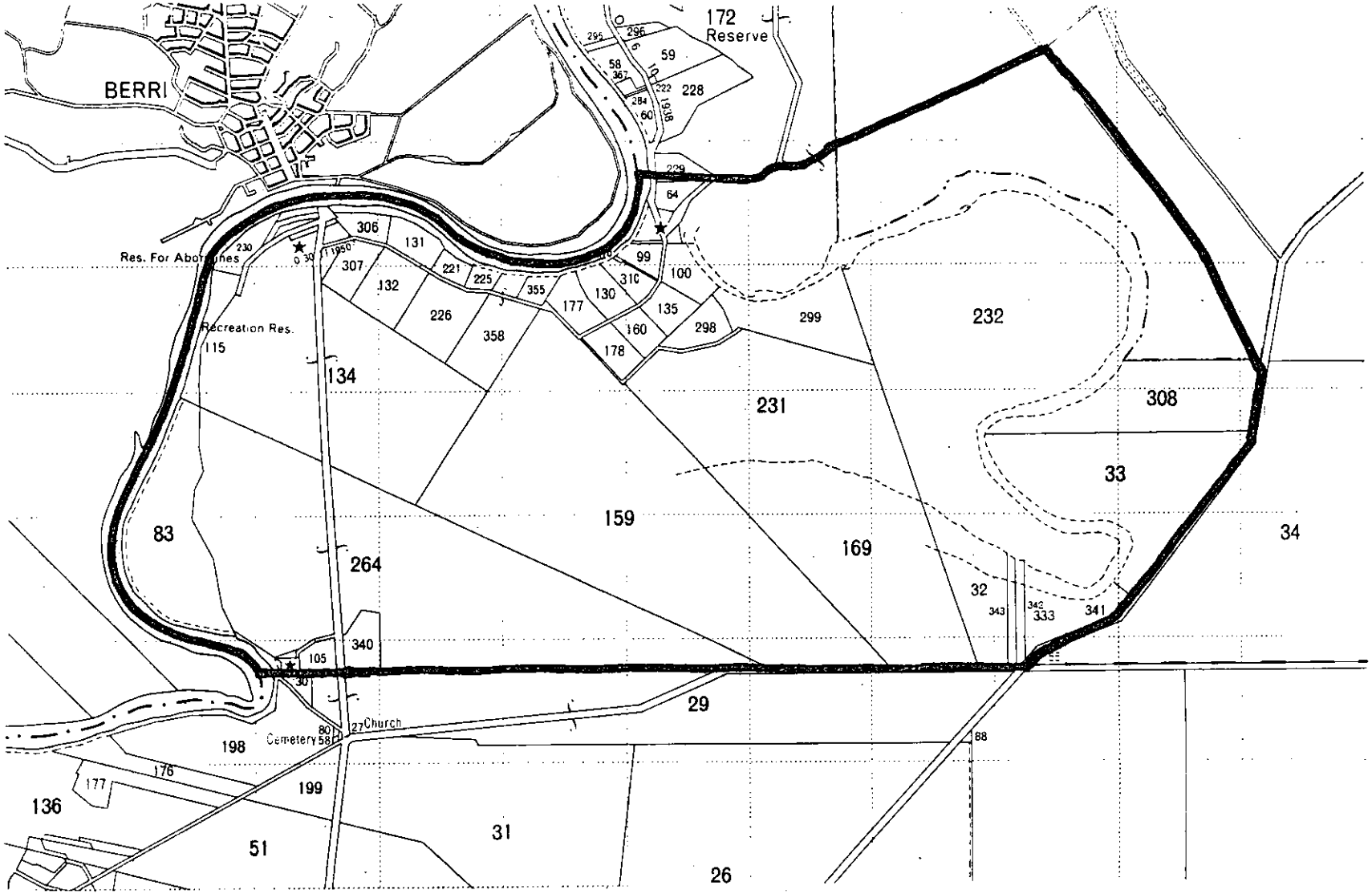
Significance - It is likely that fish breeding would occur in Pyap Lagoon at times of flooding, since the land immediately adjacent to the lagoon is quite flat. The proposed area in a general sense supplies habitat for tree and water nesting birds, possums, rats and undoubtedly a number of other animal species.

Proposal - The Pyap Lagoon Area should be acquired and declared a Conservation Park.

Management - Trails could be constructed through a section of the proposed area, but maintenance of these trails would probably be difficult due to the periodic flooding of the area. Canoeing and low speed boating could be allowed around the periphery of the area (i.e. in the River itself), but it may be unwise to allow any human activity in Pyap Lagoon. This may disturb the water birds there, and if fish breeding does occur in the lagoon, the public may inadvertently disturb this process if present at the time of spawning. Research into this could clarify the situation.

FIGURE 32

Gurra Gurra Lakes Area



BOUNDARY OF PROPOSED CONSERVATION AREA

Scale 1:50 000

Source : South Australian 1:50 000 Cadastral Series, Sheet 7029–III

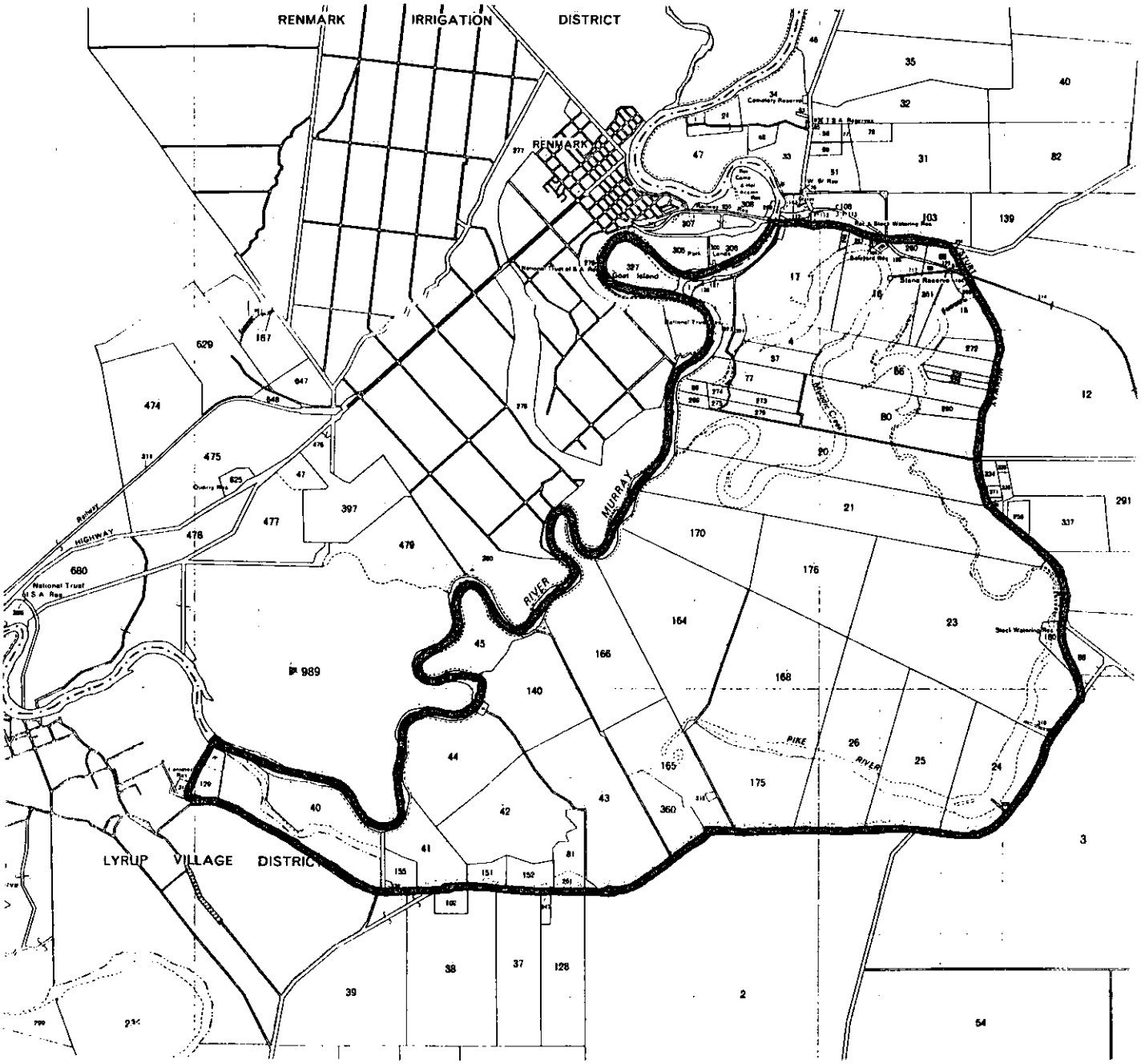
4.30 Gurra Gurra Lakes Area

Figure 32; Plates 14a, 14b, 14c.

Description - The Gurra Gurra Lakes Area is predominantly swampy, and vegetated by River Red Gum (many of which are dead) and River Box. It is totally confined to the River Valley, and is bordered by the River Murray to the west.

Significance - This area is extremely good habitat for water birds, particularly Duck species. It also probably supports a number of mammal species, and may well be important for the breeding of fish.

Proposal - The Gurra Gurra Lakes Area should be acquired. Rather than declaring it a Conservation Park, it is suggested that this area become a Game Reserve. This could be done in conjunction with a northward extension of the Katarapko Game Reserve, forming an extensive hunting complex.



BOUNDARY OF PROPOSED CONSERVATION AREA

Scale 1:100 000
Source : South Australian 1:100 000 Cadastral Series, Sheet 7029

FIGURE 33
Pike River Area

4.31 Pike River Basin

Figure 33; Plates 15a, 15b, 15c.

Description - The Pike River Basin is bounded to the east and south by cliffs, and to the west by the River Murray. It includes Goat Island, at present a National Trust Reserve. The area is intersected by numerous small creeks, and like the Gurra Gurra Lakes Area, is predominantly swampy. The vegetation consists basically of River Red Gum, River Box and Lignum.

Significance - The faunistic make-up of this area is similar to the Gurra Gurra Lakes. The Pike area is probably more important for fish breeding than Gurra Gurra, since it lies immediately downstream from Lock 5. This has the effect of allowing water levels to fluctuate more freely and noticeably, an ideal situation for fish breeding.

Proposal - The Pike River Basin Area should be acquired and declared a Conservation Park. If possible, this should be done in conjunction with the proposals for the Gurra Gurra Area. A situation similar to the Mosquito and Tolderol Points Area would then result, in that an area for conservation would exist adjacent to a Game Reserve.

Management - Since the Pike River Basin is so extensive, canoeing should be allowed in at least part of the area. There are a number of ideal locations at the top of the cliffs surrounding the Basin where look-outs could be constructed. Motor boating should not be permitted within the Basin.

4.32 Lake Woolpolool

Figure 34.

Description - At present, this is an unproductive, dry lake. The surface is badly salted and supports little vegetation. It was originally used for crop growing. But due to the salt surface, is no longer suitable for this purpose. The inflow of water is prevented by a levee bank constructed across the feeder creek.

Significance - If the levee bank were to be removed, a large open space of water would result. The vegetation would probably take a long time to revert to its natural state, but some birds would certainly use the lake during its early regeneration. Eventually, a valuable water bird habitat could result.[1]

Proposal - Lake Woolpolool should be acquired and declared a Conservation Park.

Management - Once the levee bank was removed, the regeneration of the lake should be monitored and assisted if necessary.

4.33 Lakes Merreti and Clover

Figure 34.

Description - Both lakes are freshwater and are well vegetated at their banks by River Red Gum and River Box. The water level in these lakes is largely constant due to the presence of Lock 5.

Significance - This area is reported to be rich in bird life. There is evidence of Aboriginal camp-sites in the sand dunes to the east of Lake Merreti.

Previous to the construction of Lock 5, these lakes were probably important fish breeding sites, since water levels would have fluctuated throughout the year. It has been suggested that artificial flooding and draining, if feasible, could allow fish breeding to occur once more in these lakes. This matter could be investigated further.

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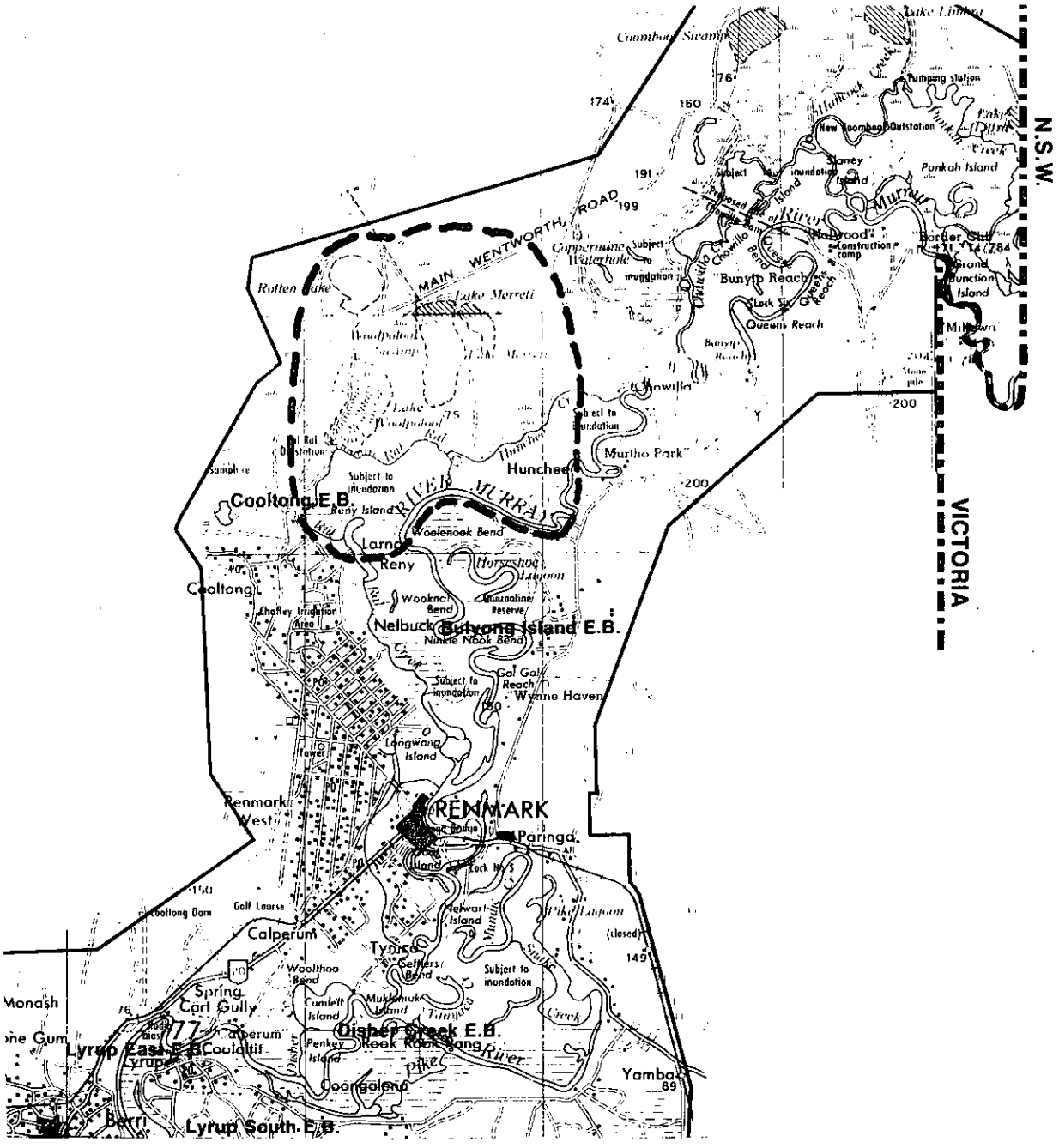
[1] Note that such action would result in a major saline inflow, at least initially, to Ral Ral Creek, and hence to the Chaffey Irrigation Pumping Station intake.



▬▬▬ APPROXIMATE BOUNDARY OF PROPOSED CONSERVATION AREA

Scale 1:250 000

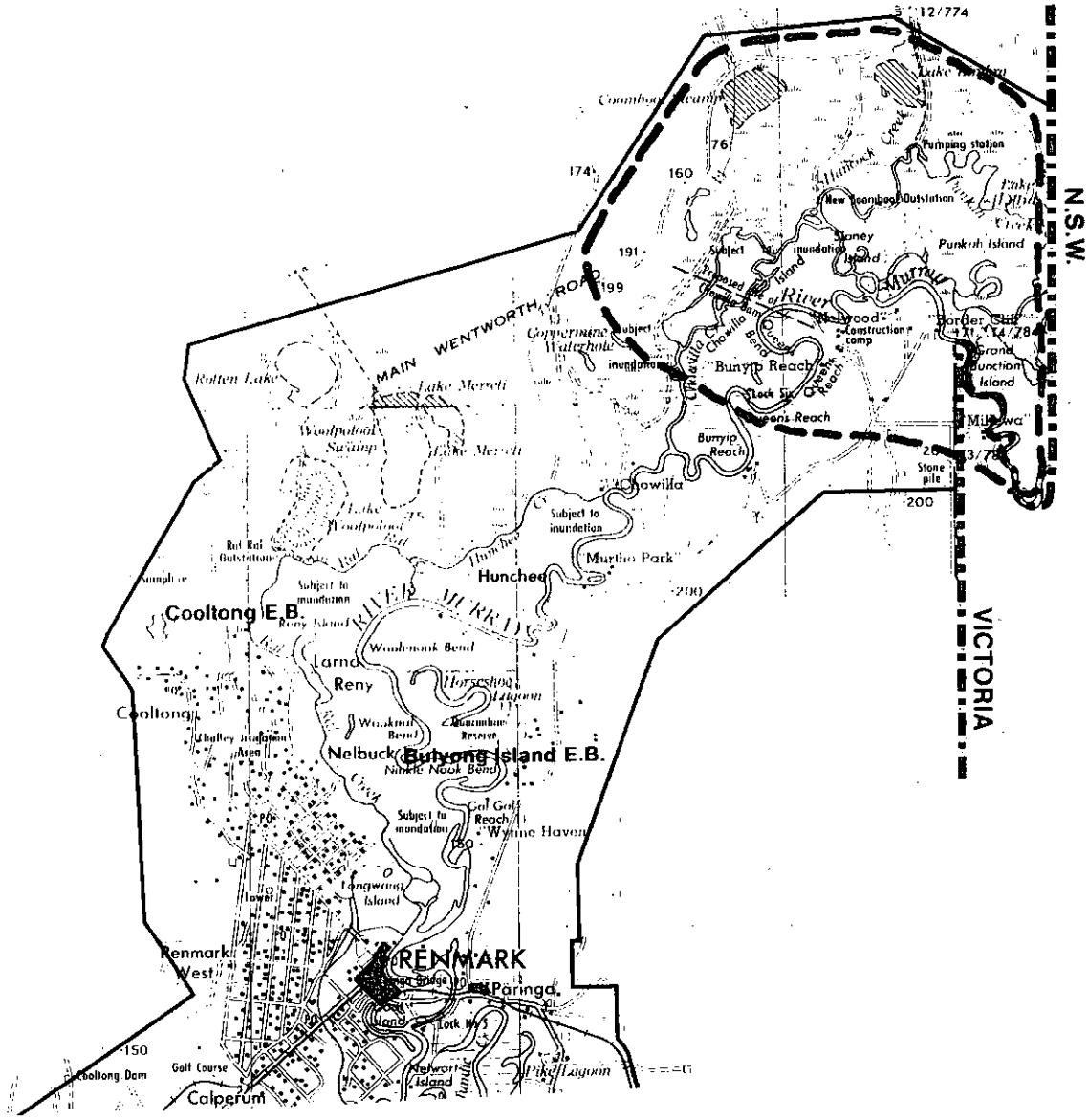
Source : Murray Valley Planning Study, S.A. State Planning Authority. 1978. Map 9-1.

FIGURE 34

Lakes Woolpolool, Merreti and Clover

Proposal - Lakes Merreti and Clover should be acquired and declared a Conservation Park.

Management - Canoeing and rowing could be allowed in the lakes, but motor boating should be prohibited. Human access within the area should be limited to particular localities so that no widespread damage of foliage, eggs, Aboriginal camp-sites, etc. can occur.



▬▬▬ APPROXIMATE BOUNDARY OF PROPOSED CONSERVATION AREA

Scale 1:250 000

Source : Murray Valley Planning Study, S.A. State Planning Authority. 1978. Map 9–1.

FIGURE 35

Chowilla

4.34 Chowilla

Figure 35.

Description - In relation to the other sites, Chowilla has been the focus of a lot of attention. There is a considerable amount of literature on the area, the two most useful sources being the Adelaide University Adult Education Summer School Report of 1966, and No. 34 of the Memoirs of the National Museum of Victoria.

The quantity of information is too great to repeat here, but the literature shows clearly that Chowilla is an area of diverse bird life, and supports a large and diverse population of mammals. The vegetation of the area is extensive, and contains a number of different plant associations, e.g. mallee scrub, bluebush and saltbush associations, sheoak associations and the riverine vegetation.

Significance - The diversity of life in the Chowilla area makes its conservation a highly desirable aim. The range of habitats is great, and fish breeding probably occurs at a number of locations.

Proposal - The Chowilla area should be declared a Conservation Park. Land to the west of Chowilla station and a strip of land on the southern bank of the Murray (opposite Chowilla) should also be acquired to extend the proposed reserve.

Management - Trails should be constructed in a localised section of the proposed area, involving picnicking and recreation facilities. There are a number of locations on the southern bank of the Murray from which excellent views of the Chowilla area may be gained across the River. Look-outs could be constructed at these localities.

4.35 Additional Notes

4.35.1 Amalgamation of proposed sites

A list of 33 separate sites has been given. Some of these sites are close enough to each other to be amalgamated into larger areas. From the point of view of managing areas of conservation, it is much simpler to have one large Park rather than three or four smaller ones. For example, if three separate Conservation Parks were managed by one team of rangers, one of two systems could be used. Either each Park has a resident ranger, or all activities are conducted from one central station. In the former instance, an unnecessary expenditure of money is required to equip each Park. In the latter instance, problems will arise with respect to mobility between Parks. The land separating the Parks would probably be used for some sort of private enterprise, and this may cause difficulties in gaining quick access between Parks.

If however the land between the Parks was also required, hence creating one large Conservation Park, access to different areas of the larger Park would be made quite simple. Access roads could be constructed to suit the needs of the rangers. This would allow the most economical use of the management's time and resources.

With the above in mind, four amalgamations of proposed conservation sites are listed below.

- Chowilla - Lakes Merreti & Clover - Lake Woolpolool - Pike River Basin.

- Gurra Gurra Lakes Area - Katarapko Game Reserve - northward extensions of Katarapko Game Reserve to form a Game Reserve complex.

- Pyap Lagoon Area - Moorook Complex - Overland Corner.

- Murray Mouth Region - Yalkuri Sanctuary - Cooronga Scrub - Coorong National Park.

Site No.	Site Name
2	Waltowa Swamp
3	Narrung Narrows
5	Alexandrina Swamps
6	Moxquito and Tolderol Points
9	Finnis Complex
11	Murray Mouth Region
1	Yalkuri Sanctuary amalgamation
8	Cooronga Scrub
17	"Peramangk"
20	Marne River Region
28	Pyap Lagoon Area
29	Gurra Gurra Lakes Area (and Katarapko extensions)
30	Pike River Basin
31	Lake Woolpolool
32	Lakes Merreti and Clover amalgamation
33	Chowilla

TABLE 5. Sites with High Priority for Acquisition for Conservation.

4.35.2 Categorisation of and Proposals for Conservation Sites

Throughout this report it has been proposed to acquire and declare as Conservation Parks the various conservation sites. From a practical point of view, all the proposed sites could not be acquired, even after possibly many years. Hence, what is required is some sort of priority listing of sites.

To this end, a very simple priority system is employed. All of the proposed areas have been divided into two categories. One consists of those sites around which there is no reasonable doubt that they should be acquired. The other category consists of the rest of the sites, which are either less important than those in the first group, or over which there is some doubt as to their worth as areas of conservation. The areas involved in this second category need not be acquired immediately, but should be investigated further to determine finally whether they merit acquisition. In the meantime, these areas should still be protected in every way possible.

Table 5 gives a preliminary list of first category sites. The list should only be treated as a guide-line, and may be added to or subtracted from as evidence demands.

The problem in devising priority scales is the lack of detailed information on each site. Before this information is gathered we can only deal in generalities. What should be done is to treat the whole River Murray as a possible area of conservation. The length of the River should then be surveyed in a similar way as this report attempts, except in much more detail and with much more diversified manpower. This would result in a much more accurate list of proposed conservation sites.

Once the sites have been selected, each should be monitored to gether specific information as to their biological components, complexities and importance. Not only will this result in a fairer final selection of conservation sites, but the knowledge gained will assist in determining how the area should be managed.

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APPENDIX 6.1

Collection List for Vegetation between Morgan and Wongulla

Murray River Collection (Museum) (Request Ref. No. 564/1973)

RJC	Morgan to Blanchetown	18-25th February	R.J. Chinnock
JZW	Blanchetown to south of Portee	18-23rd March	J.Z. Weber
NND	Swan Reach to Wongulla	14-19th April	N.N. Donner

PTERIDOPHYTA

	NND	JZW	RJC
ADIANTACEAE			
Adiantum capillus-veneris L.			143,145
AZOLLACEAE			
Azolla filiculoides Lam.	4111		27,28,
A. pinnata R.Br.			29,138
MARSILEACEAE			
Marsilea drummondii A.Br.	4094	3424A	
M. of. drummondii A.Br.		3513	55,68A
M. sp.		3424B,3496	68B
THELYPTERIDACEAE			
Cyclosorus parasiticus (L.)Farwell	4189		144,146,154

SPERMATOPHYTA

MONOCOTYLEDONEAE

AMARYLLIDACEAE			
Crinum flaccidum Herbert			54
Ceratophyllaceae			
Ceratophyllum demersum L.			24
CYPERACEAE			
Cyperus difformis L.		3426	132
C. exaltatus Retz.	4083	3491	
C. gymnocaulos Steud.		3441	132A
C. pygmaeus Rottb.		3425,3497	
C. rigidellus (Benth.) Black		3421	
Eleocharis acuta R.Br.	4167		

(*) indicates botanical name change since specimens were identified.

CYPERACEAE (Cont'd)				
	E. sphacelata R.Br.		3389	
	Fimbristylis squarrosa Vahl	4187	3472	
(*)	*Scirpus validus* Vahl		3388	
HYDROCHARITACEAE				
(*)	*Vallisneria gigantea* Craebner		3442	25
JUNCACEAE				
	Juncus pauciflorus R.Br.	4144	3443	
(*)	*J. polyanthemos* Buch.		3504	
JUNCAGINACEAE				
	Triglochin procerum R.Br.	4120,4170	3386	
	T. sp.			50
LEMNACEAE				
	Spirodela oligorrhiza (Kurz) Hegelm.			180
LILIACEAE				
	Asphodelus fistulosus L.			38
POACEAE				
	Cynodon dactylon Pers.			113
	Echinochloa crus-galli (L.) Beauv.	4158	3150	
	Enneapogon avenaceus (Lindl.) C.E. Hubbard			75
	E. nigricans (R.Br.) Beauv.		3524	103
	Eragrostis cilianensis (All.) Link ex Vign.-Lut.		3509	
	E. dielsii Pilger			67
	Paspalidium jubiflorum (Trin.) Hughes		3429,3439	120
(*)	*Phragmites communis* Trin.	4114	3430	118
	Polypogon monspeliensis (L.) Desf.	4119	3469	127,128
	Pseudoraphis spinescens (R.Br.) Vickery		3438	
	Sporobolus mitchellii (Trin.) Hubbard ex Blake		3410	131
POTAMOGETNACEAE				
	Potamogeton crispus L.			45
	P. tepperi Bennett	4125	3440	26

DICOTYLEDONEAE

AIZOACEAE			
Tetragonia tetragonoides (Pall.) Kuntze		3474A	
AMARANTHACEAE			
Alternanthera nodiflora R.Br.	4138	3422,3465	
ANACARDIACEAE			
Schinus molle L.	4145	3530	30,31
APIACEAE			
(*)*Hydrocotyle vulgaris* L.	4153		
Lilaeopsis polyantha (Gandog.) Eichler		3474	
ASCLEPIADACEAE			
Asclepias fruticosa L.	4116		
A. rotundifolia Mill.	4108	3536	158
ASTERACEAE (Comp)			
Aster subulatus Michz.	4110,4143	3437	125
Brachyscome basaltica var. *gracilis* Benth.		3401	
B. ciliaris (Labill.) Less.			40
Calotis cuneifolia R.Br.		3407	
C. scapigera Hook.	4154,4172	3393	
Centaurea calcitrapa L.			98
Centipeda minima (L.) A. Br.et Ashers.	4087,4155	3411	
C. cunninghamii (DC.) A. Br.et Ashers.		3434	
Cirsium vulgare (Savi.) Ten.		3485	
Cotula coronopifolia L.	4133	3471	153
Eclipta platyglossa Fv.	4092	3409	36,117
Epaltes australis Less.	4133	3433	130
Gnaphalium luteoalbum L.	4088	3413,3505	129,142
Inula graveolens (L.) Desf.	4141	3489	
Ixiolaena leptolepis (DC.) Benth.			97
Lactuca serriola L.		3517	104
Myriocephalus stuartii (Sond.) Benth.	4186	3534	
Olearia muelleri (Sond.) Benth.		3460	
Picris hieracioides L.	4172	3395	59,99,101
Reichardia tingitana (L.) Roth.	4090	3495	19,100
Senecio anethifolius A. Cunn. ex DC.	4190	3533	
Sonchus asper (L.) Hill	4206		
Vittadinia triloba (Gaudich.) DC.	4122,4196	3488	41,157
Xanthium californicum Greene	4177	3501	
X. spinosum L.		3511	

BORAGINACEAE			
Echium lycopsis L.		3535	
Heliotropium curassavicum L.	4135,4165	3416	139,42
H. europaeum L.	4085	3523	
H. supinum L.	4156		
BRASSICACEAE			
Lepidium hyssopifolium Desv.	4163	3455	
L. rotundum (Desv.) DC.			82
Rorippa islandica (Oedor) Borbas	4139,4176		
Sisymbrium erysimoides Besf.	4129		
CAMPANULACEAE			
Pratia concolor (R.Br.) Druce		3503,3528	21
Wahlenbergia fluminalis (Black) Wimmor ex Eichler	4081,4185	3403	20,105
CARYOPHYLLACEAE			
Spergularia of. rubra (L.) J.&C. Prosl		3514	
CHENOPODIACEAE			
Atriplex leptocarpa FvM.	4095	3397,3404	
A. limbata Benth.	4107		
A. lindleyi Moq.			71
A. aff. muelleri Benth.	4124	3531	
A. stipitata Benth.		3452,3494	74,77,168
A. suberecta Verdoorn	4106	3406	
A. velutinella FvM.	4146		
(*)*Bassia obliquicuspis* Anderson	4127		86,90,96
(*)*B. paradoxa* (R.Br. FvM.			84
(*)*B. patenticuspis* Anderson			121
(*)*B. quinquecuspis* (FvM.) FvM. *var. quinquecuspis*		3486	
(*)*B. quinquecuspis var. villosa* (Benth.) Black	4126		
(*)*B. tricuspis* (FvM.) Anderson	4166		133
Chenopodium ambiguum R.Br.	4170		
C. cristatum (FvM.) FvM.	4096	3428	
C. murale L.		3449	
C. pumilio R.Br.		3428	
Dysphania myriocephala Benth.		3423	
Enchylaena tomentosa R.Br.	4102	3447,3451	70
Kochia brevifolia R.Br.	4103,4193	3446,3518, 3519	56,72,116
(*)*K. ciliata* FvM.	4194	3456	167,85
(*)*K. rohrlachii* Wilson		3482,3520	155,165
(*)*K. sedifolia* FvM.			83,91
(*)*Rhagodia nutans* R.Br.	4162	3396	
R. parabolica R.Br.	4178,4179		
R. spinescens R.Br.		3435,3525	107
Salsola kali L.	4097	3408	73,122

CONVOLVULACEAE			
Convolvulus arvensis L.		3538	110
CRASSULACEAE			
Crassula helmsii *Kirk) Cockayne			48,175
C. purpurata (Kook.f.) Domin		3474	
CUCURBITACEAE			
Citrullus lanatus (Thunb.) Mansf.	4130	3515	
Cucumis myriocarpus Naud.	4101	3420	
EUPHORBIACEAE			
Euphorbia drummondii Boiss.	4123,4169	3521	18
E. eremophila A. Cunn. ex Hook.	4131	3526	108
E. terracina L.		3498	151
E. sp.			63
Phyllanthus fuernrohrii EvM.			57
P. lacunarius FvM.			58
Ricinus communis L.	4109	3450	
FABACEAE			
Acacia colletioides Benth.		3481	172
A. oswaldii FvM.		3483,3537	
A. stenophylla A. Cunn. ex Benth.		3454	33,76
Cassia nemophila var. platypoda (R.Br.) Benth.			92
C. nemophila var. zygophylla (Benth.) Benth.			79,93
Glycyrrhiza acanthocarpa (Lindl.) Black		3402	16,109
Lotus australis Andr.		3399	
Medicago polymorpha var. vulgaris (Benth.) Schinners		3522	150
M. sativa L.		3398	159
Psoralea patens Lindl.		3484	
Swainsona greyana Lindl.	4205	3400,3506	15
FRANKENIACEAE			
Frankenia of. gracilis Summerah.		3512	
GENTIANACEAE			
Centaurium minus Gars.			61
GERANIACEAE			
Geranium pilosum Forst.	4191		
GOODENIACEAE			
Goodenia glauca FvM.	4093	3493	23,160
Scaevola spinescens R.Br.		3444	

HALORAGACEAE			
Myriophyllum propinquum A. Cunn.	4136,4188, 4207	3390,3468	46,136,137
LAMIACEAE			
Lavandula dentata L.			166
Marrubium vulgare L.	4105	3539	124
Mentha australis R.Br.	4140		22
Salvia verbenaca L.			178
Scutellaria humilis R.Br.	4192		
Teucrium racemosum R.Br.	4195	3394,3432	171,134,156
LORANTHACEAE			
Amyema miraculosa var. *boormanii* (Blakely) Eichler		3461	95
A. preissii (Miq.) Tiegh.			94
Lysiana exocarpi ssp. *exocarpi* (Behr) Tiegh.		3462	32,171
LYTHRACEAE			
Ammannia multiflora Roxb.		3418	
Lythrum salicaria L.			140
L. sp. *aff. salicaria* L.		3417	
MALVACEAE			
Lavatera plebeia Sims	4128	3448	64,102,119, 173
Selenothamnus squamatus (Nees ex Miq.) Melville			87
Sida intricata FvM.			69,78,112
MELIACEAE			
Melia azedarach L.		3527	
MYOPORACEAE			
Eremophila divaricata (FvM.) FvM.		3492,3532	
Myoporum montanum R.Br.	4099	3419	34
M. parvifolium R.Br.			39
M. platycarpum R.Br.		3459	
MYRTACEAE			
Callistemon brachyandrus Lindl.			60
Ecualyptus camaldulensis Dehnh.	4082		163
E. largiflorens FvM.		3499	
E. socialis FvM. ex Miq.		3463	
Melaleuca lanceolata Otto		3478	

NYCTAGINACEAE			
Boerhavia diffusa L.			43,111
ONAGRACEAE			
Ludwigia peploides ssp. *montevidensis* (Spreng.) Raven	4157,4169	3467,3516	126
OXALIDACEAE			
Oxalis corniculata L.			37
PITTOSPORACEAE			
Pittosporum phillyreoides DC.		3447	114
PLANTAGINACEAE			
Plantago coronopus L.	4091		
POLYGONACEAE			
Muehlenbeckia cunninghamii (Meisn.) FvM.	4098	3405	66,161,162
Polygonum aviculare L.	4137	3436,3466	
P. lapathifolium L.	4173		
P. prostratum R.Br.		3445	
Rumex brownii Campd.	4112	3427	149
R. crystallinus Larage			135
RUBIACEAE			
Asperula gemella Airy-Shaw & Turrill		3431	141
RUTACEAE			
Geijera linearifolia (DC.) Black		3480	
SANTALACEAE			
Exocarpos aphyllus R.Br.	4180	3477	170
SAPINDACEAE			
Heterodendrum oleaefolium Desf.		3457	
SCROPHULARIACEAE			
Glossostigma elatinoides (Benth.) Benth. ex Hook. f.	4117	3502	47
G. sp. aff. *elatinoides* (Benth.) Benth. ex Hook. f.		3470	
Limosella australis R.Br.	4118	3473	49,51,53,176
Mimulus repens R.Br.	4121,4134	3391,3464	52,164
Morgania floribunda Benth, in Mitch.	4086	3412	62

SOLANACEAE

Lycium australe FvM.			106,115
L. ferocissimum Miers		3487	152
Nicotiana glauca Grah.	4104,4164	3415,3508	44
Solanum esuriale Lindl.			81
S. nigrum L.		3507	65

THYMELAEACEAE

Pimelea microcephala R.Br.	4174,4175		

URTICACEAE

Urtica incisa Poir.	4142	3475	147

VERBENIACEAE

Phyla nodiflora (L.) Greene		3392,3490	
Verbena officinalis L.		3453	35,148
V. supina L.	4204	3414	

ZYGOPHYLLACEAE

Tribulus terrestris L.	4100		123
Zygophyllum ammophilum FvM.	4084,4132		80
Z. apiculatum FvM.		3458	
Z. compressum Black		3529	
Z. crenatum FvM.	4197		

APPENDIX 6.2

Collection List for Vegetation at
Brookfield Wombat Reserve

Identifications for the South Australian Museum
(Brookfield Zoo Wombat Reserve)

Collector: J.Z. Weber Reference 572/1973

AUZIACEAE

Tetragonia eremaea Ostenf. - 3550

AMARANTHACEAE

Ptilotus spathulatus (R.Br.) Poir - 3586

APIACEAE

Bupleurum semicompositum L. - 3644
Daucus glochidiatus (Labill.) Fisch. May. & Ave-Lall. - 3623

ASTERACEAE

Angianthus strictus (Stectz) Benth. - 3614
A. tomentosus Wendl. - 3581
Arctotheca calendula (L.) Levyns - 3612
Athrixia athrixioides (Sond. & FvM.) Bruce 3547
Brachycome ciliaris (Labill.) Less. - 3556
B. lineariloba (DC.) Druce - 3613
Calotis hispidula (FvM.) FvM. - 3602
Centipeda thespidioides FvM. - 3646
Elachanthus pusillus FvM. - 3603
Gnaphalium luteoalbum L. - 3638
Gnephosis shirrophora (Sond. & FvM.) Druce - 3557
Helipterum jessenii FvM. - 3545
H. pygmacum (DC.) Benth. - 3604
Isoetopsis graminifolia Turex
Minuria leptophylla Dc. - 3620
Reichardia tingitana (L.) Roth - 3546, 3628
Olearia muelleri (Sond.) Benth. - 3595
Onopordum acaulon L. - 3657
Picnomon acarna (L.)Cass. - 3599
Senecio aff. lautus Forst. f. ex Willd. - 3627
S. quadridentatus Labill. - 3647
Sonchus asper (L.) Hill - 3653
Vittadinia cuneata DC. - 3662
V. megacephala (FvM. ex Benth.) Black - 3554
V. triloba (Gaudich.) DC. - 3559, 3622

BORAGINACEAE

Echium lycopsis L. - 3656
Halgania lavandulacea Endl. - 3583
Omphalolappula concava (FvM.) Brand - 3618

BRASSICACEAE

Sisymbrium erysimoides Desf. - 3551
S. irio L. - 3654
Stenopetalum lineare R. Br. ex DC. - 3663

CAMPANULACEAE

Wahlenbergia communis Carolin - 3544, 3639

CARYOPHYLLACEAE

Herniaria hirsuta L. - 3617, 3643
? Silene apetala Willd. - 3624, 3648
Spergularia diandra (Guss.) Heldr. - 3553

Chenopodiaceae

Atriplex acutibracta Anderson - 3637
A. suberecta Verdoorn - 3577
(*) Bassia brevifolia Ising - 3564
(*) B. diacantha (Nees) FvM. 3571
(*) B. paradoxa (R.Br.) FvM. - 3634
(*) B. sclerolaenoides (FvM.) FvM. - 3580
Chenopodium murale L. - 3555
(*) Kochia excavata Black - 3574, 3588
(*) K. pentatropis Tate - 3572, 3589
(*) K. radiata Wilson - 3590

CONVOLVULACEAE

Convolvulus erubescens Sims - 3548

CRASSULACEAE

Crassula colorata (Nees) Ostenf. - 3658
C. pedicellosa (FvM.) Ostenf. - 3562

EUPHORBIACEAE

Euphorbia drummondii Boiss. - 3615

FABACEAE

Acacia colletioides Benth. - 3605
Astragalus sp. - 3573
Cassia nemophila Cunn. ex Vogel var. nemophila - 3585
Eutaxia microphylla (R.Br. ex Ait.) Black - 3593
Medicago minima var. brevispina Benth. - 3652
M. polymorpha var. vulgaris (Benth.) Shinners - 3633

GERANIACEAE

Erodium cicutarium (L.) L'Her. ex Ait. - 3619

GOODENIACEAE

Goodenia pusilliflora FvM. - 3616
Velleia paradoxa R.Br. - 3582

IRIDACEAE

Romulea longifolia (Salisb.) Baker - 3659

LAMIACEAE

Prostanthera sp. (P. aspalathoides A. Cunn. ex Benth). - 3584
Salvia lanigera Poir. - 3578
Westringia rigida R.Br. - 3594, 3660

LILIACEAE

Anguillaria dioica R.Br. - 3611

LYTHRACEAE

Lythrum hyssopifolia L. - 3654

MALVACEAE

Malva verticillata L. - 3632, 3636
Selenothamnus squamatus (Nees ex Miq.) Melbille - 3568
Sida cardiophylla FvM. - 3600

MYOPORACEAE

Eremophila glabra (R.Br.) Ostenf. - 3576
E. scoparia (R.Br.) FvM. - 3661
(*) Myoporum montanum R.Br. - 3549, 3630

MYRTACEAE

Eucalyptus porosa FvM. ex Miq. - 3656
E. socialis FvM. ex Miq. - 3635
Melaleuca acuminata FvM. - 3597
M. lanceolata Otto - 3598

OXALIDACEAE

Oxalis corniculata L. - 3621

PITTOSPORACEAE

Bursaria spinosa Cav. - 3592

PLANTAGINACEAE

Plantago drummondii Dene. - 3640, 3670

POACEAE

Bromus rubens L. - 3641
Danthonia auriculata Black - 3552
Hordeum leporinum Link - 3650
Lophochloa phleoides (Vill.) Rehb. - 3642A
L. pumila (Desf.) Bor - 3575, 3642
Schismus barbatus (L.) Thell. - 3626
Stipa drummondii Steud. - 3625
S. platychaeta Hughes - 3560, 3569
Triodia irritans R.Br. - 3596

PORTULACACEAE

Calandrinia eremaea Ewart - 3563

RUTACEAE

Geijera linearifolia (DC.) Black - 3570

SANTALACEAE

Exocarpos syrticola (FvM. ex Miq.) Stauffer - 3579

SOLANACEAE

Nicotiana velutina Wheeler - 3561, 3649
Solanum nigrum L. - 3651

VERBENACEAE

Verbena officinalis L. - 3655

ZYGOPHYLLACEAE

Zygophyllum apiculatum FvM. - 3566
Z. aurantiacum (Lindl. ex Mitch.) FvM. - 3591
Z. ovatum Ewart and White - 3567,3631

6.3.1 FISH OF THE RIVER MURRAY

	NAME	HABITAT	FEEDING	BREEDING	MISCELLANEOUS
1.	Pouched or wide mouthed Lamphrey (*Geotria australis*)	Parasitic on other fish.	Parasitic. In larval stage probably feeds on plankton.	As breeding period approaches adults ascend River from the sea.	Very rare. Only one specimen taken in South Australia.
2.	Short-headed Lamphrey (*Mordacia mordax*)	Parasitic on other fish - attaches to their surface using a sucking disc mouth.	Parasitic. In larval stage probably feeds on plankton.	As breeding period approaches, adults ascend the River from the sea. Spawning occurs in the mud.	Uncommon.
3.	Bony Bream or Pyberry (*Flavialosa richardsoni*)	In waters of less than 600 feet altitude.	Ingests mud, also feeds on algae, aquatic plants and insects.	Spawning occurs at Spring and summer.	Schools in large numbers - provides food for fish-eating birds (e.g. Pelicans) common in South Australia.
4.	Australian Smelt (*Retropinna semoni*)	In both still and fast-flowing water.	Feed on plankton, particularly algae.	Spawning - around the last 2 weeks of September, when water temperatures reach 15°C.	Schools in large numbers near the surface. Abundant in patches.
5.	Native Trout (*Galaxia maculatus*)	Freshwater streams and rivers.		Migrates downstream to tidal reaches to spawn during late summer & autumn At the first spring tide eggs are layed on the water vegetation. The tide then recedes and the eggs develop out of water. They hatch when the next spring tide resubmerges them.	Note: the information presented under "Breeding is based on New Zealand populations. More common near the mouth of the Murray.
6.	Freshwater catfish (*Tandanus tandanus*)	Lakes and sluggish waters.	A bottom-feeder, basically carnivorous, feeding on mollusses and crustaceans.	Spawning - late spring to mid-spring. A rise in water level and temperature is required, before spawning occurs. Nests are made in peboles or gravel. The eggs are found under the gravel (see text for additional information).	Feeding habits may create turbidity. Common in South Australia.

	NAME	HABITAT	FEEDING	BREEDING	MISCELLANEOUS
7.	Short-finned Eel (Anguilla australis occidentalis)	In the main rivers and streams.	Carnivorous.	Migrates to the sea for breeding purposes.	Probably used to be common in the Murray, but is now rarely seen.
8.	Rainbow Fish (Nematocentrus fluviatilis)	Rivers and streams.	Will feed on insects.	Spawning - spring and summer. Eggs are adhesive and attach to submerged objects, particularly aquatic plants.	Common in restricted areas.
9.	Freshwater Hardyhead (Craterocephalus fluviatilis)	Rivers and streams.	Will feed on aquatic insects including mosquito larvae.	Spawning - spring and summer. Eggs are adhesive.	Common in restricted areas.
10.	Western chanda perch (Ambassis castelnaui)	Rivers and streams.		Spawning - spring and summer. Eggs are adhesive.	Uncommon. Only occurs in patches.
11.	Murray Cod (Maccullochella peeli)	Rivers and streams.	Carnivorous (crustaceans and mullusis). Young cod depend largely on juvenile Western Carp Gudgeon as a food source.	Spawning - October and November. A stimulus of a rise in water level and water temperature (to 20°C) is required before spawning will occur. Eggs are adhesive, and are attached to the inside surface of submerged tree-trunks and other objects.	High water temperatures (e.g. 25°C) may cause premature hatching of eggs. Common in South Australia. Commercially fished.
12.	Australian or Estuary Perch (Percalates colonorum)	Mostly in esturine waters.		Believed to spawn in brackish waters.	Not common in South Australia.
13.	Macquarie Perch (Macquaria australasica)	Rivers.	Carnivorous (insects and larvae).	Spawning - October and November. Eggs are adhesive and attach to stones and other hard objects on the bottom of fast-flowing rivers.	The occurrence of this species in South Australia is based on a single doubtful record. It is believed to be seriously close to extinction due to a loss of spawning sites.
14.	Golden Perch, Callop or Yellow-belly (Plectroplites ambiguus)	Warmer sluggish and often turbid waters.	Larvae and fry feed on zooplankton. Adults are basically carnivorous, feeding on shrimps, yabbies and fish.	Spawning - November to March. Stimulus for spawning - rise in water level, plus water temperature greater than 23.5°C. Spawning occurs near the surface in still water.	Does not usually school. Will live and grow under shallow water conditions. Is abundant in the River Murray.

	NAME	HABITAT	FEEDING	BREEDING	MISCELLANEOUS
15.	Silver Perch (Bream) (Bidyanus bidyanus)		Omnivorous (zooplankton shrimps, algae, aquatic plants).	Spawning - after slight rises in water levels, provided the water temperature in the shallows reach 23°C. Usually occurs October and November. Eggs are usually pelagic but will sink to the bottom in still water.	Often schools in large numbers. Abundant in South Australia. It is commercially fished.
16.	Southern Pigmy Perch (Nannoperca australis)	Larger rivers and streams.		Spawning - spring. Eggs are adhesive and attach to submerged objects.	Fairly common in South Australia.
17.	Congolli (Pseudaphritis urvili)	Essentially marine - can go up rivers and streams and has done so in the Murray as far as Waikerie.	Omnivorous (molluses, fish, crustaceans, aquatic plants).	Enter lower River Murray during autumn and winter, possibly for breeding purposes.	Mostly uncommon except at the mouth of Murray.
18.	River Blackfish (Gadopsis marmoratus)	More common in small snaggy and gravelly streams.	Mainly insectivorous. Also feeds on crustaceans and molluscs.	Spawning - spring and early summer.	Was once very common in the Murray-Darling system. Is only occasionally seen in South Australia.
19.	Flat-headed Gudgeon (Philypnodon grandiceps)	Rivers and streams.	Carnivorous.	Spawning - spring and summer. Eggs are adhesive and attach in a single cluster to solid objects.	Not common in the Murray.
20.	Western Carp Gudgeon (Hypseleotris klunzingeri)	Rivers.	Adults feed on crustaceans.	Spawning - occurs when water temperatures rise to a little over 22.5°C. It occurs in shallow water. Eggs are deposited on aquatic plants, grass stems, etc. to depths between 5 and 25 cm. Note therefore that slight drops in water level could cause large-scale dessication of eggs.	Juvenile carp Gudgeon are an important food for young Murray Cod (No. 11). Common in South Australia.
21.	Purple-spotted Gudgeon (Mogurnda mogurnda)	In larger rivers.		Eggs are adhesive.	Common in patches.

	NAME	HABITAT	FEEDING	BREEDING	MISCELLANEOUS
22.	Golden Carp or Wild Goldfish (Carassius auratus)	Prefers still often muddy backwaters.	Fry feed on plankton. Young and adult fish are omnivorous.	Spawning - spring and summer, usually when water temperature exceed 15°C. Eggs adhesive and attached to aquatic plants and other objects.	Widely distributed in South Australia. Originally from China and Japan.
23.	European Carp (Cyprinus carpio)	Tends to be more common in irrigation canals and other sluggish waters (e.g. lagoons).	Bottom feeder and omnivorous. Its feeding habits often create turbidity.	Spawning - spring and early summer, usually in shallow water when water temperatures reach 18°C. Eggs adhesive, scattered on aquatic plants, etc.	Declared noxious in South Australia and Victoria. First introduced to dams in N.S.W. in 1890. First caught in S.A. in Sept. 1969 at Renmark. Had reached the mouth of Murray by November 1970.
24.	Tench (Tinca tinca)	Muddy backwaters preferred. Fairly common in larger rivers.	Essentially carnivorous.	Spawning - late spring and early summer, when water temperatures reach 16°C. Eggs adhesive, on aquatic plants.	Habits tend to create muddy conditions. Introduced from Europe. Common in South Australia.
25.	Mosquito Fish (Gambusia affinis)	Is hardy of warm water and lack of space.		Live-bearer-eggs develop within the mother.	Common in South Australia from North America.
26.	Redfin Perch (Perca fluviatilis)	Rivers and backwaters. Prefers still waters.	Young larvae feed on plankton. Larger fish on crustaceans and small fish. Adults feed mainly on fish.	Spawning - early spring, at night, at temperatures of about 12°C. Eggs in long masses attached to aquatic plants and submerged tree-trunks.	Appears to be direct competition between this species and Murray Cod and Callop (11 and 14). Forms large populations. From Europe.

NOTES:

1) Nomenclature is correct to January 1974.

2) Genera are placed in the order of "Freshwater Fish of of South Australia" by Glover and Inglis and "Freshwater Fish of the Murray-Darling River System" by J.S. Lake.

REFERENCES:

"The Marine and Freshwater Fishes of South Australia, 2nd edition by T.D. Scott, C.J.M. Glover and R.V. Southcott. Govt Printer, Adelaide 1974 (In print).

"Freshwater Fish of the Murray-Darling River System. (The Native and Introduced Fish Species)" by John S. Lake. N.S.W. State Fisheries Research Bulletin No. 7.

ACKNOWLEDGEMENTS: John Glover, Curator of Fishes, South Australian Museum - for guidance, time and information.

6.3.2 FROGS OF THE RIVER MURRAY

NAME	DISTRIBUTION	HABITAT AND BEHAVIOUR
1. Litoria aurea (Golden Frog)	Throughout the River Murray. Also in the South East.	Amongst vegetation of rivers, lakes and marshes, often sitting half suomerged among stems at tne borders of water.
2. Litoria peroni (Peron's Tree Frog)	Usually downstream from Morgan. Has been found as far up as Chowilla. Restricted to the River Murray.	Beneath loose bark or stones near rivers and streams.
3. Litoria ewingi (Brown Tree Frog)	Northern limit along River Murray is Wongulla (near Swan Reach). Found in the Lakes region and also in the Mt. Lofty Ranges, Fleurieu Peninsula and in S.E.	Amongst low vegetation near creeks and pools. Mating usually occurs in March to October. The eggs are layed in a mass wound around stems of aquatic plants.
4. Limnodynastes dumerili dumerili (Bull Frog)	Throughout the River Murray to the Lakes. Also in the Mt. Lofty Ranges and Kangaroo Island.	A burrowing species. Lives in small cavities under damp wood and stones. During the summer months, the frogs aestivate in a sealed burrow.
5. Lymnodynastes fletcheri (Long-thumbed Frog)	Throughout the River Murray and the Lakes region. Almost exclusive to the Murray.	Beneath wood and debris at the edge of rivers and streams.
6. Lymnodynastes tasmaniensis (Marbled Frog)	Throughout the River Murray, also in the South East, Mt. Lofty and Flinders Ranges, Yorke Peninsula and Kangaroo Island.	In or near water, often beneath stones and rubbish in dry creek beds, especially during the summer months.
7. Ranidelea signifera (Brown Froglet)	Mostly downstream from the Marne River mouth, but has been noted at Blanchetown and Renmark. Also in the Lakes region, Mt. Lofty Ranges, Kangaroo Island and the S.E.	Amongst stems and debris at the edge of water-courses, swamps and lagoons, or sometimes away from water in damp areas.
8. Ranidelea parinsignifera	Confined to the River Murray, upstream from Purnong.	Amongst aquatic vegetation.

REFERENCE: Habitat and Behaviour - "Frogs of South Australia" by M.J. Tyler (Govt Printer, Adelaide)

- "Australian Frogs" by Densey Clyne (Periwinkle)

- "Frog Distributions in South Australia" by Dale Roberts, Dept of Zoology, University of Adelaide (Mimeographed, private publication)

ACKNOWLEDGEMENTS: Michael Tyler, Honorary Associate in Herpetology, South Australian Museum and Dale Roberts, Department of Zoology, University of Adelaide.

6.3.3 BIRDS OF THE RIVER MURRAY

LIST AND NOTES ON THE BIRDS WHICH BREED OR HAVE BRED

OF THE RIVER MURRAY, LAKES ALEXANDRINA AND ALBERT, AND THE COORONG

Notes: (a) The far-left column titled "No.", contains the numbers alloted by CONDON (1969) to the species concerned.

(b) The far-right column titled "Nest", codes the types of nests which the particular species build and use. The code is in numbers, one to six. The key for the code is as follows:

Code No.	Nest Type
1.	On the ground, amongst herbage (usually grasses).
2.	Nest is amongst reeds, often attached to them, usually on or above water. The next is usually made of reeds and rushes.
3.	The nest is a depression in the ground, sometimes surrounded by sticks and vegetation.
4.	The nest is in or on bushes, usuallay made of sticks and vegetation.
5.	The nest is in trees, on branches or in the fork of two branches.
6.	The nest is built on a rook or ledge.

(c) Nomenclature is that used by CONDON (1969).

(d) Species are listed in alphabetical order under the appropriate families.

References:

N.W. CAYLEY (1968) - "What Bird is that? (A guide to the birds of Australia)". Angus and Robertson.

H.T. CONDON (1969) - "A Handlist of the Birds of South Australia". S.A. Ornithological Society, Adelaide.

No.	Name	Notes	Nest
		PODICIPEDIDAE	
11.	1. Podiceps novaehollandiae novaehollandiae (Little Grebe).	Lakes, swamps, estuaries. Breeds from October to March or April.	2
12.	2. P. poliocephalus (Hoary-headed Grebe)	Lakes, streams, estuaries, salt inlets. Breeds October to January	2
13.	3. P. oristatus (Great - crested Grebe).	Rivers, swamps, reaches. Breeds November to February. Migratory - arrives from warmer latitudes in early spring.	2
		PROCELLARIIDAE	
33.	4. Puffinis tenuirostris (Mutton Bird).	Inhabits oceanic islands. Is migratory, but breeds locally.	
		PELEGANIDAE	
40.	5. Pelecanusa conspicilatus (Australian Pelican)	Rivers, lakes, estuaries, mud flats. Breeds September to March. Numbers are decreasing due to disturbance of nesting sites.	3
		PHALACROCORACIDAE	
44.	6. Phalacrocorax carbo novaehollandiae (Black Cormorant)	Lakes, streams, coastal inlets. Breeds July to October.	4, 5 or 6
48.	7. Ph. melanoleucos melanoleucos (Little Pied Cormorant)	Lakes, streams, swamps, inlets. Breeds in colonies, September to January.	5
45.	8. Ph. sulcirostris sulcirostris (Little Black Cormorant)	Lakes, streams, inlets. Breeds in colonies, August to December.	5
47.	9. Ph. varius (Pied Cormorant)	Lakes, streams, swamps, inlets. Breeds in colonies on islands, mangrove and inland swamps, September to December or March to July.	4, 5

No.	Name	Notes	Nest
		ANHINGIDAE	
51.	10. Anhinga anhinga novaehollandiae. (Australian Darter)	Lakes, streams, swamps, reaches. Breeds at various times depending on conditions. Does breed annually at the Lakes.	5
		ARDEIDAE	
53.	11. Ardea novaehollandiae novaehollandiae (White-faced Heron)	Lakes, streams, swamps, tidal flats, mangroves. Breeds September to January.	5
62.	12. Botaurus poiciloptilus (Brown Bittern)	Rivers, reedy swamps, lagoons. Breeds October to February. Partly nocturnal.	2
58.	13. Egretta alba. modesta. (White Egret)	Rivers, lakes, swamps. Breeds November to January.	5
56.	14. E. grazotta nigripes (Little Egret)	Lakes, streams, swamps. Breeds in colonies, October to January. Nomadic.	5
60.	15. Nycticorax caledonious (Nankeen Night Heron)	Tree-lined water courses, swamps, lagoons. Nomadic.	
		PLATALEIDAE	
68.	16. Platalea (Platibis) flavipes (Yellow-billed Spoonbill)	Reed margins of water areas, flood covered flats. Breeds September to January or according to conditions. Perches on dead trees. Nomadic.	5
67.	17. P. (Platalea) regia. (Royal Spoonbill)	Swamps, lagoons, reedy margins. Breeds October to April or according to rainfall. Nomadic.	2, 5
66.	18. Plegadis falcinellus (Glossy Ibis)	Margins rivers, swamps and adjacent grassland. Breeds September to December usually in centre of swamp. Nomadic.	4, 5
63.	19. Threskironis molucca strictipennis (White Ibis)	Habitat as above. Breeds in colonies, often in centre of a swamp, September to December. Nomadic.	2

No.	Name	Notes	Nest
64.	20. Th. (carphibis) spinicollis (Straw-necked Ibis)	Habitat as above. Pastoral land also. Breeds September to December. Nest on reed isles in swamps, etc. Nomadic.	2
	ANATIDAE		
86.	21. Anas castanea (Chestnut Teal)	Streams, salt lakes, lagoons, inlets. Breeds June to December.	1, 5
87.	22. A. gibberfrons gibberfrons (Grey Teal)	Streams, swamps, temporary waters. Breeds throughout year according to rainfall. Nomadic.	1, 4 or 5
88.	23. A. rhynchotis rhynchotis (Blue-wionged Shoveller)	Lakes, swamps. Breeds August to December.	3
84.	24. A. superciliosa superciliosa (Grey or Black Duck)	Streams, lakes, swamps. Breeds July to December. Nomadic, or partly so.	2, 5
76.	25. Anseranas semipalmata (Pied Goose)	Rivers, lakes, swamps, mangrove flats. Breeds July to December. Is often in flocks.	2
92.	26. Aythya australis (White-eyed Duck)	Streams, swamps, pools. Breeds September to December or January. Nest often amongst Ignium or cane-grass.	3
97.	27. Biziura lobata (Musk Duck)	Rivers, lakes, swamps. Breeds August December.	2
79.	28. Geropsis novaehollandiae (Cape Barren Goose)	Swamps, grassland. Breeds June to September.	1
94.	29. Chenonetta jubata (Maned Goose)	Timbered margins of swamps, grassy flats. Breeds all year according to rainfall. Nomadic.	5
80.	30. Cygnus stratus (Black Swan)	Rivers, lakes, swamps. Breeds Autumn and Winter. Numbers are increasing.	2
91.	31. Malocorhynchus membranaceus (Pink-eared Duck)	Usually inland (rarely coastal), swamps, shallow waters. Breeds August to December.	2, 5

No.	Name	Notes	Nest
96.	32. Oxyura australis (Blue-billed Duck)	Lakes, swamps, secluded waters.	2
83.	33. Tadorna tadornoides (Chestnut-breasted Shellduck) (Mountain Duck)	Rivers, lakes, swamps, grassy flats.	5
	RALLIDAE		
140.	34. Fulcia altra australis (Coot)	Lakes, swamps, backwaters of streams. Breeds August to December.	2, 4
138.	35. Gallinula tenebrosa tenebrosa (Dusky Moorhen)	Margins permanent waters. Breeds August to December.	2, 4
139.	36. Porphyrio porphyrio melanotus (Eastern swamphen)	Reedy margins permanent waters, river flats, swamps. Breeds August to January.	2
134.	37. Porzana fluminea (Spotted Crake)	Margins rivers and swamps. Breeds August to January	2
135.	38. P. musilla palustris (Marsh-Crake)	Habitat as above, mostly in coastal. Also mangrove areas. Breeds October to January.	2
133.	39. Rallus phillippeasis australis (Banded Landrail)	Scrub, rank herbage in swampy areas, cultivated paddocks. Breed October to January.	1
137.	40. Tribonyx ventralis (Black-tailed Native Hen) (Water-hen)	Rivers, lakes, reedbeds, grasslands. Breeds August to December.	1, 2 or 4
	ROSTRATUIIDAE		
142.	41. Rostratula benghalensis australis (Painted Snipe)	Margins swamps, streams, usually with low stunted vegetation. Breeds October to January. Nomadic. Uncommon in S.A.	3

No.	Name	Notes	Nest
		HAEMATOPODIDAE	
143.	42. Haematopus ostralegus longirostris (Pied Oystercatcher)	Seashores, inlets (especially stone and reef outcrops). Breeds October to January in S.A. (July to September in M.W. Australia). Sedentary. Nest in sand.	3
		CHARADRIIDAE	
150.	43. Charadrius alexandrinus ruficapillus (Red-Capped Dotterel) (Kentish Plover)	Margins rivers, swamps. Seashore. Breeds August to December or January. Nest is in sand.	3
156.	44. Ch. cinctus (Red-kneed Dotterel)	Usually northern part of State. Is found on margins of swamps, lakes, rivers, river flats; seldom far from water. Nomadic.	3
155.	45. Ch. melanops (Black-fronted Dotterel)	Near water, shingly or muddy banks of rivers, lakes. Breeds September to December.	3
149.	46. Ch. rubicollis (Hooded Dotterel)	Coastal. Breeds August to January. Nest in sand.	3
		RECURVIROSTRIDAE	
182.	47. Cladorhynchus leucocephalus (Banded Stilt)	Usually in interior of State. Prefers brackish water areas. Swamps, shallow lakes, etc. Breeds according to food supply.	3
181.	48. Himantopus himantopus leucocephalus (White-headed Stilt) (Black-winged Stilt)	Shallow lakes, swamps, tidal flats. Breeds August to December. Nest is often in mud near water.	3
183.	49. Recurvirostra novaehollandiae (Red-necked Avocet)	Lakes, streams, swamps, fresh and salt waters. Breeds August to December. Nest often on reed isles in swamps.	1

No.	Name	Notes	Nest
		LARIDAE	
194.	50. Chlidonias hybrida fluviatilus (Whiskered (Marsh) tern)	Flocks on lakes and swamps. Breeds October to December. Migratory.	2
196.	51. Hydroprogne tschegrava (Caspian Tern)	Coastal, on islands, near rivers. Breeds October to February in S.A. Partly migratory. Has bred at Encounter Bay, lakes, Coorong. Nest in sand.	3
201.	52. Sterna albifrons sinensis (Little Tern)	Highly migratory. Has bred at the Coorong.	
	53. S. nersis nersis (Fairy Tern)	Localised, sedentary. Has bred at the Coorong	

6.3.4 REPTILES OF THE RIVER MURRAY

Family	Name	Habitat	Feeding	Breeding and Other notes	South Australian Museum Records
VARANIDAE (Goannas)	1. Varanus gouldii (Sand Goanna)	Burrows in sandy areas.	Insects, spiders, etc. lizards, snakes, warm-blooded animals.	Egg laying	Purnong to Renmark.
	1a. V. g.rosenbergii	Sandy areas	as above	Egg laying	Lake Alexandrina
AGAMIDAE (Dragons)	2. Amphibolurus barbatus (Bearded Dragon)		Omnivorous (Insects, other reptiles, vegetation).	Female scoops a hole and buries herself in it to lay the eggs. 8 to 24 eggs are laid. Once eggs are laid mother emerges and covers the hole.	Purnong.
	3. A. fordi				Waikerie to Chowilla
	4. A. muricatus (Tree Dragon)		Insectivorous	About 8 eggs laid at a time.	Purnong.
	5. A. pictus (Painted Dragon)	Sandy soil			Tailem Bend to Blanchetown, Waikerie, Renmark and Chowilla
	6. Tympanocryptis lineata (Lined Earless Dragon)	Stony soils or rocky outcrops			Blanchetown
SCINIDAE	7. Cryptoblepharus Boutonii (small Tree Skink)				Sinclair Flat
	8. Ctenotus atlas (Species of the genus Ctenotus are commonly known as striped skinks)				20 miles NW of Renmark.

Family	Name	Habitat	Feeding	Breeding and Other notes	South Australian Museum Records
	9. Ct. brooksi				12 miles NE of Blanchetown.
	10. Ct. leonhardii (Leonhard's Skink)				Renmark and Chowilla.
	11. Ct. brachyonyx				Purnong.
	12. Ct. regius				32 miles NNW of Renmark.
	13. Egernia inornata (Desert Skink)			Gives live birth	20 miles NNW of Renmark.
	14. E. striolata (Tree Skink)	Probably in wooded areas. Often lives in dead tree stumps.			Tailem Bend to Purnong.
	15. E. whitei (White's Skink)	Wetter areas. Lives mainly under rocks.	Insects, snails, berries.	Give live birth, 2 - 3 young per season.	Purnong.
	16. Hemiergis decresiensis (Three-toed Skink)	On loamy or stony soils. Live under bushes, stones or litter.			Waikerie
	17. H. peronii (Four-toed Skink)	Sandy areas. Under bushes, stones etc.			Tailem Bend to Purnong.
	18. Lerista bouganvilli (Bouganville's Skink)				Meningie
	19. L. punctatovittata				Purnong and Blanchetown

Family	Name	Habitat	Feeding	Breeding and Other notes	South Australian Museum Records
	20. Menetia greyii (Snake-eyed Skink species)				Tailem Bend to Renmark
	21. Morethia obscura (Snake-eyed Skink species)				Tailem Bend to Renmark
	22. Sphenomorphus quoyii (Water Skink)	Watercourses	Insects and fruit	Gives live birth - about 8 young at a time. Darts into water when alarmed.	Sinclair Flat.
	23. S. richardsoni (Desert Banded Skink)	Hides in rabbit burrows during day.	Feeds at dark		Portee Station
	24. Tiliqua occipitalis (Western Blue-tongue)	Often in mallee areas.			Tailem Bend and Berri
	25. T. scincoides (Blue-tongue)		Snails, insects, fruit	Gives live birth - 6 to 20 young per litter	Usually limited to the S.E.
GEKKONIDAE	26. Diplodactylus damaeus				Loxton
	27. D. elderi (Jewelled Gecko)	Spring tussocks of porcupine grass (Triodia)			Loxton and Renmark
	28. D. ciliaris intermedius				Purnong
	29. D. vittatus (stone Gecko)	Under stones			Purnong
	30. Gehyra variegata (Dtella)	Amongst bark or debris			Devon Downs to Chowilla

Family	Name	Habitat	Feeding	Breeding and Other notes	South Australian Museum Records
	31. Heteronotia binoei (Bynoe's Gecko)	Under stones and debris			Brookfield Zoo Wombat Reserve (near Blanchetown)
	32. Phyllodactulus marmoratus (Marbled Gecko)	Under loose bark, stones, debris			Goolwa to Chowilla
	33. Phyllurus milii (Barking Gecko)	Rocky areas			Tailem Bend to Waikerie
	34. Rhynchoedura ornata (Beaked Gecko)	Ground species, living in earth cracks.			Purnong
PYGOPODIDA (Legless Lizards)	35. Aprasia pulchella (Worm Lizard species)				Purnong to Renmark
	36. A. striolata (Worm Lizard species)				Meningie
	37. Delma grayi (a "Delma")			A new species of the genus Delma has been found 3 miles NW of Tailem Bend. It has not been studied sufficiently to warrant a new name yet.	Purnong and Waikerie
	38. Lialis burtonis (Burton's Legless Lizard)		Lizard eater (small skinks and Geckos)		Morgan to Berri
TYPHLOPIDAE (Worm Snakes)	39. Rhamphotyphiops bituberculatus (Blind Snake species)				Tailem Bend to Waikerie
	40. Rh. australis (Blind Snake species)				Tailem Bend to Renmark

Family	Name	Habitat	Feeding	Breeding and Other notes	South Australian Museum Records
BOIDAE (pythons)	41. Morelia argus variegata (Carpet snake)		Warm blooded animals usually	Egg layer. This is a rare species, probably restricted to the Murray Valley.	Cobdogla, Loxton and Barmera
ELAPIDAE (front fanged snakes)	42. Brachyaspis curta (Bardick)		Insects, lizards, frogs, etc.	Gives live birth - 9 or 10 young per litter. Is partly nocturnal.	Waikerie
	43. Demansia textilis (common brown snake)		Lizards, other snakes, frogs, mice.	About 20 to 30 eggs laid each season. Considered dangerous.	Murray Bridge to Purnong, and Waikerie
	44. Denisconia coronoides				Tailem Bend
	45. D. gouldii (Black naped snake)				Ridley National Park and Waikerie
	46. Notechis scutatus (Tiger Snake)	In large colonies in swampy areas, shelter in earth cracks, yabby holes, hollow logs etc.	Frogs, lizards, rats, mice	Gives live birth - up to 30 in litter. Mostly diurnal, but nocturnal on warm summer nights. Is considered dangerous.	Miland to Mannum
	47. Pseudechis porphyriacus	Forests and swamps	Frogs, lizards, mice, rats and other snakes	Gives live birth - 12 or more young per litter. Is considered dangerous.	Mannum
	48. Vermicella australis (species of the genus Vermicella are known as Burrowing Snakes)				Purnong
	49. V. annulata (Bandy Bandy)		Exclusively on worm snakes.	Egg layer	Renmark

Family		Name	Habitat	Feeding	Breeding and Other notes	South Australian Museum Records
	50.	V. fasciolatus				Murray Bridge and Berri
	51.	V. occipitalis				Morgan
CHELYIDAE (Tortoises)	52.	Chelodina expansa (Broad shelled Tortoise)	Stream and river systems.	Carnivorus (Frogs, insects, small fish)	Females leave the water to deposit eggs. Nests are dug out of the ground, and are usually well concealed. Nest is usually further from the water than in other species	Upper reaches of Murray
	53.	Ch. longicollis (Common Long neck)	Ponds and streams	Carnivorous (Insects, frogs, tadpoles, small fish)	As above, but nests usually closer to water.	Tailem Bend to Renmark
	54.	Emydura macquarii	Stream and river systems	Basically carnivorous will eat water weeds.	As for Common Long neck	Lake Alexandrina to Renmark

The following species may possibly occur in the Murray Valley.

55. Varanus varius (F. Varanidae), Lace Monitor - Feeds mostly on warm blooded animals, and may feed on other lizards. The female scoops a hold and buries herself in it to lay the eggs. 3 to 24 are laid. Once the eggs are laid, the mother emerges and covers the hole. Probably just in the River Valley,

56. Amphibolurus nobbi coggeri (F. Agamidae), Nobbi; distributed widely in State.

57. Tiliqua rugosa (F. Scincidae), Stumpy Tail - An omnivorous feeder.

58. Acanthopsis antarcticus (F. Elapidae), Death Adder - Burrows beneath loose ground cover. The tail is shaped like a segmented caterpillar and is used to lyre food. Diet consists of warm blooded animals and lizards. Gives live birth to 9 to 15 young per litter. It is a largely nocturnal species and is considered dangerous to man. Distributed widely.

59. Demansia nuchalis (F. Elapidae), Western Brown Snake - Eats lizards, frogs, mice and perhaps other snakes. About 20 to 30 eggs are laid each season. Widely distributed.

60. D. psammophis (F. Elapidae), Yellow-faced whip snake - Usually found in savannah areas. Eats small skinks. About 6 eggs are laid each year.

61. Denisonia suta (F. Elapidae)

62. Pseudechia australis (F. Elapidae), Mulga Snake - Eats rats, mice and lizards, occasionally on other snakes. Gives live birth and is nocturnal in the tropics. Considered dangerous. 1 specimen collected 3 km NW of Nulla Homestead, N.S.W. Usually in drier areas outside Riverine tract.

Note:

1) Nomenclature is correct to the end of 1973.

2) Genera are placed in alphabetical order under the appropriate families.

3) Family names are in capitals.

4) "South Australian (S.A.) Museum Records" column lists the locations at which the species have been found, as by museum records. Tree ranges of each species along the River may well be extended, but the list serves adequately as a guideline.

5) Data on the biology of many reptiles is scanty. It has been necessary therefore to leave many blanks throughout this list.

References:

Paul Hamlyn Pty. Ltd. - "The Venemous Australians", Eclipse Books, 1970.
T.F. Houston - "Reptiles of South Australia", In "South Australian Year Book, 1973".
Eric Worrell - "Reptiles of Australia", Angus and Robertson, 1963, 1970. Distribution data of species numbered 55-62 are from T.F. Houston (pers com.)

Acknowledgements: Terry Houston, Curator of Herpetology, S.A. Museum - for guidance, information and time.

6.3.5 MAMMALS OF THE RIVER MURRAY

LIST AND BIOLOGY OF THE MAMMALS FOUND AT OR NEAR THE RIVER MURRAY IN SOUTH AUSTRALIA.

Notes: (a) The sympol (I) indicates that this is an introduced species.

(b) Some of these species may be restricted to the upper regions of the Murray as far as occurrence along the River is concerned. This is due to the large amounts of adjacent scrub not found elsewhere along the River in S.A.

References:

K.N.G. SIMPSON (1973) - "Amphibians, Reptiles and Mammals of the Murray River region between Mildura and Renmark Australia." Memoirs Nat. Mus. Victoria, No. 34, pp. 275-280.

C.H.S. WATTS (1972) - "Handbook of South Australian Rodents and Small Marsupials". Field Naturalists" Society of South Australia (Inc.).

F. WOOD JONES (1923-1925) - "The Mammals of South Australia, Parts I - III" Govt. Printer, Adelaide. Photolitho reprint, 1968.

Acknowledgements:

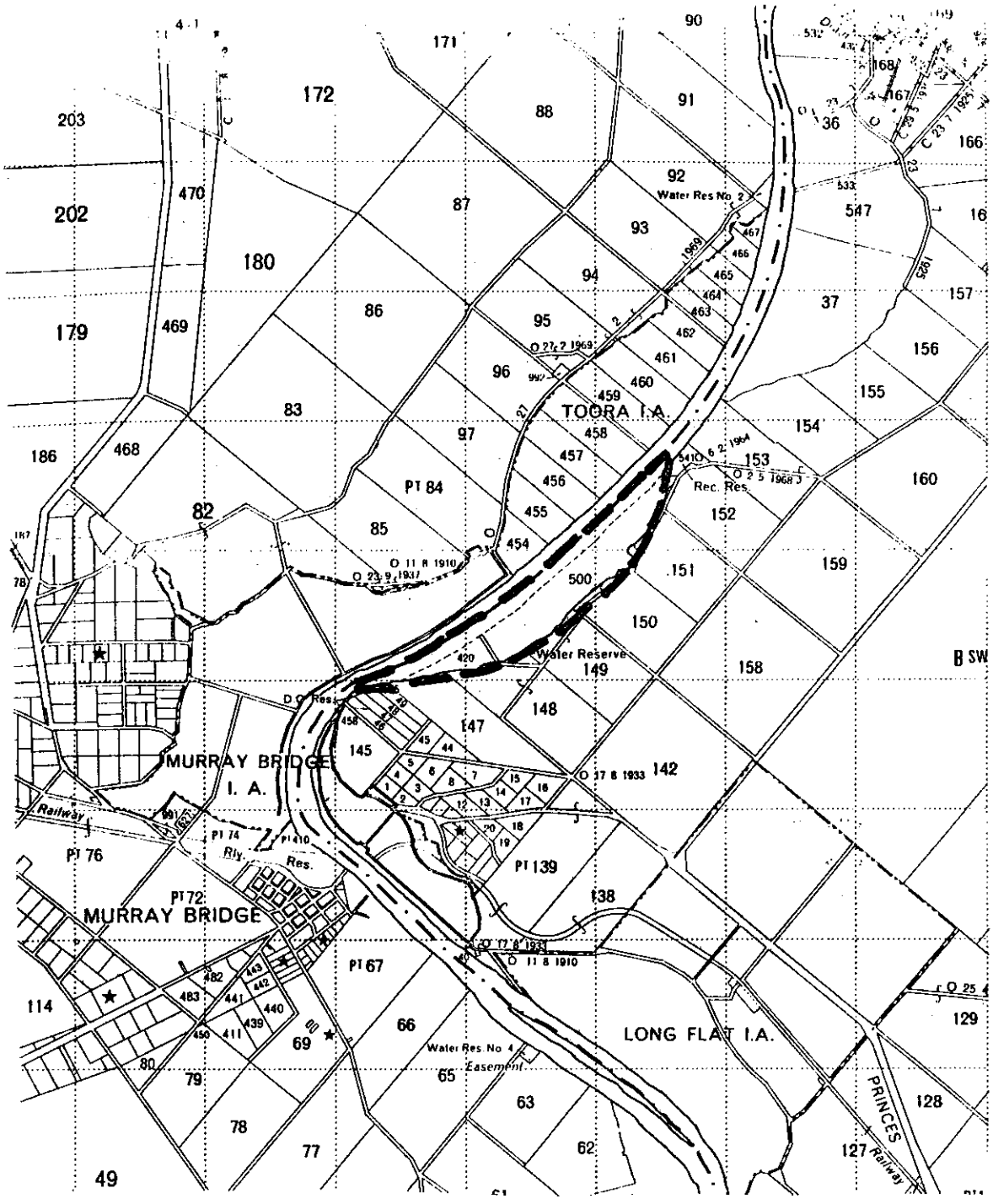
Peter Aitken, Curator of Mammals at the S.A. Museum and Mark Barritt, M.Sc. student, Flinders University for information on the genus Rattus.

ORDER MONOTREMATA	
1. Platypus (Ornithorhyncus anatinus)	It is doubtful whether this occurs in - it could possibly be nearer the S.A.-N.S.W. border. Either way, its numbers would not be great in S.A.
2. Echidna (Tachyglossus aculeatus)	Is present around the S.A. - N.S.W. border. Has no particular habitat preference. Is nocturnal and feeds on insects.

ORDER MARSUPIALIA	
3. Fat-tailed Dunnart (Sminthopsis crassicaudata)	Occurs in various habits but expecially in flood plains where the vegetation remains green for longer periods of time. Forms burrows in sandhills and in cracks in the earth. Feeds on insects, breeds during June and July producing an average of 6 young per litter.
4. Dunnart or Grey Marsupial-Mouse (S. Murina)	Habitat preferences as in S. crassicandata. Feeds on insects.
5. Swamp Phascogale (Antechinus minimus)	In damp areas usually with a thick ground cover of grass. Builds nests of grass.
6. Feathertail Glider (Acrobates pygmaeus)	Found in wooded areas. Is nocturnal and feeds on fruit, nectar, leaves, perhaps insects as well.
7. Brush-tailed Possum (Trichosurus vulpecula)	Habitat is variable - it is a specialised arboreal creature, but will thrive in treeless areas using rabbit burrows for cover. Appears to be common in the willows fringing the River, at least around the S.A. - N.S.W. border. Breeding occurs in June.
8. Euro (Wallaroo) (Macropus robustus)	Occurs usually in small communities. Forms at patchy distribution around the S.A. - N.S.W border.
9. Black-faced Grey (Mallee) Kangaroo (M. fuliginosus melanops)	Occurs around S.A. - N.S.W. border.
10. Red Kangaroo (Megaleia rufa)	Occurs around S.A. - N.S.W. border.

ORDER CHIROPTERA (Bats)	
11. Sharp-nosed Bat (*Taphozous australis*)	Its present has been indicated around the S.A. - N.S.W border. A nocturnal species, as are all bats.
12. Geoffroy's Long-eared Bat (*Nyctophilus geoffroyi*)	Occurs in timbered areas. Makes a home in dead branches on trees or beneath a loose slab of bark. Presence indicated in same area as No. 11.
ORDER RODENTIA	
13. (Australian) Water Rat (*Hydromys chrysogaster*)	Inhabits banks of water-courses where it builds a burrow. Feeds on yabbies, shell-fish, some aquatic plants, and on fish which are caught in nets. Is a nocturnal animal, breeds during late winter to early summer, producing 3 - 4 young per litter.
14. Swamp Rat. (*Rattus lutreolus*)	Inhabits damp areas, usually at the edge of water. Feeds on plants, bulbs, seeds, eggs, nestlings, dead birds. Produces 4-5 young per litter. Mainly around southern parts of River, i.e. the Lakes up to Wellington.
15. Brown Rat (*R. norvegicus*).	Lives around areas of human habitation and along high banked creeks. Builds burrows, eats seed, green plants, fruit, nuts, insects, frogs, yabbies. Produces up to 12 young per litter.
16. Black Rat (*R. rattus*) (I)	Inhabits agricultural land, towns and scrub. Builds burrows, or is found among rocks or in buildings. Feed on seed, plants, nuts, fruit, insects. Breed all year producing 5-10 young.
17. Mitchell's Hopping Mouse (*Notomys mitchellii*)	Inhabits sandy heath areas or mallee, and builds burrows. Eats vegetation, seed and some insects. 3-5 young per litter.

18. House Mouse (Mus musculus) (I)	Ubiquitous, but has a preference for sandy and cultivated areas. Builds burrows and feeds on green plants, seeds and insects. Products up to 12 young per litter.
ORDER LAGORMORPHA	
19. Rabbit (Oryctolagus cuniculus) (I)	Little needs to be said. It was introduced to Australia from 1840. Is an agricultural pest, but is probably not a "pest" as far as the native fauna are concerned, though some competition for habitat may occur.
20. Hare (Lepus europaeus) (I)	Unlike the rabbit, the hare does not build burrows. It does not appear to be much of an agricultural or ecological menace. Will not inhabit arid saltbush-bluebush areas.
ORDER CARNIVORA	
21. Red Fox (Vulpes vulpes) (I)	Like the rabbit this is considered an agricultural pest due to predation on livestock, but is not as common. Its predation has probably reduced the numbers of some small marsupials and rodents.
22. Domestic Cat (Felis catus) (I)	Wild feral cats may be found in many areas both near and away from human habitation. They constitute an agricultural pest, and a danger to small marsupials and rodents on which they may feed.
ORDER ARTIODACTYLA	
23. Goat (Capra hircus) (I)	Goats which have escaped from activity may be found roaming free around the S.A. - N.S.W. border, as well as other areas.
24. Pig (Sus scrofa) (I)	Similar situation as with goats.



▬▬▬ APPROXIMATE BOUNDARY OF PROPOSED CONSERVATION AREA

Scale 1:50 000

Source : South Australian 1:50 000 Cadastral Series, Sheet 6727-I

FIGURE 19

River Glades

4.17 Sunnyside Swamp

Figure 20.

Description - The name Sunnyside Swamp refers to two artificially separated swamps called Sunnyside and Sellick's Swamps. The land between the two parts of the swamp has been drained, and now supports cattle grazing. Sunnyside Swamp is similar to the River Glades, consisting basically of reed shores and islands. The area has received a considerable amount of publicity, and attempts have been made since at least 1968 to acquire the swamp.

Significance - What has been said about the River Glades equally applies here. This is a relatively unique swamp for this part of the River, and it supports a number of water bird species, the most numerous being Swans.

Proposal - This area should be acquired and declared a Conservation Park. The swamp areas should be acquired first, and the drained portion bought up eventually and reflooded. This would not simply be to increase the total area of swamp, but to rid the area of the effects of agricultural practices. The cattle in this central portion would destroy the vegetation bordering the swamp and may be a disturbing influence on the water birds.

Management - The small size of Sunnyside Swamp makes it necessary to disallow human access into the area.