JENNY ARNOLD'S

PERTH WETLANDS RESOURCE BOOK

CHAPTERS 12 - 15

WETLANDS OF THE EASTERN COASTAL PLAIN
AND OF THE INNER CENTRAL SUBURBAN AREA

WETLANDS OF THE RIVERS AND ESTUARIES IN PERTH
AND OF THE SERPENTINE REGION

ENVIRONMENTAL PROTECTION AUTHORITY
AND THE WATER AUTHORITY OF WESTERN AUSTRALIA

BULLETIN 266 DECEMBER 1990

Jenny Arnold's Perth Wetlands Resource Book

Chapters 12 - 15: Wetlands of the Eastern Coastal Plain and of the Inner Central Suburban Area. Wetlands of the Rivers and Estuaries in Perth and of the Serpentine Region

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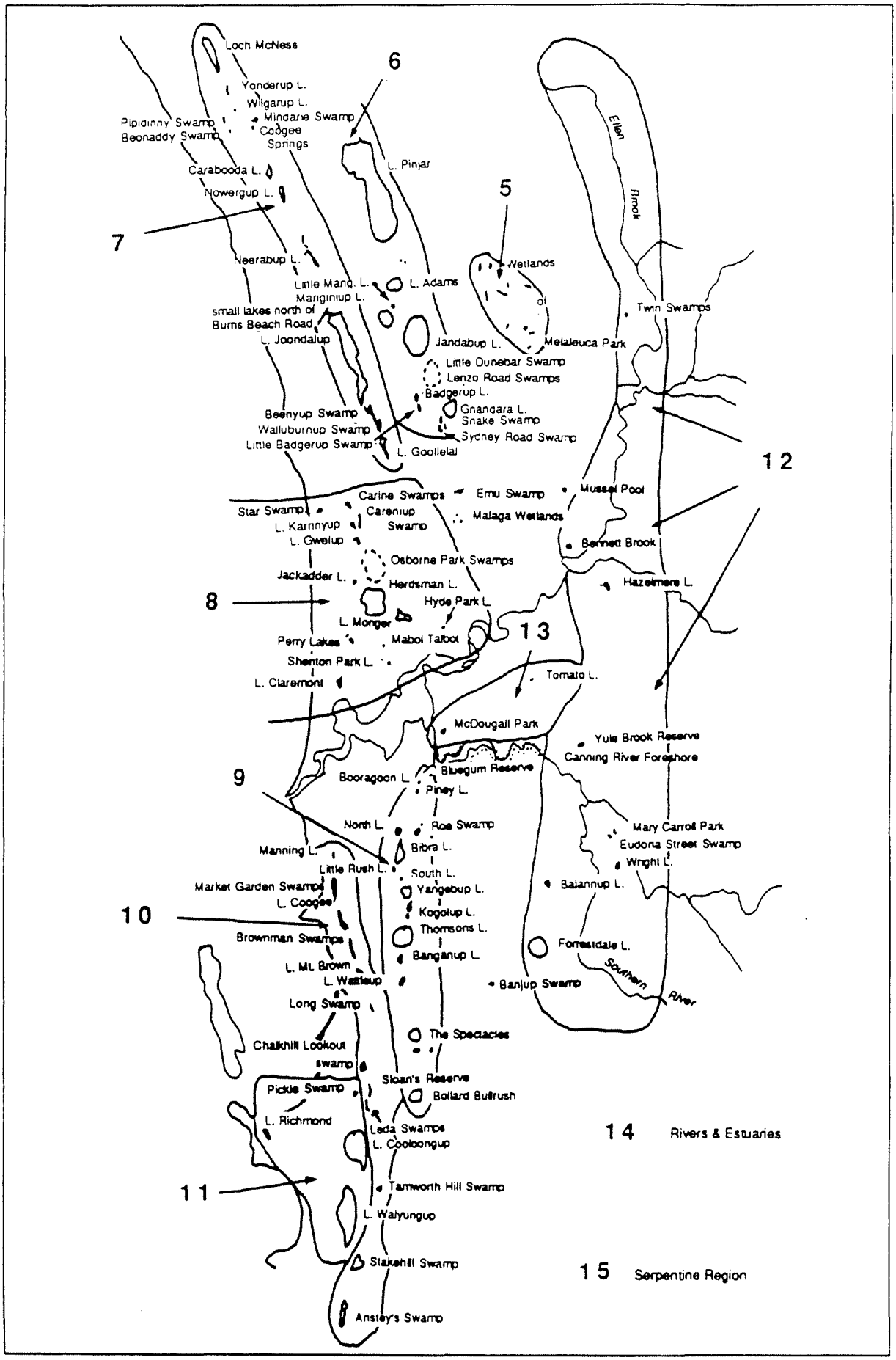
NOTES FOR USERS

Bulletin 266 consists of 15 chapters published in 6 separate volumes.

Chapters 1 - 4 (bound with the appendices) contain information general to wetlands. They form essential background to the subsequent chapters which describe most of the clearly definable seasonal and permanent lakes with open water. As such readers of Chapters 5 - 15 should be used in conjunction with Chapter 1 - 4.

The Bulletin is not an exhaustive inventory of all wetland types. Readers are referred to C. A. Semeniuk (1987), Wetlands of the Darling System - A geomorphic approach to habitat classification. Journal of the Royal Society of Western Australia. Volume 69, Part 3. pp 95-112 for a comprehensive classification of wetland types on the Swan Coastal Plain.

The index map on page (ii) shows how the wetland chains have been grouped into chapters. The position in the text where individual wetlands are discussed is shown in the index on page 418 (Chapters 1 - 4).



Map of Perth's wetlands showing the grouping of wetlands into Chapters in this Bulletin.

Chapters 12 - 15: Wetlands of the Eastern Coastal Plain and of the Inner Central Suburban Area. Wetlands of the Rivers and Estuaries in Perth and of the Serpentine Region

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12. WETLANDS OF THE EASTERN COASTAL PLAIN (Figure 12.1)

12.1 GENERAL

12.1.1 'SOUTHERN RIVER'

There are many seasonal wetlands on the crest, and north-eastern and eastern flanks of the Jandakot Mound. The geomorphology of these wetlands has been variously classified as 'marsh in interdunal swale' (Gozzard, 1983) or 'eolian deflation hollow' (Jordan, 1986). The seasonal wetlands have swamp deposits in a thin veneer of Bassendean sand over clayey sands of the Guildford formation. Cross sections on environmental geology maps (Gozzard, 1983 and Jordan, 1986) elucidate the relationship of these wetlands to the elements of the coastal plain.

Figure 12.3 is a diagrammatic cross-section with extreme vertical exaggeration to illustrate the relationship of the wetlands to the water table and to water level records across the Jandakot Mound. When contour maps are superimposed on air photographs of the area striking relationships between vegetation and surface contours are evident. This no doubt indicates the important role depth to groundwater plays in determining vegetation boundaries. Havel (1979) discussed environmental factors, including moisture regime, which determine vegetation patterns.

Comparable to the situation south of the Swan Estuary, are the wetlands north of the Swan in the east of the metropolitan region in the area south of Gnangara Road and west of the Swan Valley. Figure 12.4 is a diagrammatic cross-section which indicates the relationships of these wetlands.

12.1.2 PINJARRA PLAIN

There are many seasonal wetlands on the eastern flank of the the Jandakot Mound and on the Pinjarra Plain. Almost all of them are in freehold land. North of the Swan River, comparable seasonal wetlands occur associated with Bennett Brook and Ellen Brook. The swamps often have a clay base, so that they fill rapidly in winter in contrast to sand-based wetlands further west which do not fill until sufficient rain has fallen to raise the water table. The following quotation is from Appendix 1 by D L Serventy, in Seddon (1972):

> "The third type of lake, or really pond, on the Pinjarra Plain, has considerable affinity with the clay-pan habitat of the northern and inland areas. These lakes are ephemeral, drying-up in summer. The water is opaque, due to colloidal clay particles in suspension."

The clay-based swamps on the Pinjarra Plain have been recognised as a hybridisation zone between two closely related species of frogs, Ranidella pseudinsignifera and Ranidella insignifera, the former breeding in temporary ponds on the plateau and the latter in the slow-filling sandy swamps of the coastal plain.

Semeniuk (in Western Australian Water Resources Council, 1987) recognises several suites of related wetland suites on the eastern coastal plain.

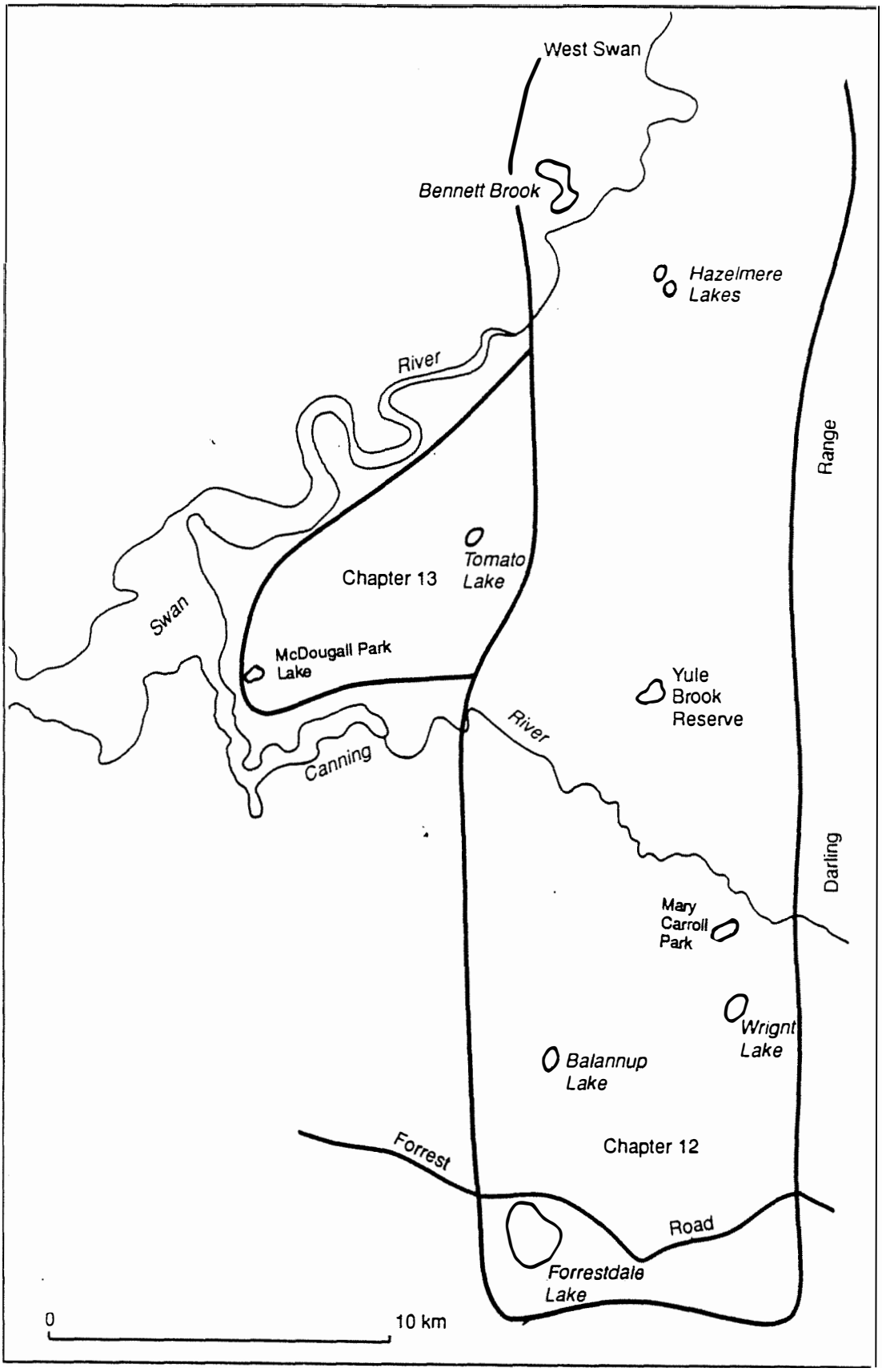

Figure 12.1 Map showing wetlands of the Eastern Coastal Plain (Chapter 12) and Inner Central Suburban Area (Chapter 13)

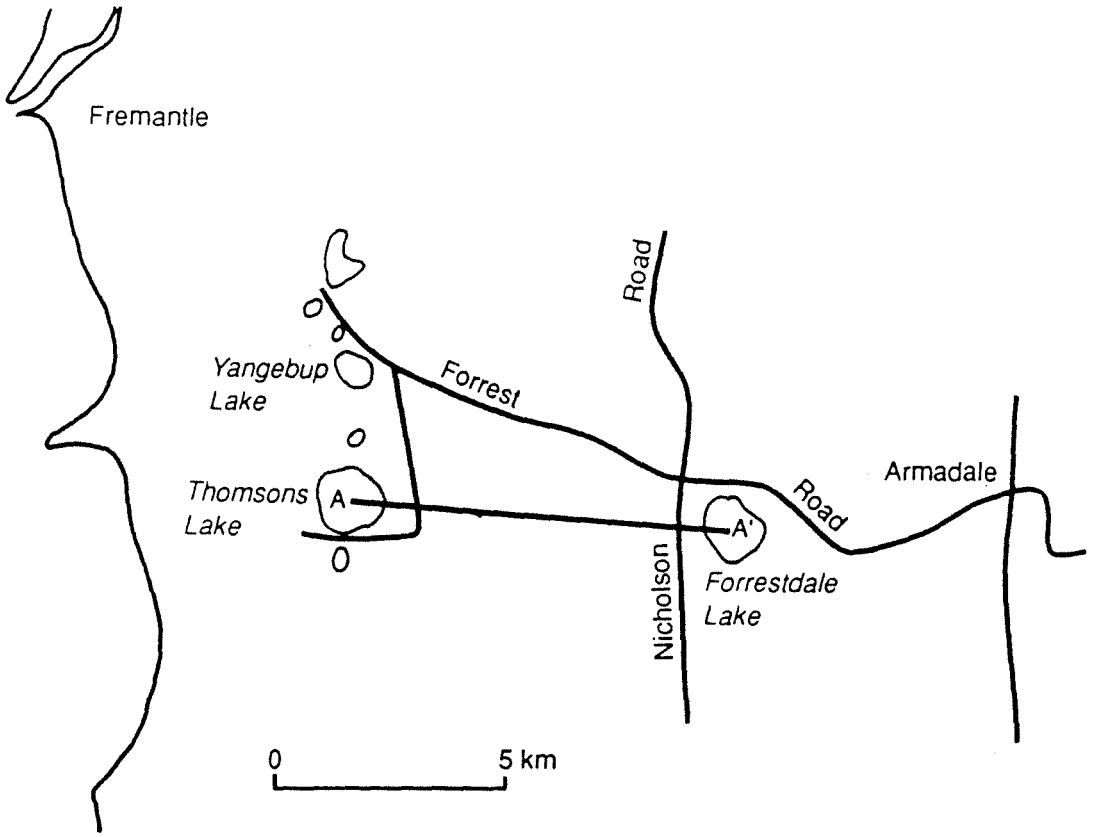

Figure 12.2(a) Location of diagrammatic cross-section across the Jandakot Mound shown in Figure 12.3

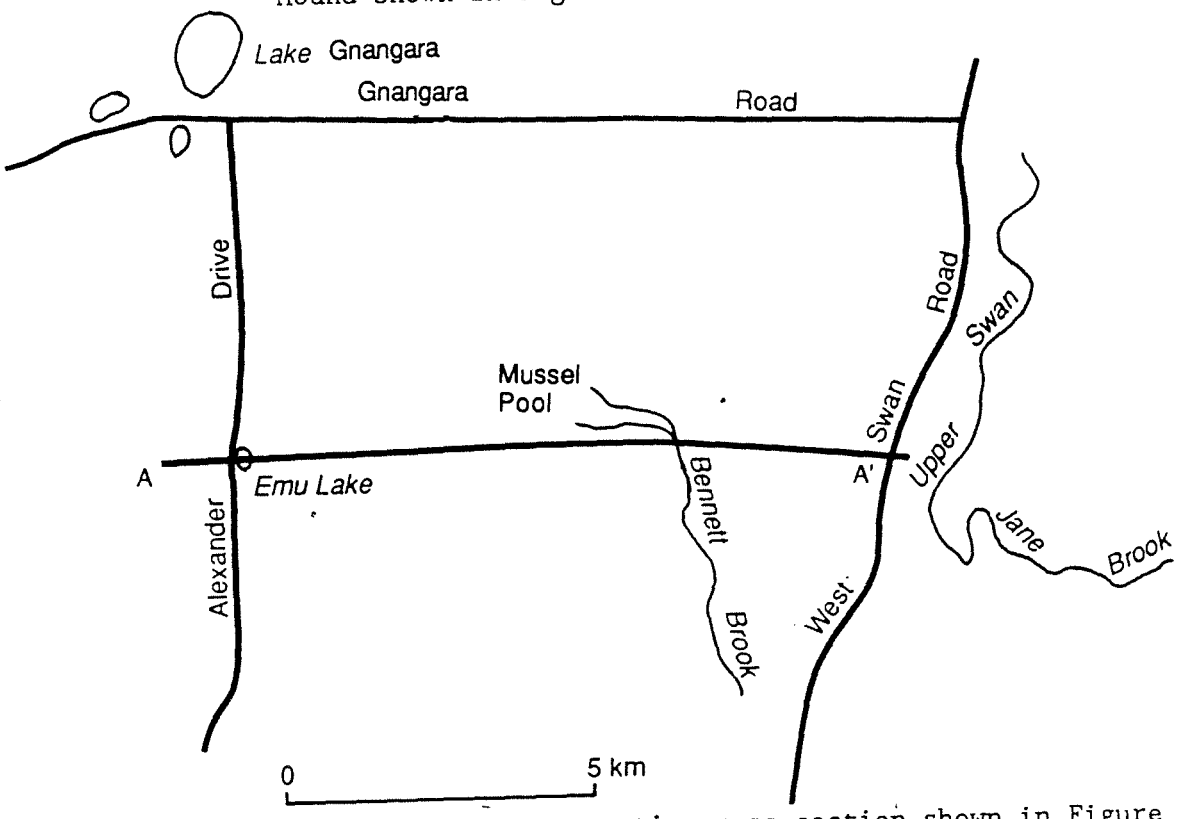

Figure 12.2(b) Location of diagrammatic cross-section shown in Figure 12.4

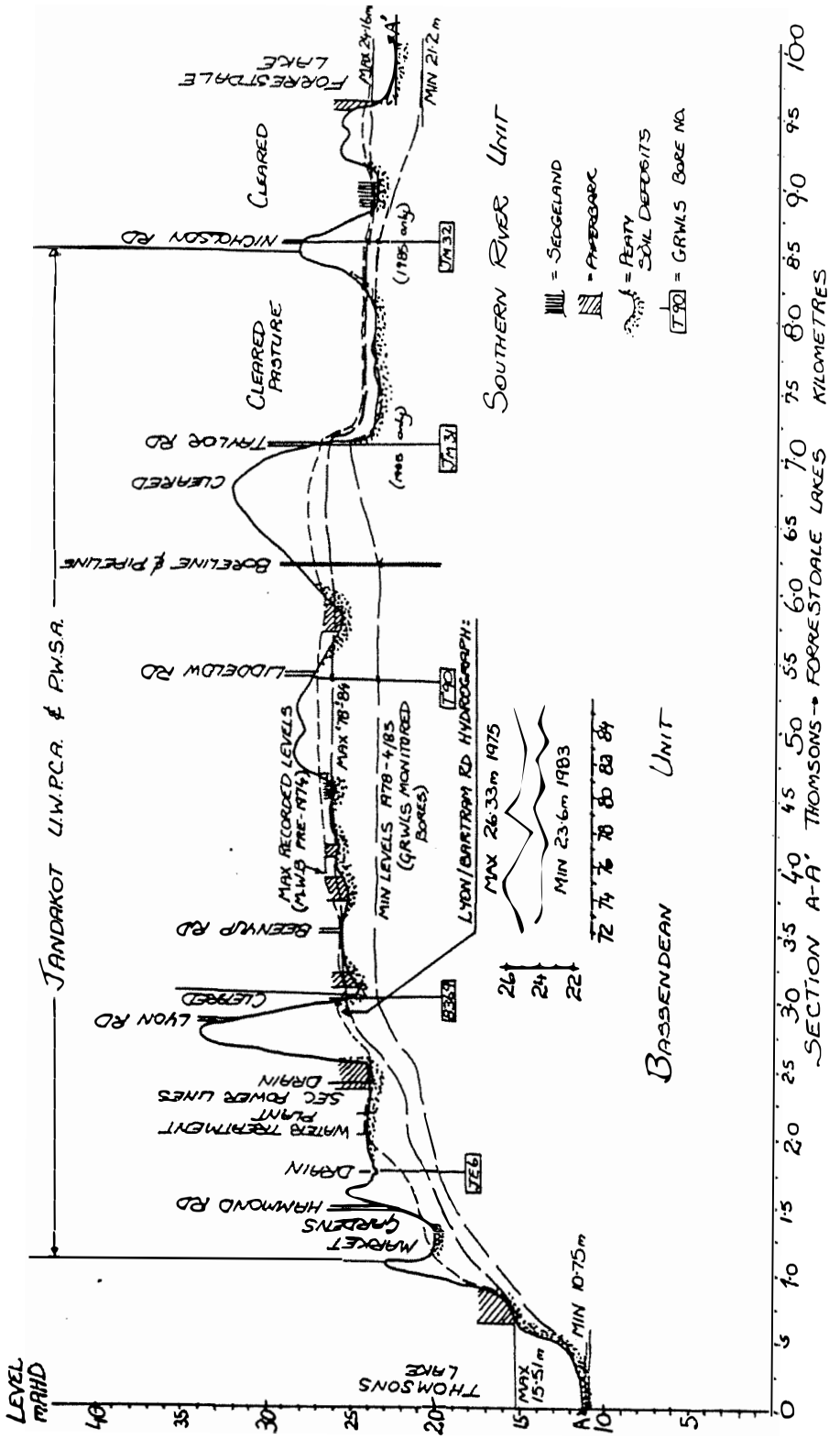

Figure 12.3 Diagrammatic cross-section across the Jandakot Mound.

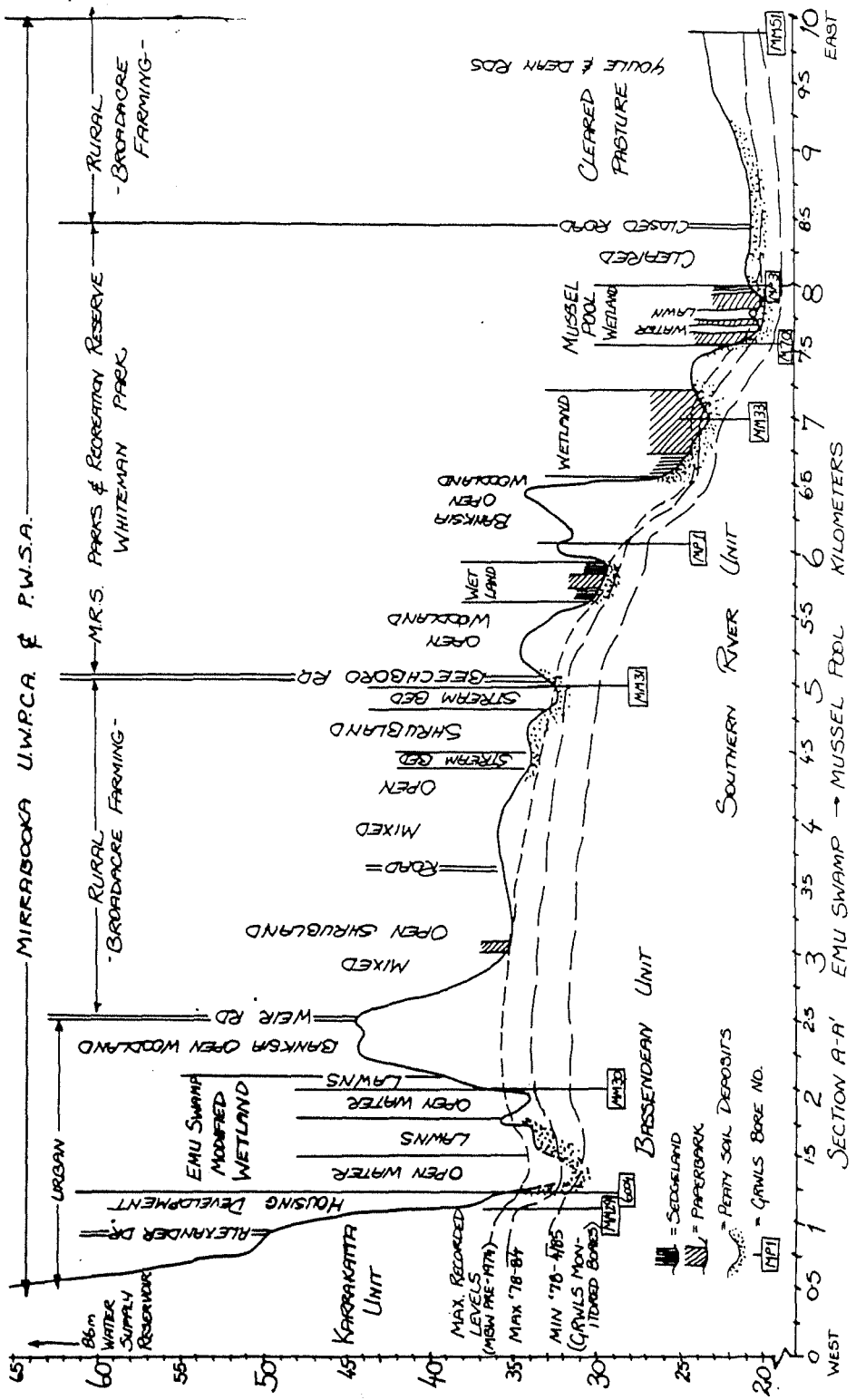

Figure 12.4 Diagrammatic cross-section Emu Swamp - Swan River.

The wetland in Ellen Brook Reserve at Upper Swan is of special significance as it is one of only two known refuges of the rare and endangered Short-necked Tortoise.

The Pinjarra Plain temporary swamps are likely to be important feeding and breeding areas for waterbirds. More information is required.

Flooding of low-lying, previously swampy land on the Pinjarra Plain at Westfield, near Armadale, in July 1987 has provided a warning about the hazards of development in these areas.

12.1.3 REFERENCES

Havel, J J (1979), Vegetation: natural factors and human activity. pp 122-152 in 'Western landscapes'. Edit J Gentilli. University of Western Australia Press, Nedlands, Western Australia.

Gozzard, J R (1983), Fremantle Part Sheets 2033 I & 2033 IV, Perth Metropolitan Region, Environmental Geology Series, Geological Survey of Western Australia.

Jordan, J E (1986), Armadale, Part Sheets 2033 I & 2133 IV, Perth Metropolitan Region, Environmental Geology Series, Geological Survey of Western Australia.

Western Australian Water Resources Council (1987), Environmental significance of wetlands in the Perth to Bunbury region. Volume 2. WAWRC, Leederville.

12.2 FORRESTDALE LAKE

12.2.1 GENERAL INFORMATION

LOCAL AUTHORITY: Town of Armadale
MRS ZONE: Parks and Recreation
RESERVE NUMBERS: A24781 for Conservation of Flora and Fauna; C37016 Protection of Flora and Fauna and Recreation; C27165 + freehold land
MANAGEMENT: Department of Conservation and Land Management: Management Plan establishes management objectives.
SYSTEM 6 RECOMMENDATION: M95.
WAC CLASSIFICATION: LE.f.l.se.o
DRAINAGE: Inflowing drain on western side; outflowing drain (?non-functional according to Bartle et al. 1987); stormwater inflow from Forrestdale townsite on the north-east.

12.2.2 PHYSIOGRAPHY AND GEOLOGICAL SETTING

The diagrammatic cross-section (Figure 12.3) shows the relationship of Forrestdale Lake to the Jandakot Mound. The Management Plan (Bartle et al. 1987) provides a general description of Forrestdale Lake. However, the following details are relevant. Forrestdale Lake is located in the Southern River landform (Churchward and McArthur, 1980). Other wetlands in this landform include seasonal wetlands in the localities of Forrestdale, Southern River, Huntingdale and Gosnells. Examples are Lake Balannup, Wright Lake, Mary Carroll Park and extensive areas which are inundated through mid-winter to spring.

Churchward and McArthur (1980) regarded the Southern River landform as a unit of the Bassendean Dunes, where sand appears to have blown over the alluvial soils so that the swamps often have a clay base. As a consequence of this structure, once the swamps have filled in winter there is little infiltration and they remain inundated well into spring.

Forrestdale Lake is the largest lake in this system and is apparently unique in its hydrological relationships to the unconfined groundwater aquifers of the region. It is a circular depression surrounded by a ring of low dunes. It appears to be a lake within a lake, with a second ring of dunes situated outside the first. Wind action appears to have played a large part in shaping the lake. The smaller Wright Lake north-east of Forrestdale Lake appears also to be a deflation basin. Analogues of Forrestdale Lake with respect to their hydrology may be lakes on the eastern flank of the Gnangara Mound near Gingin, such as Lake Bambun and the lake in Reserve 31402.

12.2.3 AREAS

Total area of reserve	243.6 ha
Wetland area	247.5 ha
Paperbarks	14.8 ha
Sedgeland	10.7 ha
Open water area	221.1 ha

12.2.4 HYDROLOGY (Figure 12.6)

The lake has been subject to marked changes in water level in recent years. These changes are discussed by Bartle et al., (1987).

Table 12.1. Forrestdale Lake: water levels 1971-84 (Water Authority of Western Australia water level records).

i Maximum level recorded 24.16 m AHD (1963).

ii Number of years the maximum level has fallen within the specified ranges.

m AHD	1971-75	1976-84
23.5-24.0	1	0
23.0-23.5	3	2
22.5-23.0	1	5
22.0-22.5	0	2

iii Minimum level recorded 21.11 m AHD (1984).

iv Number of years the minimum level has fallen within the specified ranges.

m AHD	1972-75	1976-85
22.0-22.5	3	2
21.5-22.0	1	3
21.0-21.5	0	5

After a marked fall in maximum levels from 1974 to 1979, maximum levels have been relatively similar, between 22.4 and 22.6 m AHD since 1979.

Low minimum levels and relatively early drying-out in summer possibly reflect reduced groundwater input in recent years.

Bathymetric contours of the lake show that the deepest points of the lake basin lie between 21.6 and 21.7 m AHD.

The following tabulation summarises available information on lake area, lake water level and depth and lake volume (source: Water Authority surface-area, surface-volume and volume-area curves):

Table 12.2. Forrestdale Lake: relationships between lake area, level and volume.

SURFACE AREA		LAKE LEVEL		VOLUME	
HECTARES	PERCENT	m AHD	DEPTH	m^3	PERCENT
224	100	23.70	2+m	3.40×10^6	100
168	75	22.65	c 1m	1.30×10^6	38
112	50	21.85	c20cm	0.10×10^6	3
56	25	21.70	<10cm	0.02×10^6	0.6

Recently less than 75% of the surface area and 38% of lake volume have been achieved at maximum lake levels.

12.2.5 WATER QUALITY

The Water Authority monitoring data for Forrestdale Lake are shown as figures by Bartle et al. (1987). They draw attention to high levels of phosphorus and nitrogen in the lake waters. Points of interest include:

- P levels are high relative to the Vollenweider index of eutrophication.
- A reduction in P levels appeared to occur between 1978 and 1982 but more recently levels have been rising.
- There is a falling trend in organic nitrogen levels but a marked rise in inorganic nitrogen since 1982.

If management of water quality is to be effective efforts should be made to explain the observed trends. Possible explanations may relate to increased input from septic tanks at Forrestdale (older installations will tend to be less efficient at retaining nutrients); increased fertiliser use; and changes in patterns of rural land use. Investigation of nutrient levels in groundwater around the lake may provide some insight.

12.2.6 LAND USE - Refer to Figure 12.5

12.2.7 VEGETATION (Figure 12.5)

The vegetation and fauna of the Forrestdale Lake reserve have been described in detail by Bartle et al. (1987) and detailed vegetation maps and lists of plant species are included. Bartle et al. (1987) identify four major vegetation associations: banksia woodland, acacia thicket, paperbark forest and bullrush stands; and four minor associations. They document the remarkable expansion of Typha in the 10 years since 1976 - a phenomenon which has also occurred in other wetlands of the region. It is noteworthy that there has been an expansion not only of Typha but of "other reeds and grasses", ie the influences favouring Typha also favour other fringing species. Related developments in wetlands of the region include the development of thickets of young paperbarks and flooded gums at lower levels than mature belts of these species. This suggests a vegetation response to lower water table levels through increased germination and/or survival of seedlings.

12.2.8 FAUNA

Bartle et al. (1987) document the fauna of the lake, in particular the large number of waterbirds, both in terms of species represented and numbers of individuals, which use the lake. The occurrence there of large numbers of breeding species and transequatorial migrants makes the lake especially important. It is noteworthy that the lake meets the criteria of a wetland of international significance. Notes on Forrestdale Lake as a bird-watching site are provided by Van Delft (1988).

The trend towards lower water levels, with the lake drying early in summer, will diminish the lake's value as a wildlife habitat, and expose it to increasing disruption from off-road vehicle use on the lake bed.

The aquatic animals of the water column and lake bottom are key elements of the lake ecosystem, contributing to the lake's value as a bird habitat. Large populations of chironomid midges swarm in spring and summer, causing annoyance to Forrestdale residents. However, these organisms provide a food source for waterbirds so that management of the populations assumes great importance. The midge fauna of the lake has been investigated (Davis et al. 1986). An initiative was announced in August 1987 of a project to be funded jointly by State Government and concerned local authorities which will investigate midge populations and midge control. This study will be undertaken by a group from Murdoch University led by Dr J Davis.

12.2.9 MANAGEMENT ISSUES

Stresses

These are discussed in detail by Bartle et al. (1987). They include:

- falling water levels;
- nutrient enrichment of lake waters;
- disturbance due to inappropriate recreational use; and
- pesticide application for midge control.

These stresses will become increasingly important as the human population of the region grows.

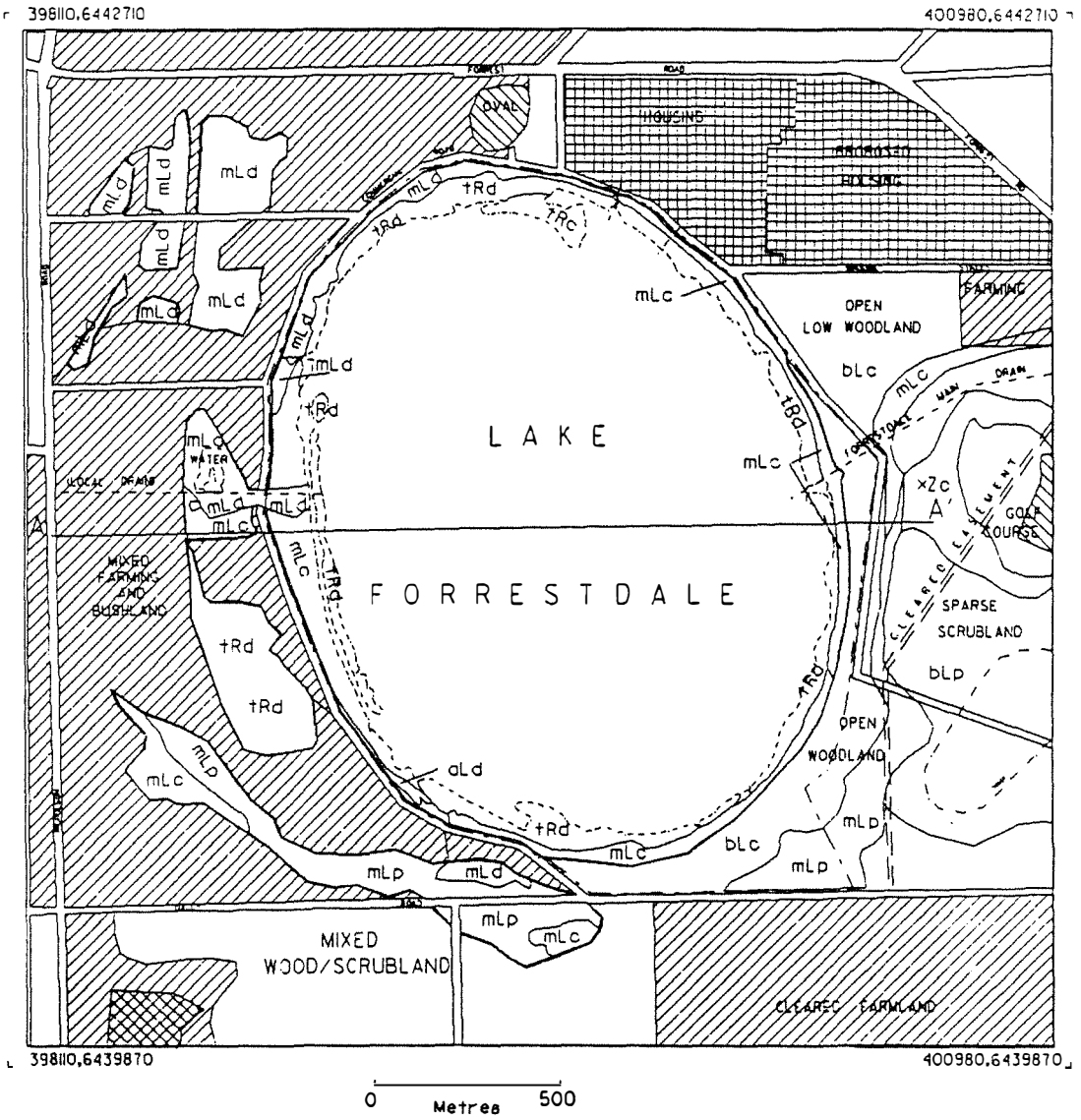

Figure 12.5 Forrestdale Lake: wetland plant communities and surrounding land use.

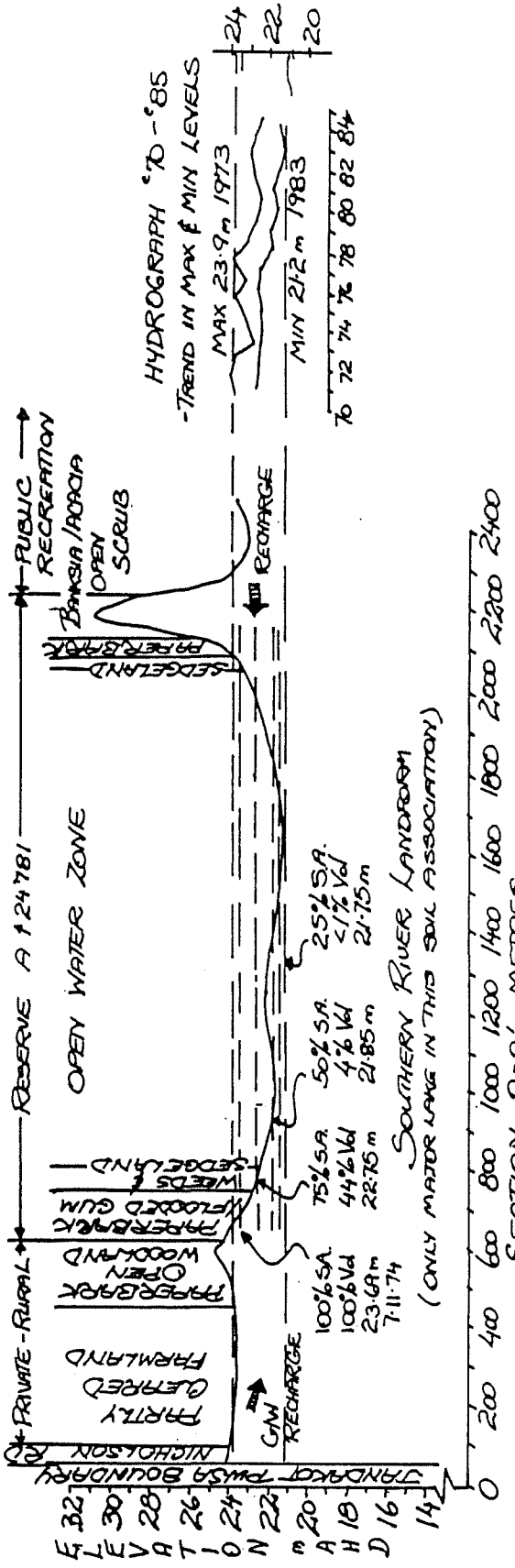

Figure 12.6 Forrestdale Lake: diagrammatic cross-section and water level record.

Management Issues

Management objectives are identified and procedures to be followed are described by Bartle et al. (1987).

Key issues are:

- maintenance of water levels so that summer levels are maintained into the autumn months;
- sources of nutrient enrichment to lake waters are identified and managed to minimise inputs to the lake;
- enhancement of natural vegetation;
- management of midge populations; and
- management of human use.

12.2.10 REFERENCES

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12.3 WRIGHT LAKE

12.3(a) GENERAL INFORMATION

LOCAL AUTHORITY: City of Armadale
MRS ZONE: Parks and Recreation
SYSTEM 6 RECOMMENDATION: n/a
WAC CLASSIFICATION: LE.f.sm.se.o.
DRAINAGE: Urban runoff.

12.3(b) SETTING (Figures 12.7 and 12.8)

Wright Lake is a small lake with a flat, shallow basin encircled by low dunes. Development approaches very close to the lake margins. The lake no doubt has a very important drainage function in this flat, low-lying area. There is apparently no information about water levels, water quality and wildlife values.

12.3(c) AREAS

Total wetland area	26.7 ha
Open water area	24.0 ha
Paperbark/Acacia	0.5 ha
Sedgeland	very small area
Modified	2.2 ha

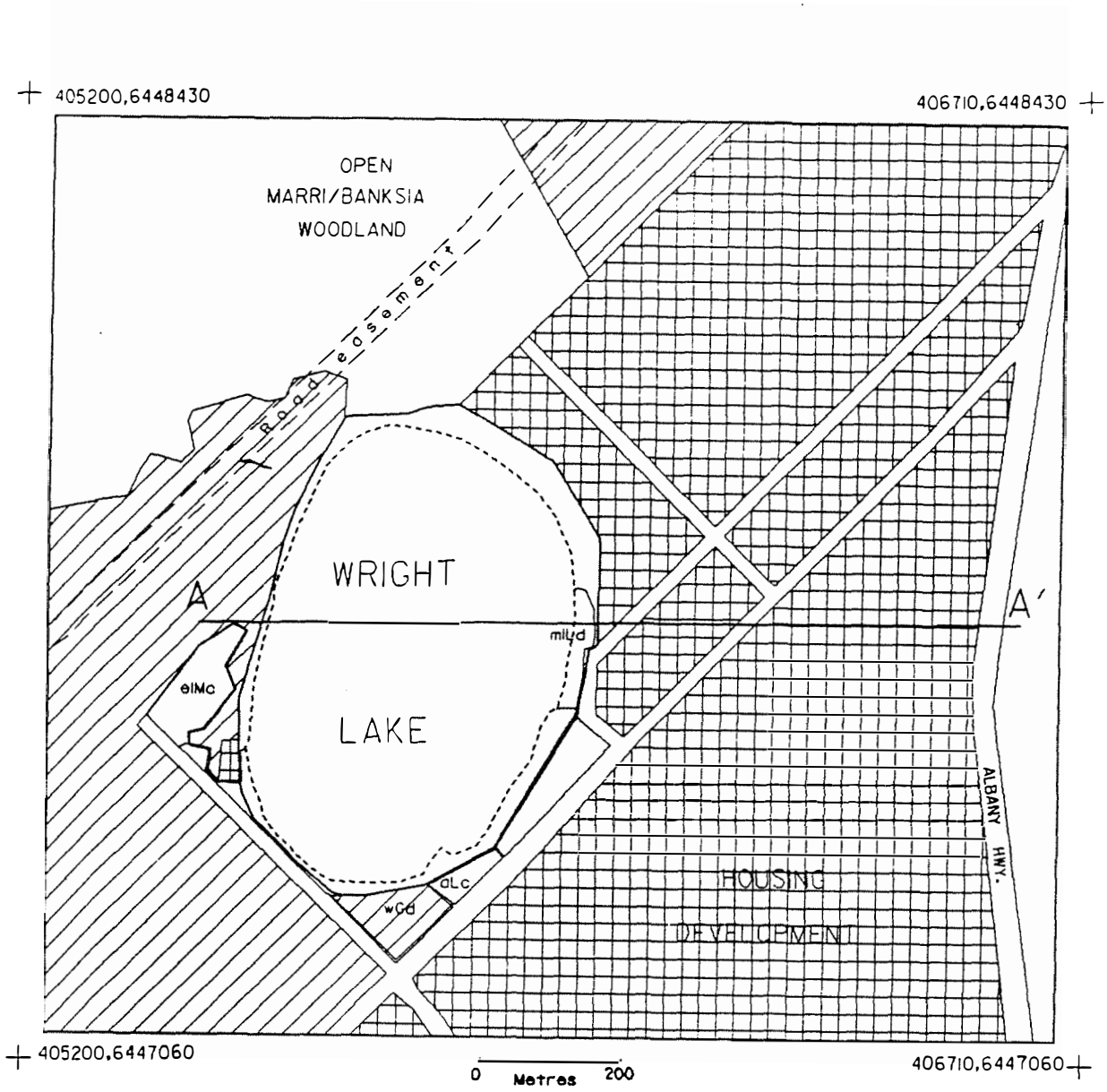

Figure 12.7 Wright Lake: wetland plant communities and surrounding land use.

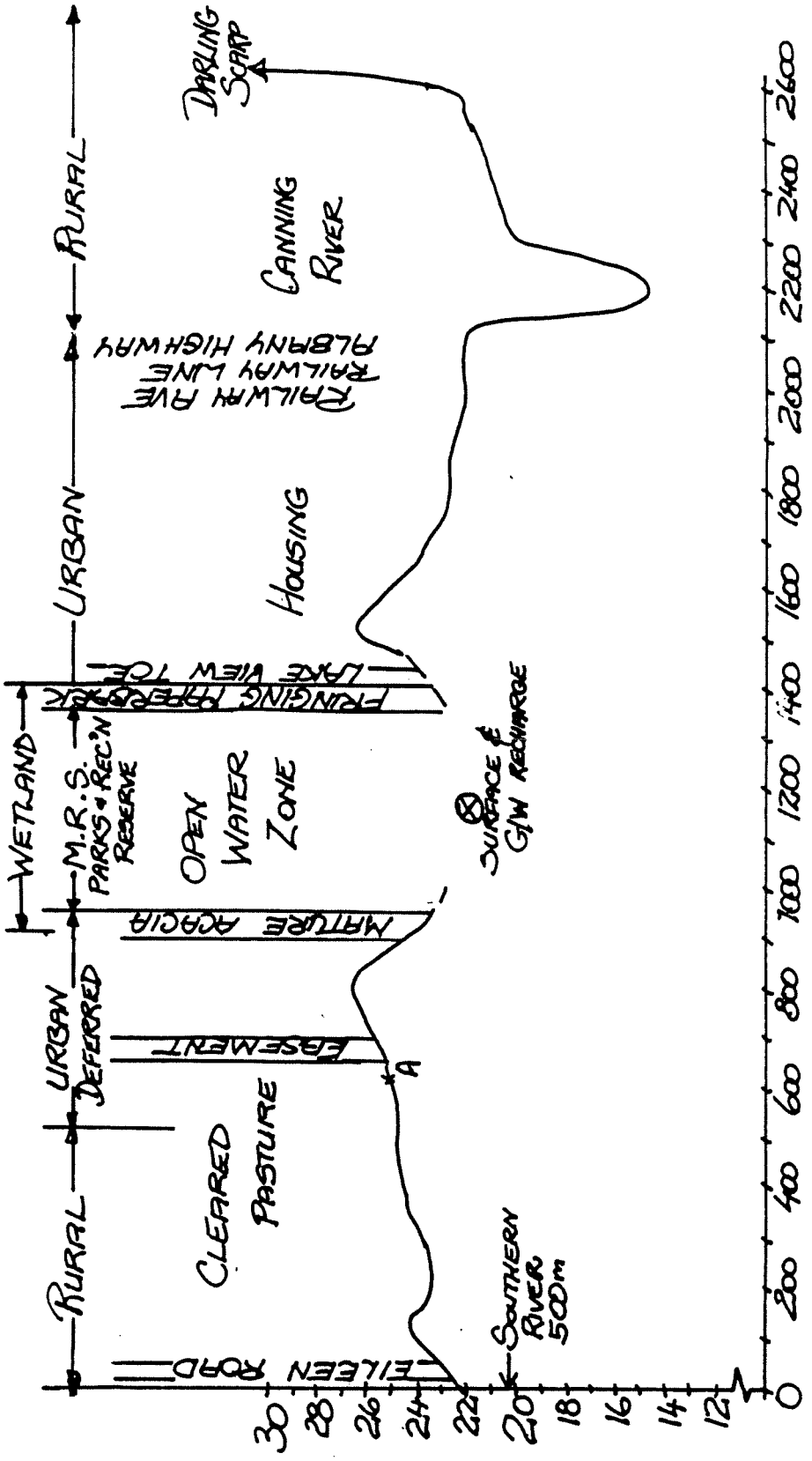

Figure 12.8 Wright Lake: diagrammatic cross-section.

12.4 MARY CARROLL PARK AND EUDORIA STREET SWAMP

12.4.1 GENERAL INFORMATION

LOCAL AUTHORITY: City of Gosnells
MRS ZONE: Urban
LAND STATUS: Reserves and Freehold land
SYSTEM 6 RECOMMENDATION: M76
WAC CLASSIFICATION: LE.f.sm.se.o.
DRAINAGE: Urban runoff

12.4.2 PHYSIOGRAPHY AND GEOLOGICAL SETTING

Eudoria Street Swamp and the swampland that has been modified within Mary Carroll Park are two small oval-shaped deposits of peat-rich sand west of the Canning River in Gosnells. The larger of the two, Mary Carroll Park, has been deepened to provide a drainage feature and lake within the park. Efforts are made to control the water level so that there is open water throughout the year.

12.4.3 AREAS

Areas below are for both swamps:

Total wetland		19.4 ha
Total reserved area	approx	16.4 ha
Total wetland in reserve	approx	15.3 ha
Sedgeland		3.5 ha
Paperbark		5.8 ha
Open water zone		5.7 ha
Modified (parkland)		1.4 ha

12.4.4 HYDROLOGY

The swamps receive their water as piped runoff from surrounding roads, partially unsewered residential areas and groundwater seepage. Overflow is to the Canning River. The outflow is managed so that the lake in Mary Carroll Park has permanent water to provide landscape amenity and a waterbird refuge.

12.4.5 WATER QUALITY

Two drain inlets, Verna Street and Coulston Way, and four sites in the Mary Carroll Park wetland, were sampled regularly from 7 January 1988. Analysis of the samples indicated several trends including:

- relative stability of total dissolved solids in the drain inputs but increasing concentration through summer in samples from the body of the lake; and

. differences in total nitrogen, phosphate and total phosphorus levels between the two drain inputs.

There is scope for a refined water sampling programme and careful analysis of the results.

12.4.6 LAND USE - Refer to Figure 12.9

12.4.7 VEGETATION (Figure 12.9)

Both wetlands have healthy fringes of flooded gum, swamp paperbark (Melaleuca rhaphiophylla) and Melaleuca teretifolia. Eudoria Street Swamp supports vigorous stands of Typha orientalis. Typha stands in the lake in Mary Carroll are now less vigorous than previously, possibly because the lake water level has been maintained at a level unfavourable for the plant.

12.4.8 FAUNA

The wetlands support large populations of waterbirds through the summer and bird breeding takes place during winter and spring. In recent summers many birds have died at the lake from botulism and local people have made heroic efforts to find and resuscitate birds suffering the effects of the toxin. Conditions that favour the initiation of outbreaks of botulism include high ambient temperatures, low oxygen levels in waters and sediments, high salinity and water level changes. It appears that all these conditions occur in summer at Mary Carroll Park. The City of Gosnells and community groups cooperated to collect, and treat or dispose of all sick and dead birds found at Mary Carroll Park during the summer of 1987-88. This considerable effort kept mortality to a fairly low level compared with the previous summer. Removal of affected birds appears to have limited propagation of the botulisum toxin, thus limiting infection. Notes on Mary Carroll Park as a bird-watching site are provided by Van Delft (1988).

12.4.9 MANAGEMENT ISSUES

The wetlands are managed by the Gosnells City Council. They provide an important recreational focus in the area and are well used by visitors. There is a great deal of community concern about the well-being of the park. Community involvement includes the activities of the Gosnells Junior Park Rangers in maintaining the amenity of the area.

The Gosnells City Council has set up a working party to investigate the causes and management of botulism outbreaks in the wetlands. Representatives of the Council, local groups and State agencies are involved in the working group.

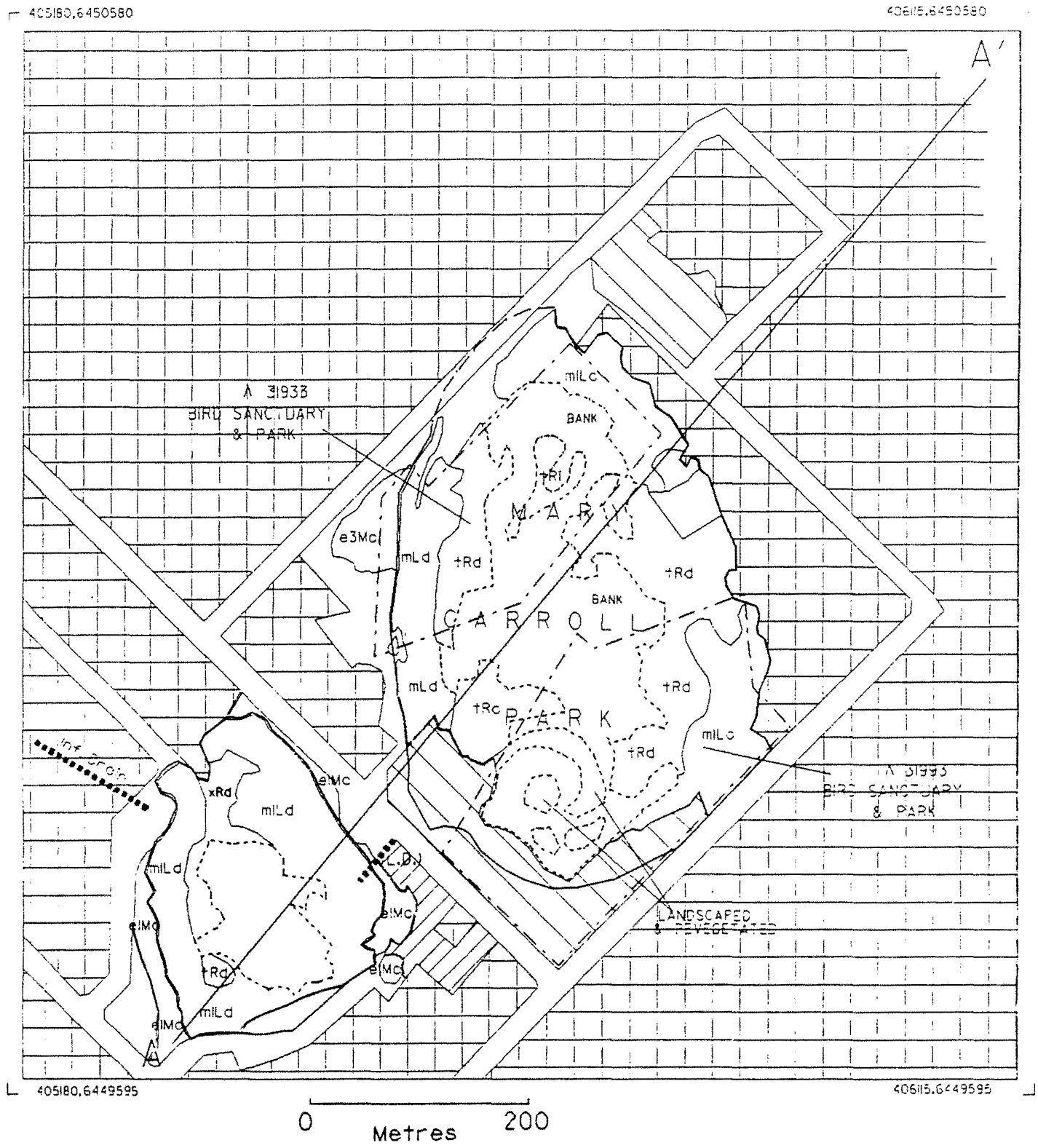

Figure 12.9 Mary Carroll Park and Eudoria Street Swamp: wetland plant communities and surrounding land use.

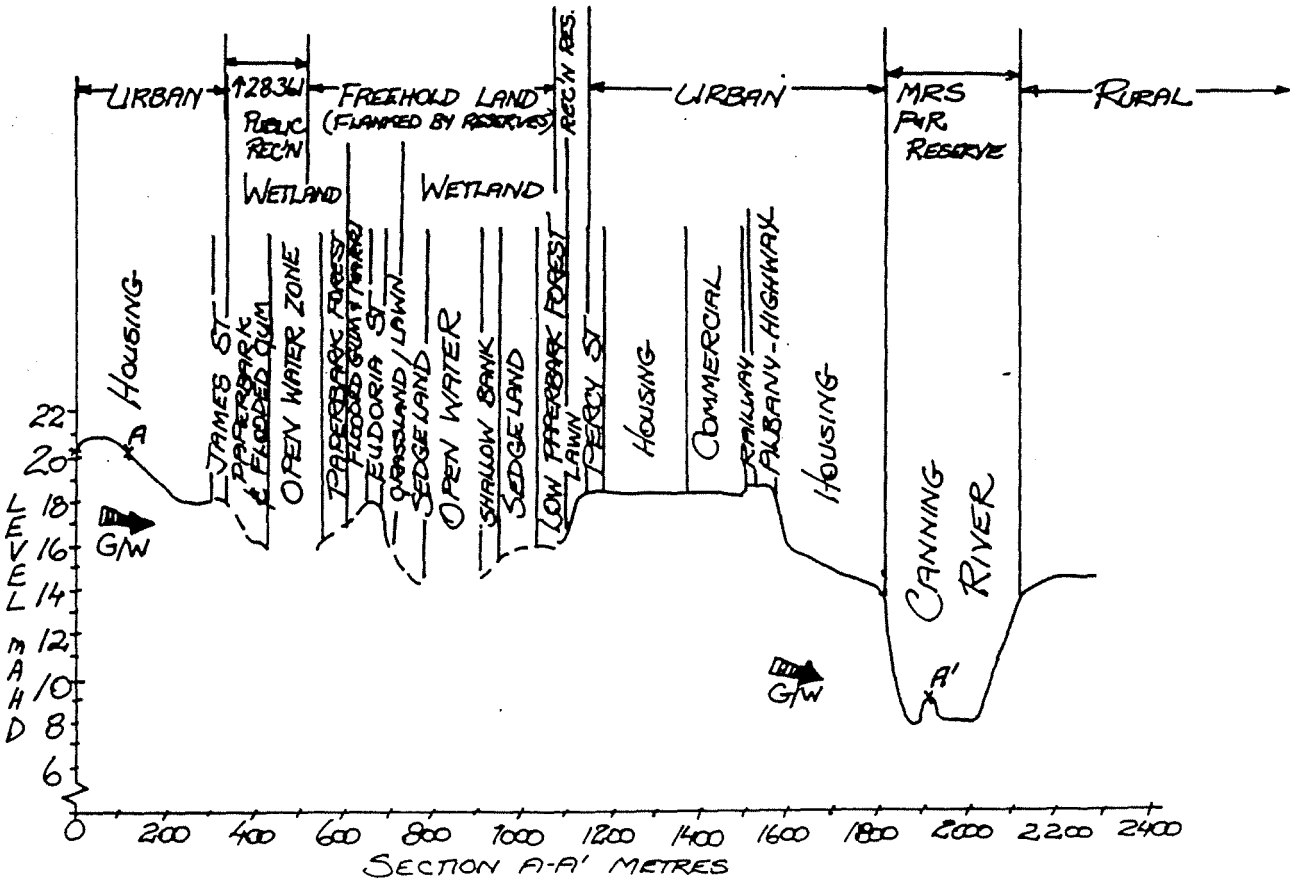

Figure 12.10 Mary Carroll Park and Eudoria Street Swamp: diagrammatic cross-section.

12.4.10 REFERENCE

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12.5 OTHER WETLANDS WEST OF THE CANNING RIVER

There are many seasonal wetlands west of the Canning River. They are generally in private ownership. Lake Ballanup, on the boundary between the local authorities of Gosnells and Armadale, is an example of a relatively large deep wetland in this area. They are usually characterised by swamp paperbark and wetland heath. As temperatures rise in the spring, the standing water is covered by mats of the small floating fern, Lemna. The flora and fauna of these wetlands warrant investigation.

There have been some efforts to modify these seasonal wetlands to incorporate them as landscape features in residential developments, as for example near Forest Crescent, Thornlie. Such use of wetlands should be undertaken with a full understanding of long-term management needs. Accumulation of plant nutrients from parklands and domestic gardens may lead to development of unfavourable environmental conditions, for example, algal blooms and associated noxious smells, bird deaths from botulism and insect pests. Furthermore, residents may expect permanent water in the lakes, and thus require they be recharged from bores. It should be considered whether this is a reasonable use of water resources.

12.6 YULE BROOK RESERVE, KENWICK

12.6.1 GENERAL INFORMATION

LOCAL AUTHORITY: City of Gosnells
MRS ZONE: Reserved for special uses within rural zone.
LAND STATUS: Freehold land, University of Western Australia
SYSTEM 6 RECOMMENDATION: M69
WAC CLASSIFICATION: LE.f. sm.se.c.
DRAINAGE: May be affected by adjoining rural uses.

12.6.2 PHYSIOGRAPHY AND GEOLOGICAL SETTING

The reserve is situated in the Guildford landform. It consists of a clay flat crossed by two parallel sand ridges of Bassendean Sands. Part of Kenwick Swamp extends into the Reserve on the south-west but the remainder lies to the south of it. A tributary of Yule Brook drains the north-eastern margin of the reserve towards the north-west.

The Yule Brook Reserve provides a sample of the vegetation characteristic of this landform. Most of the vegetation of the Guildford landform has been substantially altered by urban and rural uses, service corridors and highways. Developmental pressure on this eastern part of the coastal plain will continue to intensify.

12.6.3 AREAS

The Yule Brook Reserve has an area of roughly 31 hectares.

12.6.4 HYDROLOGY

There is no record of water levels at the Yule Brook Reserve to show whether there are changing trends in winter and summer water levels. The clay soils of the Guildford formation slow infiltration of winter rains so that water accumulates on the surface; surface water occurs in low-lying parts of the reserve through the winter months into spring. From mid-winter till early summer a water table zone of saturated soil of up to 1.5 m is perched in the sand dunes upon the clay layer (Speck and Baird, 1984). Summer conditions are very arid on the site.

12.6.5 WATER QUALITY

There has been no regular monitoring of water quality.

The area could be subject to nutrient enrichment from rural uses and minor point sources.

12.6.6 LAND USE

The area is used by students for studies (See Section 12.6.7). See also Figure 12.11.

12.6.7 VEGETATION (Figure 12.11)

The Yule Brook Reserve represents a sample of vegetation associations once widespread on the eastern Swan Coastal Plain but now very restricted in occurrence. Speck and Baird (1984) described the vegetation of the Reserve and provide a list of 370 plant species which occur there, a quite extraordinary number of species for an area of about 30 hectares. The list includes representatives of 57 families, including a number of primitive plants of limited distribution. The characteristics of the reserve make it an invaluable teaching resource. It has been the site of research which has made notable contributions to current understanding of the native flora, including responses to fire (Baird, 1984), and responses of a range of highly adapted species to the regime of temperature and rainfall characteristic of the mediterranean climate of the region (Bell and Stephens, 1984). An outline of the outstanding involvement of the Reserve with botanical research is to be found in Speck and Baird (1984).

12.6.8 FAUNA

The fauna of the reserve is less well known than the vegetation. However, given the rich vegetation of the reserve it is to be expected that it would provide a refuge for many species of insects, nectarivorous birds, sand-dwelling reptiles and frogs; all components of the fauna which are under pressure from urban development

12.6.9 MANAGEMENT ISSUES

Refer to the System 6 recommendation and Section 12.6.2.

12.6.10 REFERENCES

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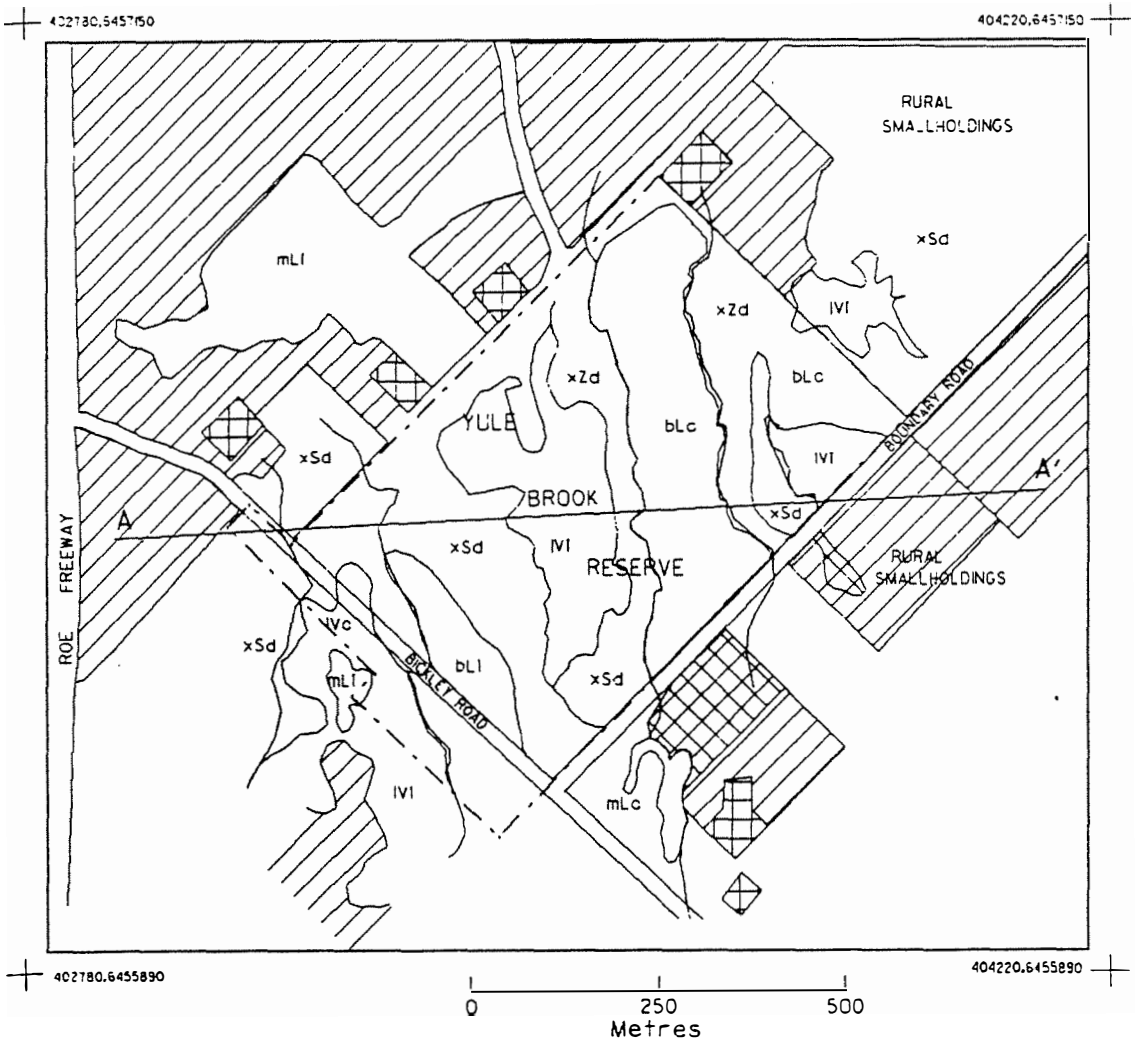

Figure 12.11 Yule Brook Reserve: wetland plant communities and surrounding land use.

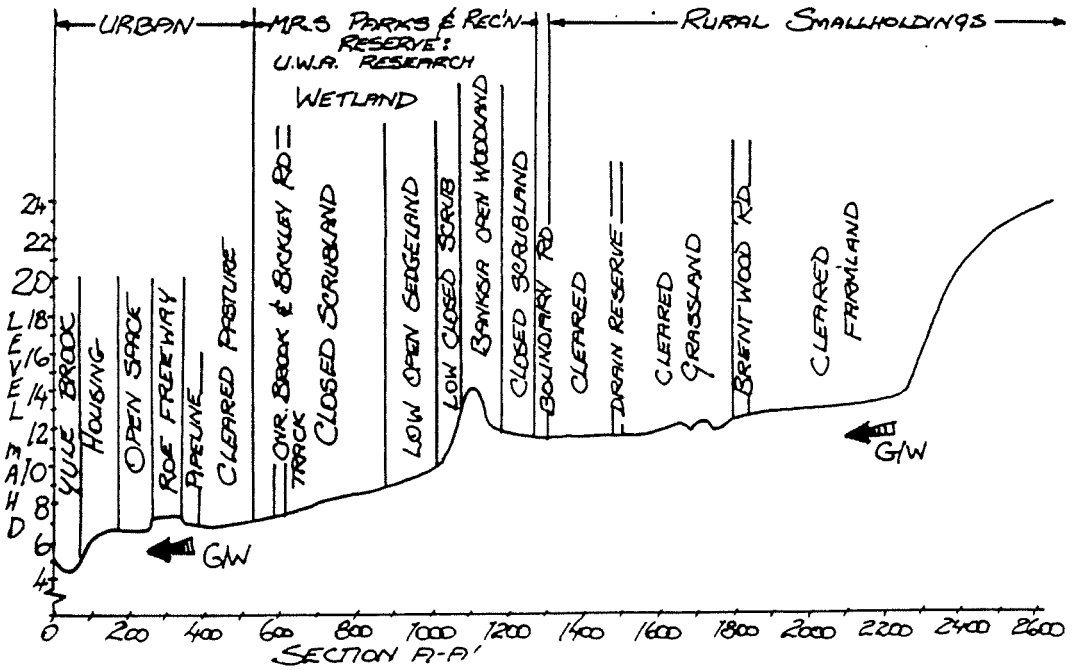

Figure 12.12 Yule Brook Reserve: diagrammatic cross-section.

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12.7 HAZELMERE LAKES AND OTHER WETLANDS ON THE CLOVERDALE GROUNDWATER FLOW SYSTEM

12.7(a) GENERAL INFORMATION: HAZELMERE LAKES

LOCAL AUTHORITY: Shire of Swan
MRS ZONE: Rural (Urban near northern margin)
LAND STATUS: Freehold land
SYSTEM 6 RECOMMENDATION: M45
WAC CLASSIFICATION: LE.f. sm.p.o.
DRAINAGE: May be affected by adjoining rural uses.

12.7(b) AREAS

(includes both Hazelmere lakes)

Wetland	26.5 ha
Paperbark	7.1 ha
Sedgeland	negligible
Open Water	15.2 ha
Modified (pasture)	4.2 ha

12.7(c) SETTING (See Figures 12.13 and 12.14)

Whereas wetlands north of the Swan River are generally surface expressions of the Gnangara groundwater flow system and those south and west of the Canning and Southern Rivers are related to the Jandakot groundwater flow systems, those wetlands between the foothills of the Darling Scarp, and the Helena, Swan and Canning Rivers are related to the small Cloverdale flow system (Water Authority of Western Australia, 1987).

The Hazelmere Lakea are the largest of a number of wetlands in the South Guildford, Hazelmere, Newburn, High Wycombe localities, most of which have been affected by developments such as roads, railway, airport and industrial. Gozzard (1986) maps these wetlands as 'marshes in interdunal swales' within the Bassendean Dunes. In this region this Bassendean sand overlies alluvial deposits of the Guildford formation.

The two Hazelmere Lakes are both in private property and none of the other wetlands in the area is reserved for conservation or recreation. The wetland adjacent to High Wycombe within Perth Airport land has been shielded from developmental pressures but would be affected by airport expansion.

12.7(d) REFERENCES

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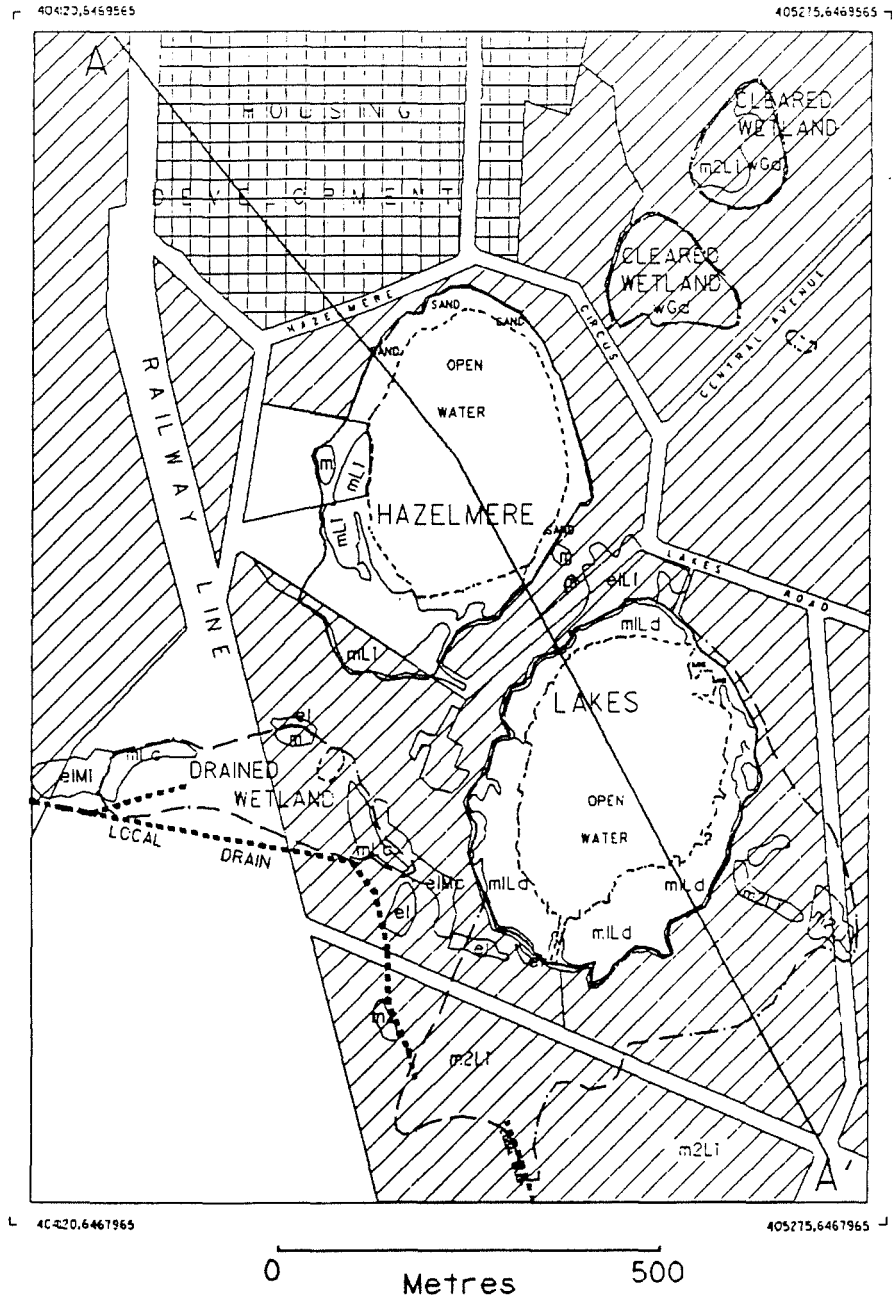

Figure 12.13 Hazelmere Lakes: wetland plant communities and surrounding land use.

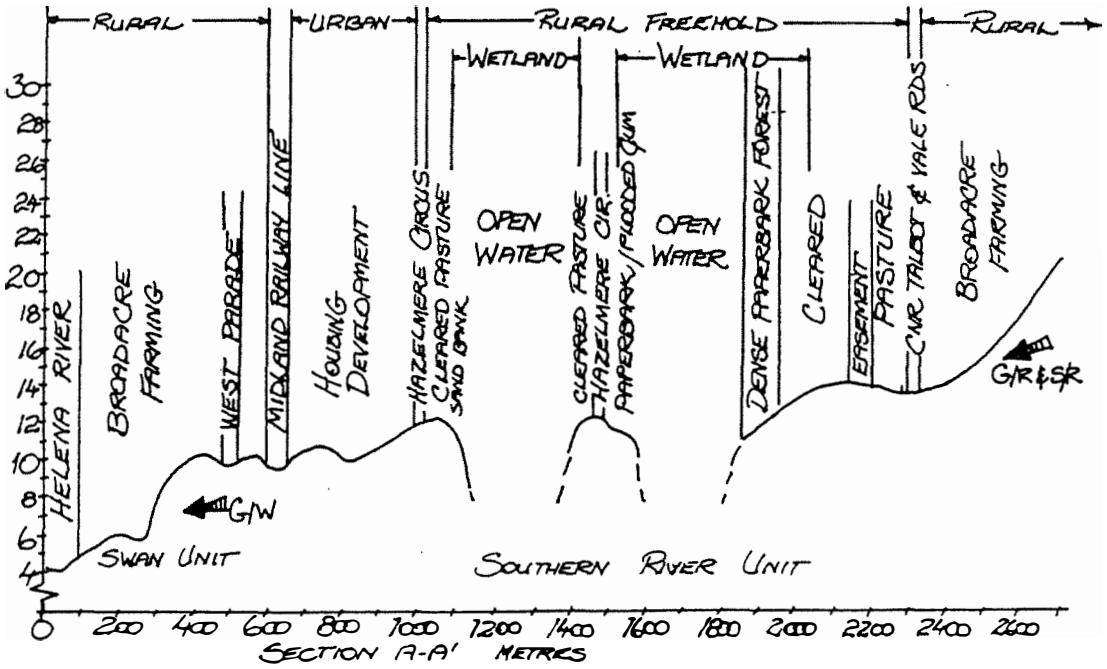

Figure 12.14 Hazelmere Lakes: diagrammatic cross-section.

12.8 BENNETT BROOK

12.8.1 GENERAL INFORMATION

LOCAL AUTHORITY: Shire of Swan
MRS ZONE: Parks and Recreation
SYSTEM 6 RECOMMENDATION: M41
WAC CLASSIFICATION: LE/Lo.f.l.se.c.
DRAINAGE: Affected by rural drains

12.8.2 PHYSIOGRAPHY AND GEOLOGICAL SETTING

Bennett Brook is a seasonal tributary of the Swan River. The wetland of especial interest is the river terrace and floodplain in Pyrton and south of Benara Road in Caversham.

12.8.3 AREAS

Total wetland	approx 93	ha
Paperbark/flooded gum	59.7	ha
Sedgeland	4.0	ha
Samphire/Halophytes	9.6	ha
Modified wetland	approx 15.6	ha
Open water	4.4	ha

12.8.4 HYDROLOGY (Figure 12.16)

The water supply of this wetland is complex, including discharge from Bennett Brook, surface runoff from the flood plain, flood events in the Swan River system and groundwater seepage. The presence of samphire and Casuarina obesa woodland on the eastern side of the swamp indicates relatively high salinity levels. Flows in Bennett Brook would be expected to be fresh, largely originating as groundwater discharge in the headwaters of the brook. Reduced discharge could lead to the swamp becoming smaller and more saline.

12.8.5 WATER QUALITY - Refer to Section 12.8.4

12.8.6 LAND USE - Refer to Figure 12.15

12.8.7 VEGETATION (Figure 12.15)

The Bennett Brook wetland encompasses a range of wetland plant communities including flooded gum/swamp paperbark, closed swamp paperbark, samphire and casuarina woodland. It is thus a rather complex area.

12.8.8 FAUNA

The author is unaware of any systematic study of the fauna. It appears to offer a rich range of habitats for waterbirds.

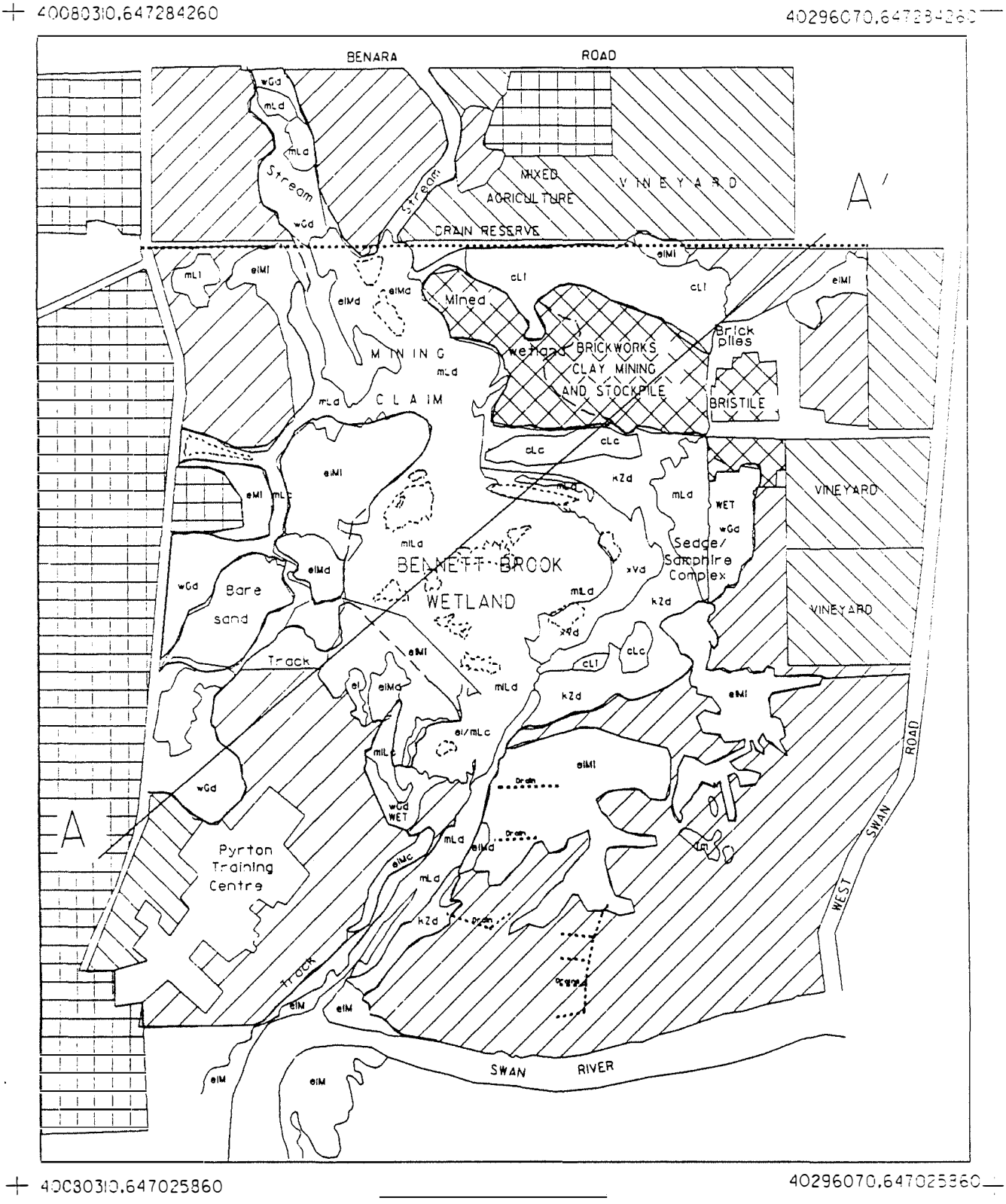

Figure 12.15 Bennett Brook wetland: wetland plant communities and surrounding land use.

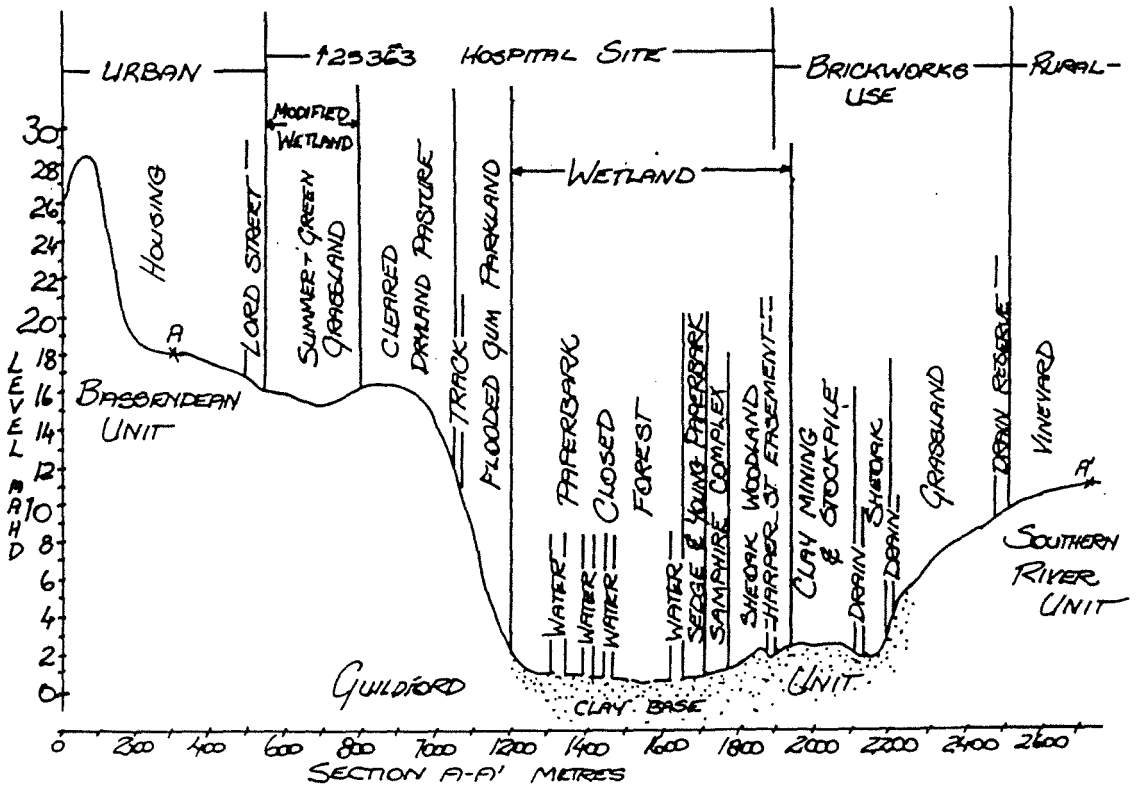

Figure 12.16 Bennett Brook wetland: diagrammatic cross-section.

12.8.9 MANAGEMENT ISSUES

Efforts should be made to maintain the vegetation diversity within the swamp, to manage access in such a way as to protect the vegetation and wildlife and to prevent dumping and other encroachments. Siltation and nutrient enrichment from land uses upstream in the catchment of Bennett Brook could cause a reduction in environmental quality.

12.9 OTHER WETLANDS NORTH OF THE SWAN RIVER

Wetlands occur on the eastern flank of the Gnangara Mound and on the eastern side of the valleys of the Swan River and Ellen Brook. Groundwater discharge into seasonal wetland flats forms the headwaters of east-flowing tributaries such as Henley Brook, the Belhus Brook, Pit Gully, Bulls Brook and many unnamed tributaries of Ellen Brook. Significant wetlands in the area include Ellen Brook Reserve, Twin Swamps Reserve, and Lake Chandala. On the north-east of the Gnangara Mound are Lakes Bambun, Nambung and Mungala, the lake in Reserve 31241 within the proposed Yeal Nature Reserve and other substantial wetlands. Groundwater discharge from the northern flank of the mound, as in Quin Brook, appears to be northward towards Gingin Brook. (See Section 5: Wetlands of the northern and eastern Gnangara Mound.)

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13. WETLANDS OF THE INNER CENTRAL SUBURBAN AREA

13.1 SETTING (See Figure 12.1)

The area considered here lies west of the alluvial plain (roughly west of the Forrestfield marshalling yards) between the Swan and Canning Rivers and extending to the Como foreshore. Most of it is in the Bassendean dune system, except for a strip 1.5 to 2 km wide in South Perth/Como which is within the Spearwood dune system.

The wetlands of this area are marshes within interdunal swales. They are surface expressions of the Cloverdale groundwater flow system.

Almost without exception the wetlands have been greatly altered by urban development. Wetlands are represented by remnant areas of paperbark through the industrial areas of Kewdale and Welshpool. A number have been modified to small water features in Belmont and Cloverdale and in Collier Park Golf Course in Como. The largest of these urban wetlands is Tomato Lake in Kewdale.

Much of the area is served by main drains with inverts below the water table. These drains discharge to the Swan and Canning Rivers.

Both Tomato Lake and McDougall Park Lake are important parts of parklands. They are recharged with bore water to prevent them drying out in dry summers.

13.2 TOMATO LAKE

13.2(a) GENERAL INFORMATION

LOCAL AUTHORITY: City of Belmont
MRS ZONE: Parks and Recreation Reserve
RESERVE NOS: Freehold, City of Belmont
MANAGEMENT: City of Belmont
SYSTEM 6: No recommendation
DRAINAGE: Part of main drainage system.

13.2(b) AREAS

Parks and Recreation Reserve	approx 19.2 ha
Total wetland	6.6 ha
Paperbark	scattered trees only
Sedgeland	<1.0 ha
Open water	4.6 ha
Islands	1.0 ha

13.2(c) NOTES Figures 13.1 and 13.2 show vegetation of the area and a cross-section across the reserve respectively.

Tomato Lake was the scene of heroic efforts by volunteer groups to rid it of the exotic weed Salvinia in the 1970's. The lake is now free of the choking weed through these efforts and the involvement of the Agriculture Protection Board.

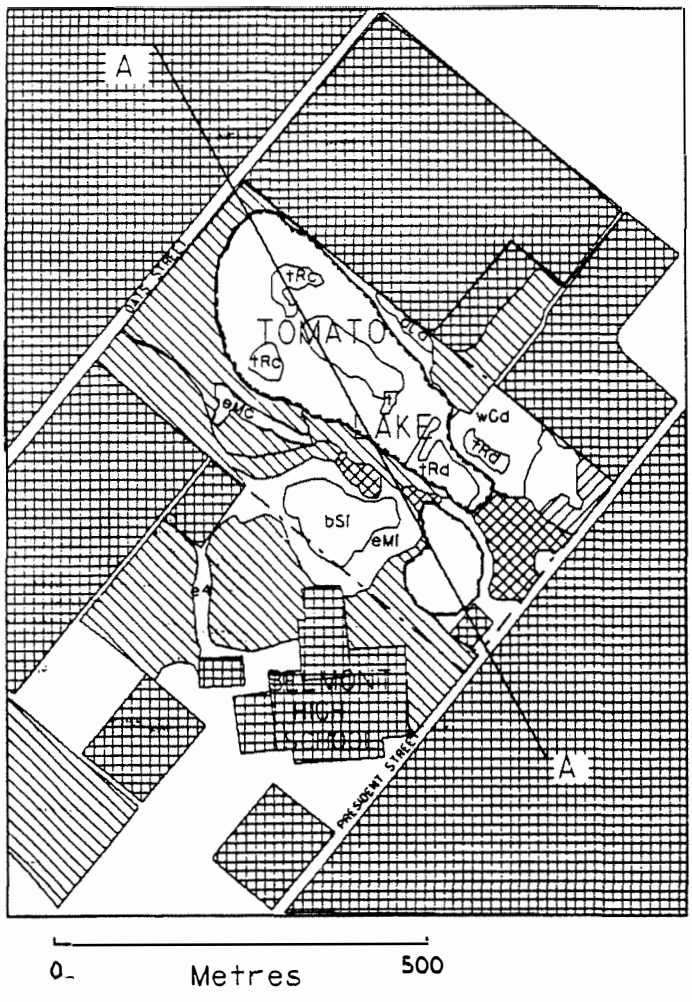

Figure 13.1 Tomato Lake: wetland plant communities and surrounding land use.

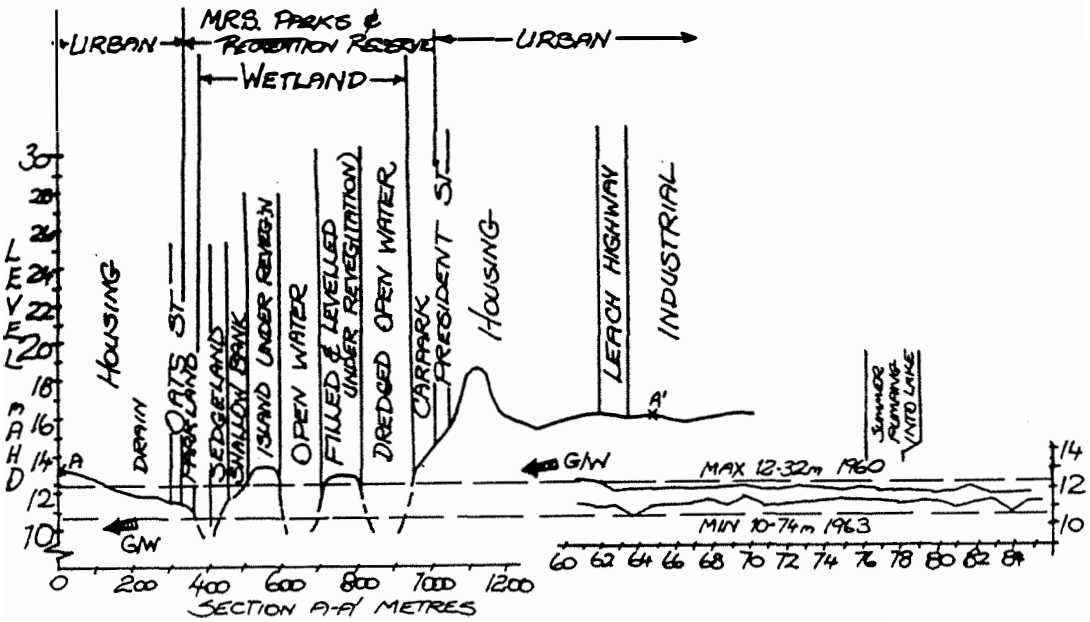

Figure 13.2 Tomato Lake: diagrammatic cross-section and water level record.

A small study centre is located at the lakeside with resources for wildlife study.

13.3 McDOUGALL PARK

13.3.(a) GENERAL INFORMATION

LOCAL AUTHORITY: City of South Perth
MRS ZONE: Urban.
MANAGEMENT: City of South Perth
SYSTEM 6: No recommendation
DRAINAGE: Drains from local roads.

13.3.(b) AREAS

Total area of reserve	approx 9.7 ha
Total area of lake	2.8 ha
Open water	2.3 ha
Island	0.5 ha

13.3.(c) NOTES

McDougall Park, in Como, is a modified marsh in an interdunal swale of the Spearwood dune system.

Figures 13.3 and 13.4 show vegetation of the area and a cross-section across the reserve respectively. McDougall Park is integrated into the residential area and is used intensively for passive recreation.

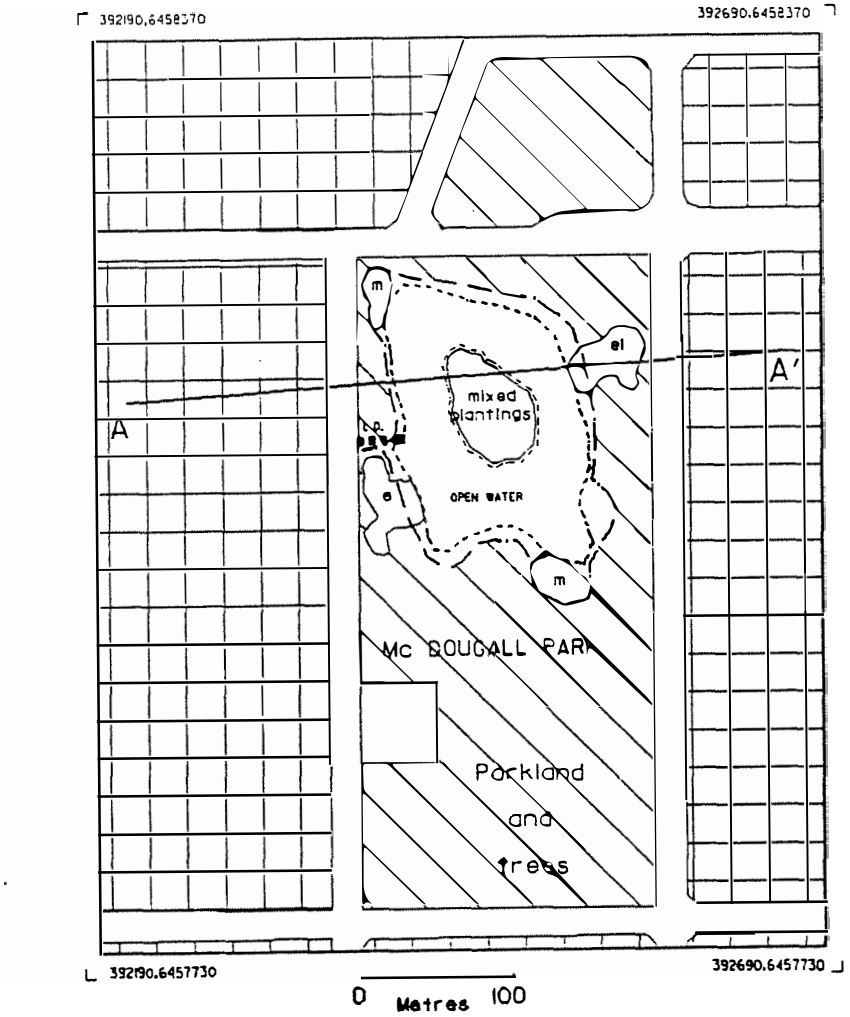

Figure 13.3 McDougall Park: wetland plant communities and surrounding land use.

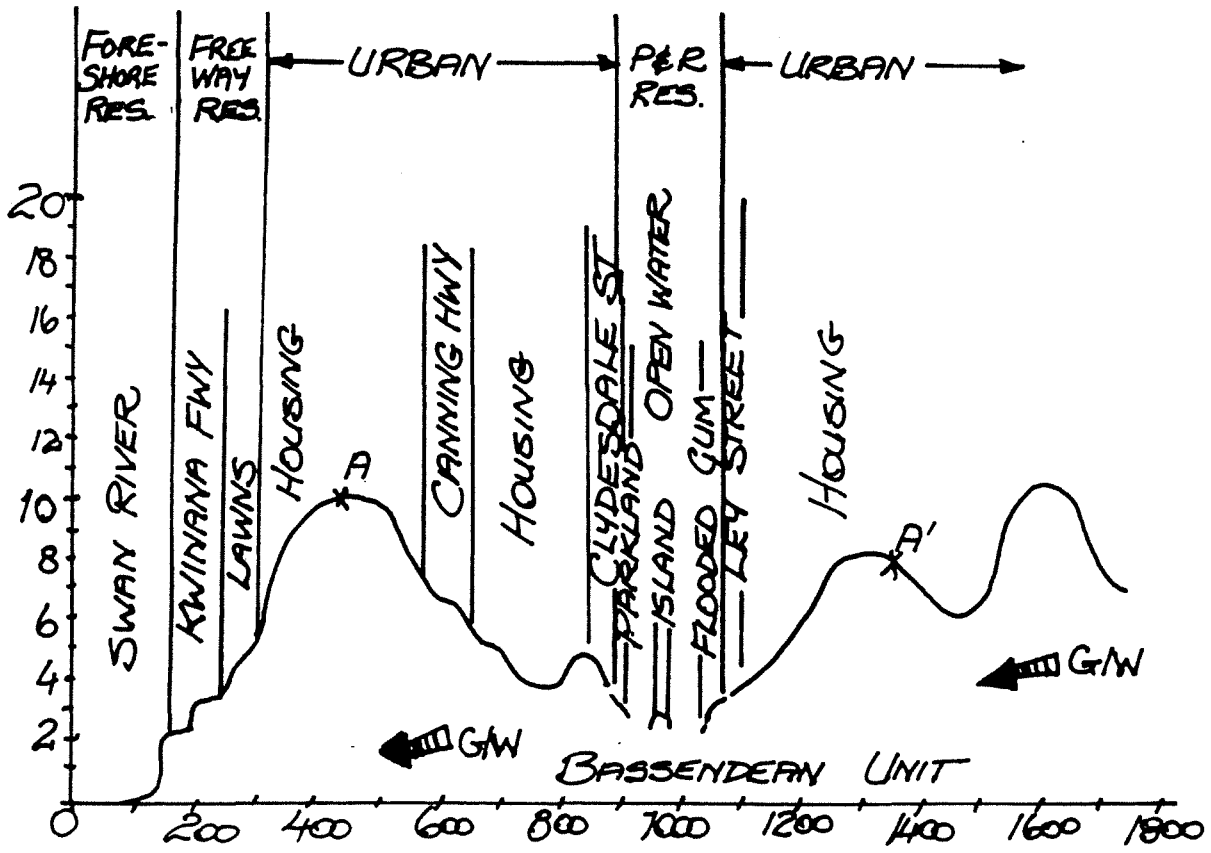

Figure 13.4 McDougall Park: diagrammatic cross-section and water level record.

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14. WETLANDS OF THE RIVERS AND ESTUARIES IN PERTH

No attempt will be made here to consider the individual wetlands fringing the Swan and Canning estuaries and rivers. An exhaustive resource inventory has been prepared (Thurlow, Chambers, and Klemm, 1986) and management is currently under intensive review (Management Strategy Task Force, 1987).

14.1 RELATIONSHIP OF FRINGING WETLANDS TO GROUNDWATER FLOW SYSTEMS

The unconfined groundwater flow systems discharge on their landward margins at the rivers and estuaries of the coastal plain. Thus, the Gnangara Mound discharges to Gingin Brook on the north, Ellen Brook, Bennett Brook and the Swan River on the east, and the Swan Estuary on the south. The Jandakot Mound discharges to the Canning River and the Canning/Swan Estuary on its northern side and towards the Serpentine River on the south. Groundwater discharge contributes substantially to stream flows on the coastal plain (Bestow, 1976; Davidson, 1984). The discharge areas support freshwater wetland vegetation. Thus: "The existence of seemingly freshwater-loving paperbarks along the Swan and Canning Rivers even as far downstream as Attadale and Dalkeith foreshores may be explained by postulating the presence of freshwater soil flushes. Such flushes may also explain the presence of mildly salt-tolerant plants such as the introduced bulrush Typha orientalis, the native bulrush Typha domingensis and the flooded gum Eucalyptus rudis in estuarine vegetation as far downstream as the area east of Point Walter." (Riggert, 1978). On the margins of the estuaries the fringing wetlands consist of mosaics of freshwater and salt-tolerant vegetation determined by the balance between groundwater discharge and tidal influences (Pen, 1983).

14.2 THE EXTENT OF THE WETLANDS

Seddon has characterised the river and estuary margins in 'Swan River Landscapes' (1970) and 'A sense of place' (1972). Pen (1981) made a detailed study of the existing fringing vegetation in 1981, and made careful comparisons with early air photographs to show the extent of change that has taken place in the forty years 1942-81. A synopsis of this study was subsequently published (Pen, 1983). The study compared vegetation distributions in 1981 with distributions 40 years earlier and showed there has been substantial reduction of fringing vegetation, for instance, between 1950 and 1971, 247 hectares of foreshore tidal flat and flood plain had been reclaimed along the rivers by using public refuse (Public Health Department, 1974). Pen identified characteristic plant communities and discussed vegetation dynamics.

Wetland vegetation is very limited on the lower reaches of the estuary but substantial remnants remain on the upper reaches of the Swan and on the Canning River. The value of the Canning River wetlands has been recognised by both the City of Canning and the City of Gosnells with the development of parklands with a river focus. Wetlands on the Canning River between Riverton Bridge and Nicholson Road Bridge have a high priority for recognition as a Regional Park.

The remaining wetlands on the Canning and the Swan will possibly be strongly affected by roadwork if major roads such as Swan River Drive and the Spencer-Chapman road link are constructed.

Because much wetland has been lost in the past, and because it continues to be under pressure, ad hoc reductions in its area should be avoided. Wetlands have useful functions and their retention can be justified because of these functions.

14.3 FUNCTIONS OF THE WETLANDS

Functions of the wetlands include:

Flood assimilation;
River bank stabilisation;
Wildlife habitat;
Contributions to the productivity of the estuaries;
Nutrient uptake and sediment trapping from drainage waters discharged to the floodplain; and
Contribution to landscape interest and diversity.

- Flood assimilation: Filling of low-lying land near the estuaries may limit capacity of the floodplain during high river flows.

- River bank stabilisation: The methods used to establish sedges for this purpose are documented by Pen (1983)

- Wildlife habitat: For example, estuarine and riverine wetlands and mudflats provide very rich bird habitats. Alfred Cove (Keeling, 1987) is famous enough to bring overseas visitors to see the transequatorial migratory waders so that it is, among other things, a significant tourist attraction (Western Australian Tourism Commission, 1987). The range of wetland vegetation at the Cove contributes to its value. Furthermore, the Cove complements other wading bird habitats such as Pelican Point and Como foreshore.

  Brock and Pen (1984) made detailed observations of wildlife in the Canning wetlands and showed that it has diverse bird populations.

  The RAOU has listed 87 bird species that make some use of wetlands and has identified the following wetland habitats as being important for birds:

  - deep fresh water;
  - shallow open water;
  - mudflats (non-tidal);
  - bare margins - sand and/or mud;
  - grasslands - paddocks;
  - grasslands - lawns;
  - rushbeds (sedgeland);
  - inundated trees and shrubs (seasonal or permanent);
  - flooded grasslands;
  - estuary: open water;
  - estuary: mudflats (tidal);
  - non-living roosts - posts, dead trees; and
  - non-living nest sites - hollow trees, stumps.

  Many of these habitats are offered by estuaries and their fringing wetlands and floodplains.

- Contributions to productivity: Birds are perhaps the most obvious elements of the aquatic ecosystems but may not be the most reliable indicators of productivity.

The wetlands form part of an integrated ecosystem which includes the banks and seagrass beds. All of these contribute to the food webs utilised by fish, prawns, crabs and waterbirds. Fish, prawns and crabs contribute in no small measure to the recreation opportunities available to residents of Perth and their requirements should therefore be valued. The role of the tidal and freshwater wetlands should not be discounted.

. Enhancement of drainage waters: Drainage waters are discharged to the estuary, either directly to the water body, to the flood plain or to the freshwater wetlands. Wetland vegetation has some capacity to improve water quality before it reaches the estuary and can, therefore, be regarded as a management tool. With respect to effective management of the wetland resource, disturbance of the wetlands by dumping fill, dredge spoil or rubbish encourages weed incursions to wetland habitats.

. Landscape diversity: There are many instances of strong community pressure to prevent clearing of foreshore vegetation. This suggests that the community values the estuarine vegetation.

Other Issues

Retention of the wetlands on the foreshores is an alternative to modifying the river margins to irrigated grasslands. This could avoid problems arising from saltwater intrusion from pumping groundwater to maintain grassed foreshore reserves. Such problems are arising in the Perth metropolitan region (Water Authority of Western Australia, 1987).

Some wetlands have been downgraded by off-road vehicles and rubbish dumping. These problems can be overcome by management and public awareness.

Mosquito control is costly and time-consuming. However the City of Canning is achieving good results in pest control using techniques which cause relatively little environmental disturbance. Given the identified functions of estuarine wetlands, reductions in area in the cause of pest management should be avoided.

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15. WETLANDS OF THE SERPENTINE REGION

15.1 GENERAL DISCUSSION

This section deals briefly with a large area in the south-east of the Perth metropolitan region, defined approximately by the northern edge of the Serpentine River plain, the ridge of Spearwood Dunes in the west, the southern border of the metropolitan region in the south and the foothills of the Darling Scarp on the east. It includes the alluvial plain of the Serpentine River system and a large area of Bassendean sands. Gozzard (1983) and Jordan (1986) map marsh in interdunal swale, oxbow and cutoff channels, and wetlands on floodplain and indifferentiated river terraces. Most of the marshes in interdunal swales are in shallow Bassendean sand over clayey sand or sandy clay of the Guildford formation (alluvial plain).

There are very few conservation areas in the region. The System 6 Study makes recommendations for only two areas:

M105 ..... The Lowlands woodland and Hymus Swamp (freehold).
M108 ..... Goegrup Lakes (much of the recommendation area is freehold).

The main drains and drain reserves fulfil a significant function as wildlife refuges, eg the Punrack drain reserve. Many seasonal wetlands remain in freehold land.

The area has been substantially altered by rural activities. Coy (1984) in a history of the Shire of Serpentine-Jarrahdale, noted that 35 000 hectares of virtual swampland was drained in the early 1920s with the construction of 540 km of drains at a cost of about 320 000 Pounds.

In spite of these changes, there are a variety of wetlands in the region, some of them man-made:

- residual pools of the trained Folly River, eg Folly Pool and Maramanup Pool;
- seasonal wetlands of the floodplain of the upper coastal plain reaches of the Serpentine River, eg in the Lowlands woodland area and Hymus Swamp;
- pools on the untrained lower reaches of the Serpentine River from Keralup Pool to the Goegrup Lakes;
- seasonal wetlands in interdunal swales of the Bassendean Dunes, eg Yangedi Swamp;
- residual swamps along the drains, and the drains themselves, eg the Punrack drain; and
- claypits near St Albans Road and Zig Zag Road in Baldivis (Kabay and Nichols, 1981).

The area under consideration lies within the catchment of the Peel Estuary. Whereas in the 1920s priorities were directed to increasing the area of land available for farming, a new priority has emerged in the 1980s. Environmental problems in the Peel and Harvey Estuaries have arisen because of high levels of plant nutrients entering the water bodies from fertilisers leached from the catchments (Hodgkin et al., 1980).

It has been recognised that wetlands play a role in fixing nutrients in ecosystems (Chambers, 1984) and it may be that the wetlands of the Bassendean sands in the Serpentine region should be regarded as a tool to be used in catchment management.

The normal role of the extensive areas of wetland in the interdunal swales of the Bassendean sands of the east side of the Swan Coastal Plain may be as follows:

The wetlands fill as the deep sandy soils become recharged with water by winter rains and by the scarp streams which discharge onto the east side of the coastal plain. The water table, and hence the wetlands, reach maximum water levels in late spring. Thereafter, water levels fall as a result of evaporation and transpiration so that there is little or no surface water in summer. It is likely that, for a time in early summer, there is movement of water back from the wetlands to the groundwater. In effect, the wetlands hold back water in the system, so that it is discharged more slowly to the Serpentine River than would be the case if the area was cleared of vegetation and had lost the accumulations of organic matter, characteristic of wetlands.

The importance of the wetlands of the region for catchment management can be recognised when they are looked at in this light. The Bassendean sands have little capacity to adsorb plant nutrients. When these nutrients are applied, either as fertilisers or as effluent from intensive feedlots and piggeries, they rapidly leach to the groundwater and hence to the streams. Wetland soils and vegetation possibly act as brakes on the discharge of water and nutrients.

The vegetation of the wetlands of the area includes elements of the Dardanup, Serpentine, Southern River, Bassendean - Central and Southern and Herdsman vegetation complexes (Heddle, Loneragan and Havel, 1980). The lower reaches of the Serpentine, through the Goegrup Lakes, have extensive areas of saltmarsh.

The freshwater wetlands on the east side of the coastal plain are quite important spring feeding and breeding sites for waterbirds and there is growing recognition of the importance of dense paperbark woodland as breeding areas for species such as Freckled Duck and spoonbills.

15.2 REFERENCES

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END OF SECTION