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WESTERN AUSTRALIA

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Report on Lake Chandala with Recommendations of its Importance as a Fauna Reserve

BY
ALAN TINGAY
AND
SUSAN TINGAY

PERTH
WESTERN AUSTRALIA

1976

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NOTE

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Department of Fisheries and Wildlife

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108 Adelaide Terrace

PERTH

R E P O R T

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RECOMMENDATIONS OF ITS IMPORTANCE
AS A FAUNA RESERVE

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ALAN TINGAY

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SUSAN R. TINGAY

Department of Psychology, University of Western Austral

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REPORT ON LAKE CHANDALA WITH RECOMMENDATIONS OF ITS IMPORTANCE AS
A FAUNA RESERVE.

Alan Tingay and Susan R. Tingay,
C/- Wildlife Research,
C.S.I.R.O.,
Fyfe Street, Helena Valley, Western Australia, 6056.

ABSTRACT

The hydrology, vegetation, fauna and land use of Lake Chandala (31°30'S, 115°57'E) is described on the basis of field and literature surveys. The significance of the lake as a Straw-necked Ibis (Threskiornis spinicollis) nesting rookery is emphasised and recommendations are made for its acquisition and future management.

I LOCATION AND LAND USE

Lake Chandala, also called Lake Mandowin or Reedhead Swamp, is located 7.5 kilometres north of Muchea and east of the Midland railway at 31°31'S, 115°57'E. It is roughly circular in shape with a diameter of approximately 1 km and an area of 128 hectares.

Although it has been settled for more than 50 years the adjacent land has relatively recently been opened up by agriculture and the native vegetation has been largely cleared from this area. The portion of land being offered to the W.A. Fisheries and Wildlife Department comprises approximately 128 hectares, being portion of Swan Location 1371 and being part of Lot 2 on Diagram 15381 and owned by Ellenbrook Nominees Pty Ltd, of 154 Victoria Avenue, Dalkeith. This land includes about three-quarters of the lake and about 34.5 hectares of agricultural land to the north (see Fig. 1). Details of adjacent landowners of properties are shown on Table 1.

The Darling Range lies immediately to the east of the lake and to the west is a large area of land zoned for industrial purposes (Figs. 2 & 3). This latter area is the site for the proposed Pacminex alumina refinery which was the subject of an environmental impact study by the W.A. Environmental Protection Authority in 1972. As a result of this study the proposed site was shifted

FIGURE 1 Land Use around Lake Chandala

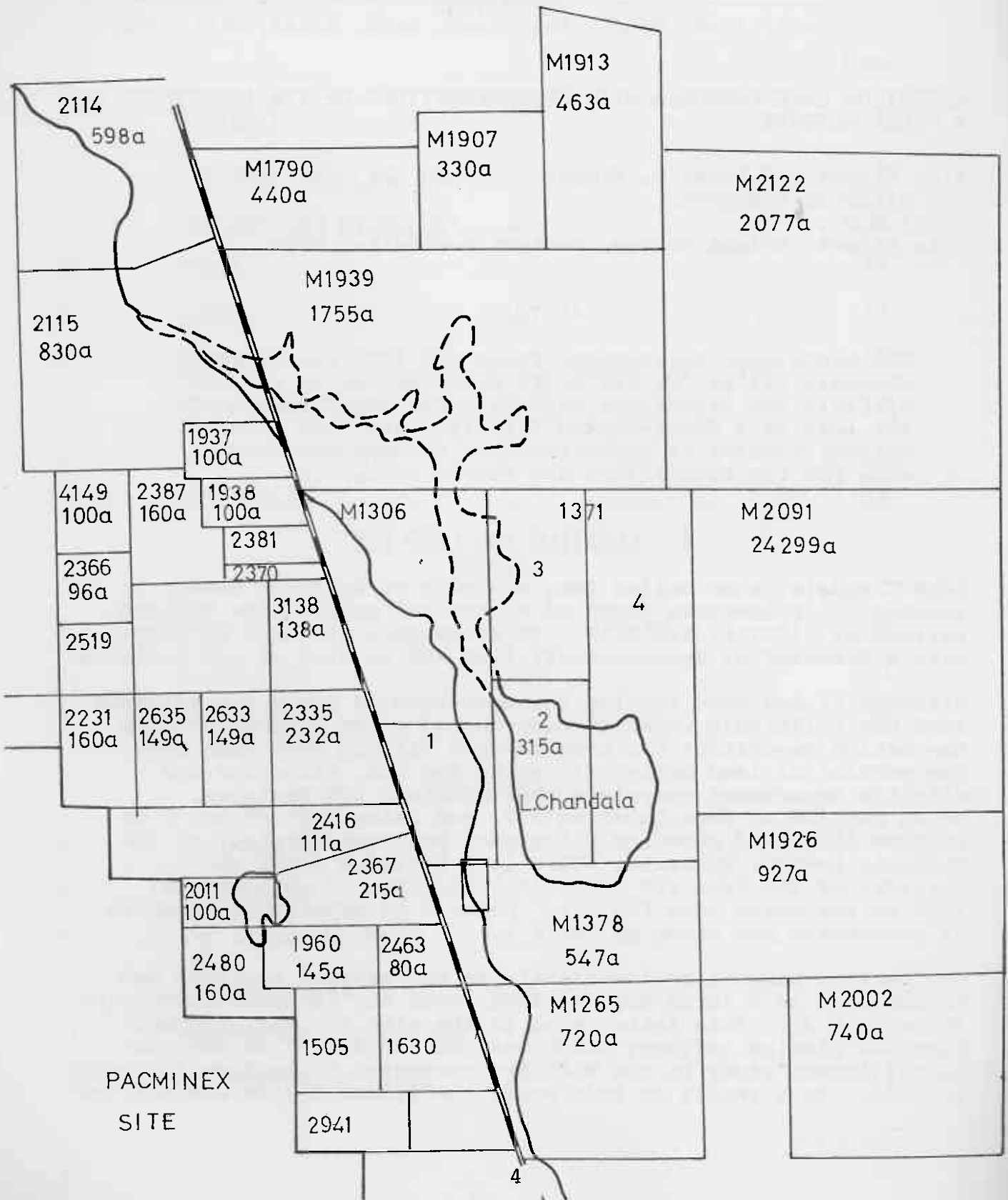


FIGURE 2 Topography around Lake Chandala

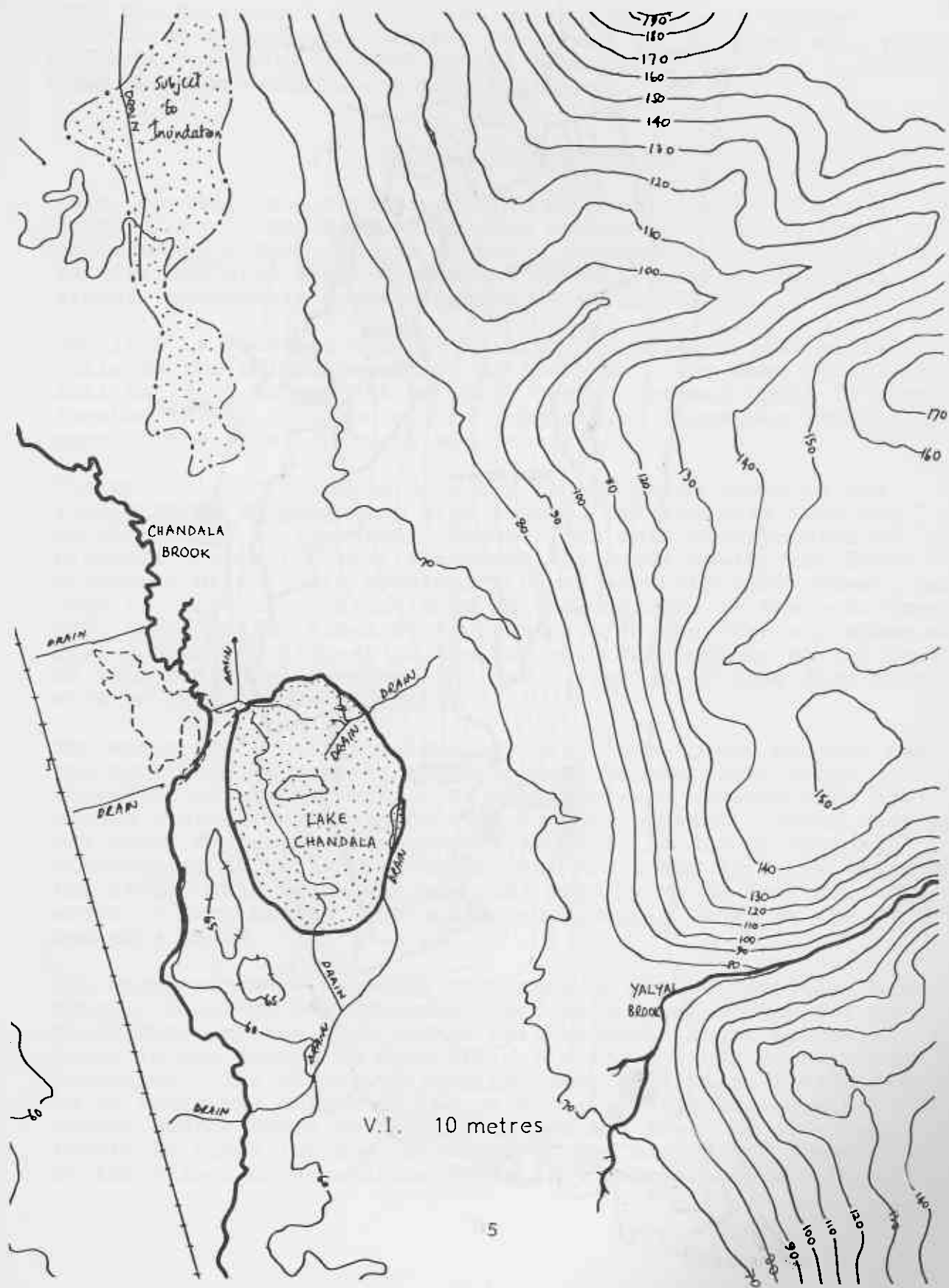
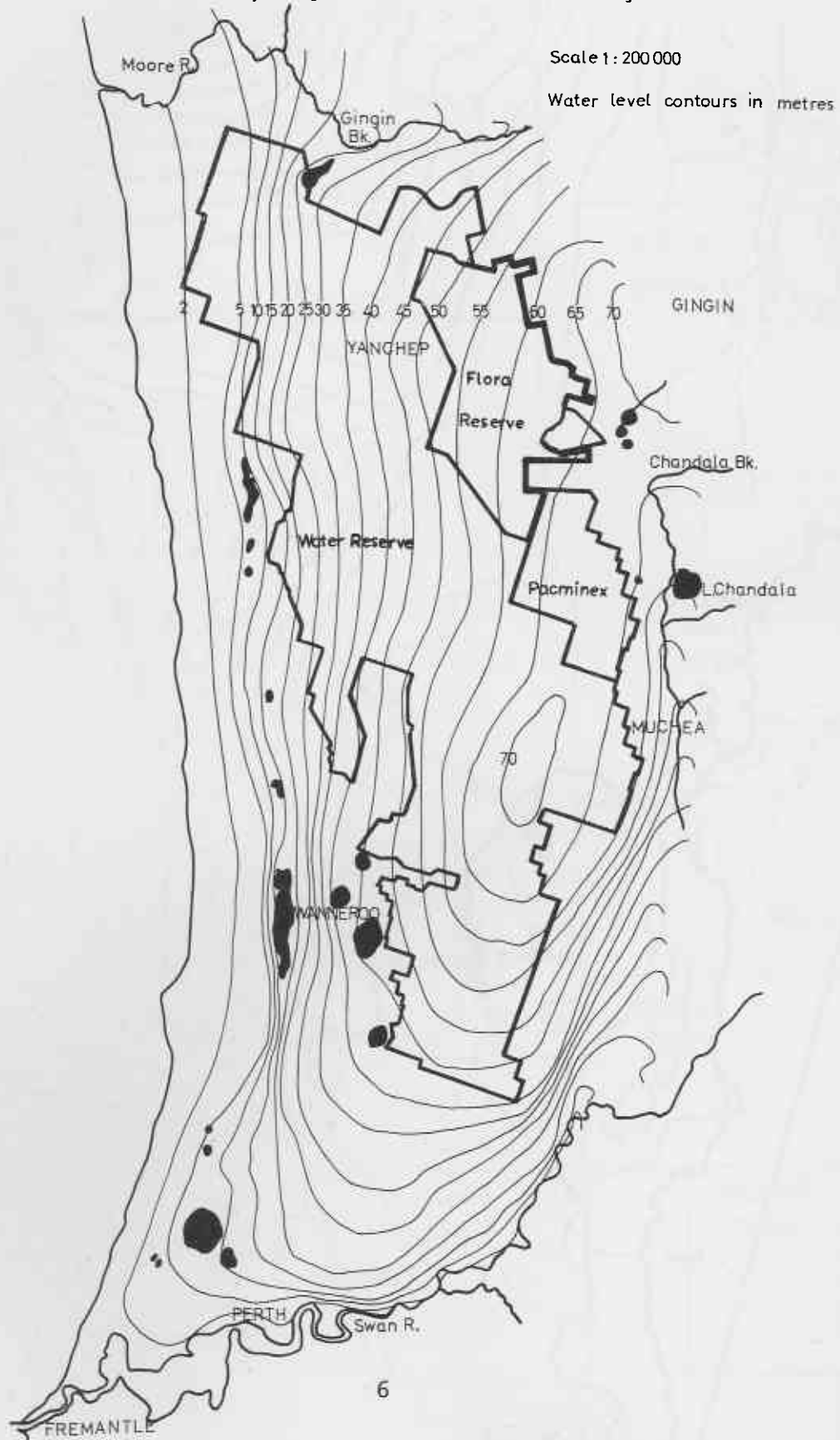


FIGURE 3 Hydrological Contours of the Gngangara Mound



from the Bullsbrook area to the present location. Future activities at both the Darling Range and the Pacminex site present possible potential hazards to all wetlands in the area including Lake Chandala. These are detailed below.

II GEOLOGY AND HYDROLOGY

Lake Chandala is a typical example of sandy swamps found in depressions in the Bassendean dune System and lies on the easternmost fringe of this System. These swamps are generally ill-drained with about a metre of surface sand overlying an almost impermeable organic hard pan (Seddon 1972).

The lake is seasonal and its fluctuating water level mainly reflects the rainfall pattern of the area. The mean annual rainfall is 797.5 mm, 88-94% of which occurs between April to October (Bestow 1971). In late spring evaporation increases rapidly and most of the lake is dry by mid-January.

The rainfall contributes directly to the water level in the lake through run-off from high ground, particularly from the Darling Range to the east. However the main contribution of rainfall occurs indirectly through the water table, the flow direction of which is apparently from the north-east (Steer, pers. comm.). This is substantiated by the contours of the hydrology map. Groundwater flows at right angles to the contours shown on Fig. 3 from the highest to the lowest. The contour to the north of Lake Chandala is curved and the direction of flow from this will be into Chandala Brook.

The water table near the lake is very close to the surface and the central pool appears to be lower than the water table and therefore rarely dries up. Mr W. Steer, who visited this pool almost every summer between 1928 and the present, claims that it was never dry until recent years and this is due to drainage programmes, in particular the recent drain dug from the south of the lake. This statement was confirmed by Mr A. Fewster. The water is part of the vast underground supply known as the Gnangara mound.

The Gnangara mound is being developed by the Metropolitan Water Supply, Sewerage and Drainage Board as a water supply for the Perth Metropolitan area and it will become a major source of water in the future as bore fields in its western portion are developed. The effect of pumping water from these fields will be to lower the height of the water table with consequent stress and/or death to vegetation and the lowering of water levels in lakes (Bestow, op. cit.). The extent and location of the effect on vegetation is largely unpredictable with

present knowledge but it may be considerable (Burton 1975). Aplin (1975) of the W.A. Herbarium states that "The compound effects of water level variations could include massive invasions of alien plant species, biological pollution of swamps and lakes, and general degradation of the native vegetation and flora".

The water level reduction in wetlands could be minimised, but not eradicated, through careful planning in the positioning of bores. As the proposed borefields are in the western portion of the Gngangara mound it is predicted that Lake Chandala may be little affected (Bestow, pers. comm.) but this is not certain. Adequate steps should be implemented to protect wetlands within the affected area which are of great importance as waterfowl drought refuges (Riggert 1975).

In addition, Lake Chandala faces four other potential problems associated with its hydrology. Firstly a large area of land 3.5 km west of the lake is zoned for use for industrial purposes and is the site of the proposed Pacminex Alumina refinery (Fig. 3). Should this refinery be built a potential pollution hazard will occur from possible leakages from the associated red-mud lakes which will cover 3 600 ha (Appendix I). These lakes are usually lined with impermeable clay to prevent seepages and a monitoring system of surrounding bore holes may be drilled as a warning system. Should seepages occur it is possible to pump the contaminated water from these bores back into the mud lakes and to effectively prevent its further spread in the water table. However, the fact that it is possible to install these controls does not necessarily ensure that they will be installed and properly monitored in the absence of strict regulations. The siting of the mud lakes within the Pacminex site might also reduce the potential hazard to Lake Chandala but not to the Gngangara mound water supply in the general area. Further, the site appears to be a major recharge area by vertical infiltration to the underlying confined aquifer.

For these reasons it is suggested that the Fisheries and Wildlife Department should recommend to the State Government that the zoning of the proposed Pacminex site should be altered from industrial uses to the conservation of flora and fauna. The area could then be added to the reserve immediately north of it. There is every indication that other government departments and the beekeeping industry would support this policy. However, should this be unsuccessful, and if a refinery is ultimately built on the site, the department should seek assurances that adequate pollution controls will be implemented and that it will be supplied with monitoring data.

The second potential problem arises from the increasing number of private bores sunk in the area. There is no available information on the number and location of these although they are

required to be registered by law. The situation has no doubt arisen due to ignorance of the law but without controls these bores may cause a general lowering of the water table with consequent death or stress to vegetation. The Fisheries and Wildlife Department should request the MWSS&DB or the Geological Survey to undertake a census of bores around Lake Chandala and Lakes Bambun, Nambung and Mungala and Wellerling Swamp a few kilometres north-west, which are important wetlands. Regular information on the water table could be collected from these bores and the combined information would enable effective controls to be implemented if required.

Thirdly, the clearing of land on the Darling Scarp presents a continuing grave threat of salination, the universal and most serious threat facing Western Australian wetlands. Already the Geological Survey of W.A. has recorded high salinity levels a few kilometres south of Lake Chandala which is attributed to this source (Bestow, pers. comm.). Only effective legislation controlling clearing will ultimately solve this problem.

Finally, previous owners of the lake and adjacent land have tried to drain it for agricultural purposes. In the 1950's a drain was dug from the north-east corner along the eastern margin of the lake in an attempt to divert the flow of groundwater southwards into Ellen Brook. This attempt failed when a rock outcrop south of the lake prevented further progress and this drain is now largely choked with water plants. More recently in 1972 a new owner dug a drain from the southern end of the lake to Ellen Brook. His intention was to drain the lake, clear the vegetation, fill it with sand from adjacent areas and then to use it for pasture. Due to the poor nature of the soils this plan would have been an agricultural failure and was probably conceived as a means of acquiring taxation benefits. Fortunately, the plan never came to fruition although the drain is still extant and operative (Fig. 4). Such plans to utilize wetland of extreme importance and beauty in an attempt to exploit marginal agricultural land for a short period underline the necessity of acquiring legislative protection of important reserves on private property. This example also indicates the necessity of acquiring sufficient land to maintain the integrity of the lake and to protect it effectively from adjacent activities. Carrick (1962) states, "It is flood prevention measures and the control of natural waters for mainly agricultural purposes that threaten the breeding of ibis and waterfowl generally" (p. 80).

III FLORA

As can be seen from the vegetation map (Fig. 4) the lake is virtually covered by an extensive area of forest and scrub from 2-10 metres in height. This forest provides particularly good cover for waterbirds and a wide variety of nest sites which are exploited by a number of different species. In addition, the bottom topography of the lake comprises an extensive shallow shelf surrounding a relatively deep central pool. This topography provides a variety of food niches which are exploited by different species. In all, Lake Chandala represents an ideally diverse wetland for waterbirds and such lakes are now few in south-western Australia.

The flora of Lake Chandala may be classified into three major plant formations. These are:-

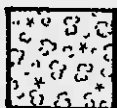
- (1) Low closed forest: This formation is made up entirely of Swamp paperbarks (*Melaleuca raphiophylla*) and Flood gums (*Eucalyptus rudis*), growing to 15 metres, which form an overhead canopy and with few perennial understorey plants. Many of these trees are of great age but there is evidence of a relatively recent fire (≤ 20 years ago) which has resulted in patches of immature trees. Undisturbed examples of this formation, once common in south-west wetlands, are now few and warrant urgent protection. In addition, this formation is the principal nesting area for waterfowl on the lake and supports the nesting colony of the Straw-necked Ibis.
- (2) Closed scrub: Surrounding the low closed forest is an extensive area of closed scrub to 4 metres in height and made up almost entirely of the melaleuca species *M. hamulosa* and regrowth of *M. raphiophylla*. Other melaleucas, particularly *M. lateritia* and *M. uncinata*, and some rushes are present especially in the eastern part of this formation
- (3) Samphire herbland: Small areas of samphire (*Arthrocnemum halecnemoides*) surround and intrude into the southern and western parts of the closed scrub.

The closed scrub and samphire herbland are regrowth areas and are a direct result of clearing by previous owners in attempts to develop the land. Originally the entire lake was covered with low closed forest, of which the central area is the last remaining vestige. With adequate protection the lake should return to its original state and thus increase in its already high significance as a fauna sanctuary.

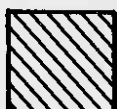
KEY TO FIGURE 4



LOW CLOSED FOREST



LOW OPEN FOREST



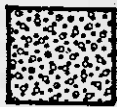
LOW WOODLAND



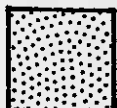
CLOSED SCRUB



CLOSED SCRUB WITH EMERGENTS



TALL OPEN SHRUBLAND



LOW SHRUBLAND



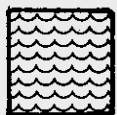
LOW OPEN SHRUBLAND



PASTURE GRASSLAND

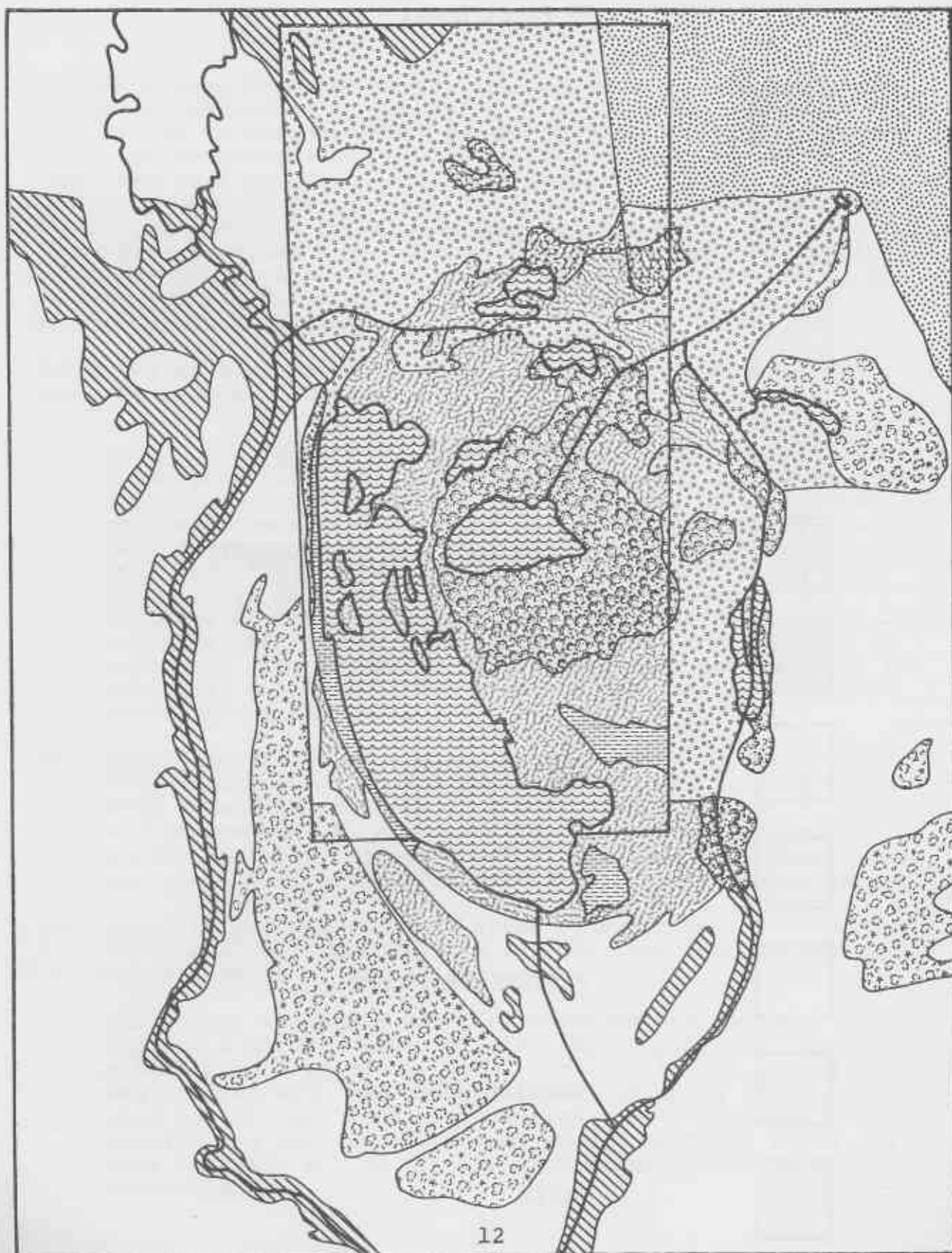


SAMPHIRE HERBLAND



WATER

FIGURE 4 VEGETATIVE FORMATIONS OF LAKE CHANDALA'



The surrounding area originally comprised Banksia-Sheoak-Pricklybark low open forest formation to about 6 metres and closed scrub with emergent *Melaleuca preissiana* but this has been largely cleared for agriculture. Details of vegetative formations are shown on Fig. 4 and Table 2.

IV BIRDS

As Lake Chandala was dry at the time the present report was commissioned a recent survey of the avifauna was not possible. However, the authors visited the area in late December, February and March 1975-76, and CSIRO and various naturalists banded many birds on the lake in 1961 and 1962. A bird list for Lake Chandala compiled from these sources is given in Table 3.

The plant associations of the lake provide nesting niches for a wide cross-section of waterbirds and particularly for the Straw-necked Ibis (*Threskiornis spinicollis*).

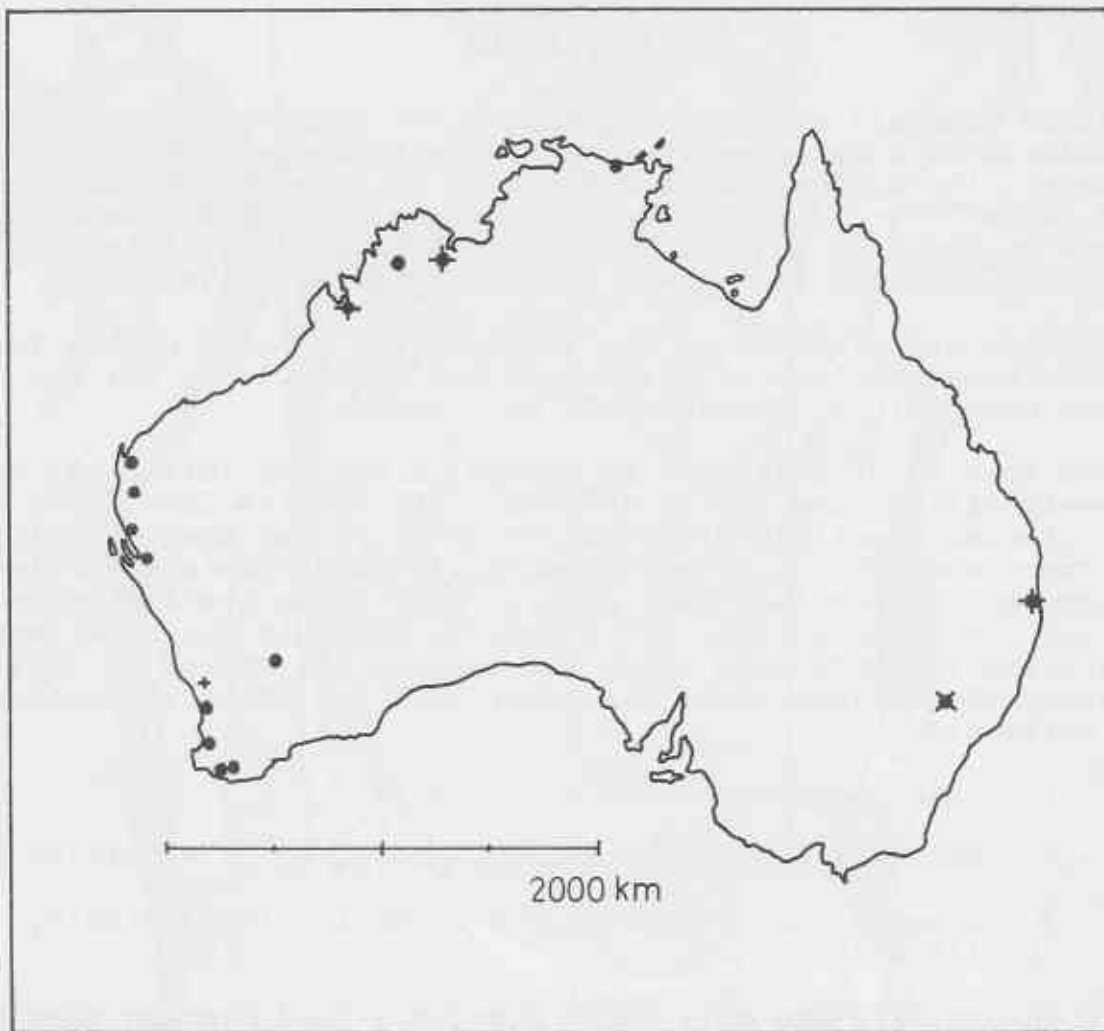
Three species of ibis nest in Australia but the latter has no closely allied form and is endemic. All species invariably nest in colonies sometimes of thousands of pairs and they therefore are more susceptible to environmental change than are species which nest in non-localized sites. Only three nesting colonies of the Straw-necked Ibis are presently known in south-western Australia (an area into which the species has spread in this century (McKilligan 1975; Alexander 1920)). Their location is as follows:-

1. Lake Chandala, 31°31'S, 115°57'E.
2. Marida and Bullrush swamps, Moora, 30°39'S, 116°00'E.
3. A swamp near the south end of Peel Inlet, 32°40'S, 115°40'E.

Lake Chandala is the only large regularly used nesting site and it may support more than 90% of the nesting population of Western Australia. (Edgar, pers. comm.).

In addition, Welling Swamp, a flora and fauna reserve a few kilometres north-west of Lake Chandala, was a very important nesting site until a fire destroyed the vegetation in 1963. Subsequent stock activities have prevented regrowth and 14 years later this swamp only provides roost sites. This example underlines the necessity of protecting all wetland reserves from stock

FIGURE 5 Recoveries of Straw-necked ibis
banded as young at Lake Chandala
1955 - 1970



Years after banding

● 0-1

✦ 1-2

✕ >2

and fire damage. The protection may be effected simply by fencing and firebreaks.

The example also illustrates the vulnerability of the Straw-necked Ibis population. When such disasters occur the species faces two alternatives:

- (a) to find a suitable alternative colony site or
- (b) to leave the area

with subsequently decreased local recruitment or even local extinction of the species. The number of alternative colony sites in Western Australia has declined drastically and the effect of continuing destruction of habitat in the Muchea area has been to concentrate the nesting colonies at Lake Chandala (Edgar and Steer, pers. comm.).

Carrick (1962) stated, "As natural waters in Australia come increasingly under control for agricultural and other purposes, with consequent diminution of flooding, the breeding of Straw-necked Ibis must be seriously affected. Now is the time to consider their requirements and to seek practicable measures of habitat and water manipulation which will ensure their survival". (p. 71).

Lake Chandala has also been the site of intensive banding programmes of Straw-necked Ibis nestlings by the CSIRO and members of the RAOU. Up to the present more than 2 000 nestlings have been banded there and at Wellerling Swamp, and by 1972 thirteen of these had been recovered at more than 160 km distance (Fig. 5, Purchase 1970, 1971, 1973; Carrick 1962; McKilligan 1975). Some individuals apparently disperse northwards along the coast from south-western Australia to northern Australia and then south into southern Queensland and even New South Wales. This dispersal may be very rapid and one bird travelled from Muchea to Arnhem Land in seven months at an average of 100 km/day.

The research value of Lake Chandala is considerable in the areas of:

- (a) bird movements and dispersion in Australia;
- (b) the transportation of tropical arboviruses by long distance migrants;
- (c) the ecology and behaviour of particular species especially the Straw-necked Ibis and
- (d) the study of animal populations and especially the

causation and function of colonial nesting (Lack 1954, 1966; Wynne-Edwards 1962; Krebs 1975; Tingay 1976).

V MAMMALS

No systematic survey of mammals of Lake Chandala has been conducted but suitable habitats exist for the Short-nosed Bandicoot (*Isoodon obesulus*) and the Water-rat (*Hydromys chrysogaster*). The Western Grey Kangaroo (*Macropus fuliginosus*) occurs in the area and scats of this species were common on the lake during our visits. The introduced fox (*Vulpes vulpes*) and rabbit (*Oryctolagus cuniculus*) were sighted. In addition, cattle are pastured in the area and these are causing continuing environmental degradation.

VI RECOMMENDATIONS

Lake Chandala represents a wetland flora and fauna habitat of the greatest importance and every effort should be made to acquire and effectively protect it as an "A" class reserve. The lake contains an intact remnant of once typical wetland vegetative formations and is one of the very few remaining nest sites of the Straw-necked Ibis in south-western Australia.

Carrick (op. cit.) suggests that this species is worthy of protection because of its economic significance as a predator of insects including the Australian plague locust (*Chortoicetes terminifera* (Walk.)); because it forms part of the natural food of aborigines in Northern Australia; and because of aesthetic considerations and the enjoyment derived by humans in bird-watching and naturalist pursuits. To these may be added the great scientific importance of this particular colony which presents a magnificent zoological study area very close to Perth, and the present general belief that man has an ethical responsibility to conserve animal and plant populations not only for potential profit and gain but in their own right.

The land is at present zoned for agricultural use and, although it is not valuable for crop planting, it provides good pasture and water for cattle. The agricultural value of the land is therefore equivalent to surrounding farmlands whose values are rapidly increasing. It is thus highly desirable that purchase should be effected as soon as possible. Should Lake Chandala privately change hands again it will certainly be again threatened by draining and clearing and, as it has survived two past attempts, this would be particularly tragic. While this report was being prepared, Lake Catambro, an important wetland 1 km west of Lake Chandala, was cleared by a new owner who intends to drain it and

plant vegetables. This example emphasises the continuous threat to wetlands in the area and the need for immediate protection of Lake Chandala.

On the basis of the evidence provided in this report the authors recommend -

- (1) That urgent steps should be taken for the immediate purchase of Lake Chandala as a fauna and flora reserve.
- (2) That the area of land purchased should also include the southernmost portion of the lake to maintain its integrity and to prevent future drainage problems. This would require the consent of the Town Planning Authority. The present owner has indicated his consent to include this land in the sale.
- (3) That the entire southern drain and the north-east section of the eastern drain should be filled in.
- (4) That bisecting fences should be removed.
- (5) That entry should be restricted to protect the Straw-necked Ibis nesting colony.
- (6) That the MWSS&DB or Geological Survey of W.A. be asked to provide monitoring information on the number of bores, the height of the water table and salinity readings for a large adjacent area.
- (7) That the Fisheries and Wildlife Department should suggest to the Environmental Protection Authority that in the light of recent information -
 - (i) the 'Pacminex' site should be re-zoned as a reserve to provide use compatible with the area and its significance as a water catchment, and
 - (ii) that the E.P.A. should consider proposing legislation to limit continuing clearing through requiring agriculturalists to maintain a minimum specified percentage of their land as bush or planted forest.

Implementation of these recommendations would effectively preserve Lake Chandala and the Straw-necked Ibis as a breeding species in south-western Australia.

VII ACKNOWLEDGEMENTS

A number of people readily supplied information on all aspects of this report. Mr J. Goodsell of the Fisheries and Wildlife Department, Mr T. Bestow of the W.A. Geophysical Survey, and Mr B. Carbon of the CSIRO Division of Land Resource Management supplied hydrological information. Dr Neville Marchant of the W.A. Herbarium identified plant specimens and Mr A. Fewster and Mr W. Steer provided details of past land use. Mr Ian Edgar, who originally reported the existence of the nesting colony at Lake Chandala, supplied the bird list based on many years of observation.

We gratefully acknowledge their ready co-operation which has greatly assisted the report to be prepared in the short time available.

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TABLE 1

Land Use in the Lake Chandala area - Current owners

Location No.	Area (ha)	Owner
2114	242	K.J. & D.A. Hodby, Medical Practitioner, 22 Riverview Street, South Perth.
2115	336	D.W. & B.G. Hodby, Dental Practitioner, 81 Smyth Road, Nedlands.
M1939	437	R.J. Lynch, Solicitor, 34 Brockman Avenue, Dalkeith and others.
M1306		W. Steer, Farmer, Great Northern Highway, Muchea.
3	137	Marchese Holdings Pty Ltd, 238 William Street, Perth.
4	312	Caveat A938185
M2091	981	G. Stefanelli, Sawmiller, Great Northern Highway, Middle Swan.
M1926	375	A. Warren, Farmer, 281 Campersic Road, Herne Hill.
M1378	221	Ellenbrook Nominees Pty Ltd, 154 Victoria Avenue, Dalkeith.
2	128	Ellenbrook Nominees Pty Ltd, 154 Victoria Avenue, Dalkeith.
1	99	Koonawarra Holdings Pty Ltd, Gingin Road, Muchea.
2367	87	Caveat A995756 held by K.J. Stansby, Business Manager, 5 Todea Court, Duncraig.
2011	40	Caveat A995756 as above.
2146	45	Caveat A995756 as above.
2480	65	Caveat A995756 as above.

TABLE 2

Plant List of Lake Chandala and Surrounding Area

1. Angiosperms (Monocotyledons)

Typhaceae

Typha domingensis Pers.

Cyperaceae

Cladium laxium (Mees) Benth.

Scirpus prolifer Rottb.

Lemnaceae

Lemna minor Linn.

Juncaceae

Juncus pallidus R.Br.

Angiosperms (Dicotyledons)

Casuarinaceae

Casuarina fraseriana Miq.

Proteaceae

Banksia attenuata R.Br.

Banksia ilicifolia R.Br.

Banksia menziesii R.Br.

Chenopodiaceae

Arthrocnemum halocnemoides var. *pergranulatum* Nees .

Chenopodium glaucum L.

Lauraceae

Cassytha sp.

continued

TABLE 2
(continued)

Mimosaceae

Acacia cyanophylla Lindl.

Fabaceae

Jacksonia furcellata (Bonpl.) DC.

Myrtaceae

Eucalyptus rudis Endl.

Eucalyptus todtiana F. Muell.

Melaleuca hamulosa Turcz.

Melaleuca lateritia Otto.

Melaleuca preissiana Schau.

Melaleuca rhapsiophylla Schau.

Melaleuca uncinata R.Br.

TABLE 3

List of Birds Recorded for Lake Chandala

Little Grebe *	<i>Podiceps novae-hollandiae</i>
Hoary-headed Grebe *	<i>Podiceps poliocephalus</i>
Little Black Cormorant *	<i>Phalacrocorax sulcirostris</i>
Little Pied Cormorant *	<i>Phalacrocorax melanoleucos</i>
Australian Darter	<i>Anhinga rufa</i>
White Egret	<i>Egretta alba</i>
White-faced Heron *	<i>Ardea novae-hollandiae</i>
White-necked Heron	<i>Ardea pacifica</i>
Nankeen Night Heron	<i>Nycticorax caledonicus</i>
Straw-necked Ibis *	<i>Threskiornis spinicollis</i>
White Ibis	<i>Threskiornis molucca</i>
Yellow-billed spoonbill	<i>Platalea flavipes</i>
Black Swan *	<i>Cygnus atratus</i>
Mountain Duck	<i>Tadorna tadornoides</i>
Black Duck	<i>Anas superciliosa</i>
Grey Teal *	<i>Anas gibberifrons</i>
White-eyed Duck	<i>Aythya australis</i>
Maned Goose *	<i>Chenonetta jubata</i>
Blue-billed Duck	<i>Oxyura australis</i>
Musk Duck	<i>Biziura lobata</i>
Whistling Eagle	<i>Haliastur sphenurus</i>

continued

TABLE 3
(continued)

Black-tailed Native Hen	<i>Tribonyx ventralis</i>
Dusky Moorhen	<i>Gallinula tenebrosa</i>
Coot *	<i>Fulica atra</i>
Banded Plover	<i>Zonifer tricolor</i>
Black-fronted Dotterel *	<i>Charadrius melanops</i>
White-headed Stilt	<i>Himantopus himantopus</i>
Avocet	<i>Recurvirostra novae-hollandiae</i>
Twenty-eight Parrot	<i>Barnardius zonarius</i>
Pallid Cuckoo	<i>Cuculus pallidus</i>
Laughing Kookaburra	<i>Dacelo gigas</i>
Sacred Kingfisher *	<i>Halcyon sancta</i>
Bee-eater	<i>Merops ornatus</i>
Welcome Swallow	<i>Hirundo neoxena</i>
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>
White-winged Triller	<i>Lalage sueurii</i>
Brown Songlark	<i>Cinclorhampus cruralis</i>
Banded Blue Wren	<i>Malurus splendens</i>
Western Warbler	<i>Gerygone fusca</i>
Western Thornbill *	<i>Acanthiza inornata</i>
Broad-tailed Thornbill	<i>Acanthiza apicalis</i>
Yellow-tailed Thornbill *	<i>Acanthiza chrysorrhoa</i>
Grey Fantail *	<i>Rhipidura fuliginosa</i>

continued

TABLE 3

(continued)

Willy Wagtail	<i>Rhipidura leucophrys</i>
Silvereye *	<i>Zosterops gouldi</i>
Brown Honeyeater	<i>Lichmera indistincta</i>
Singing Honeyeater	<i>Meliphaga virescens</i>
Magpie-lark *	<i>Grallina cyanoleuca</i>
Masked Wood-swallow *	<i>Artamus personatus</i>
Black-faced Wood-swallow	<i>Artamus cinereus</i>
Grey Butcher-bird	<i>Craeticus torquatus</i>
Western Magpie *	<i>Gymnorhina dorsalis</i>
Raven *	<i>Corvus coronoides</i>

* Denotes nesting record

PLATES



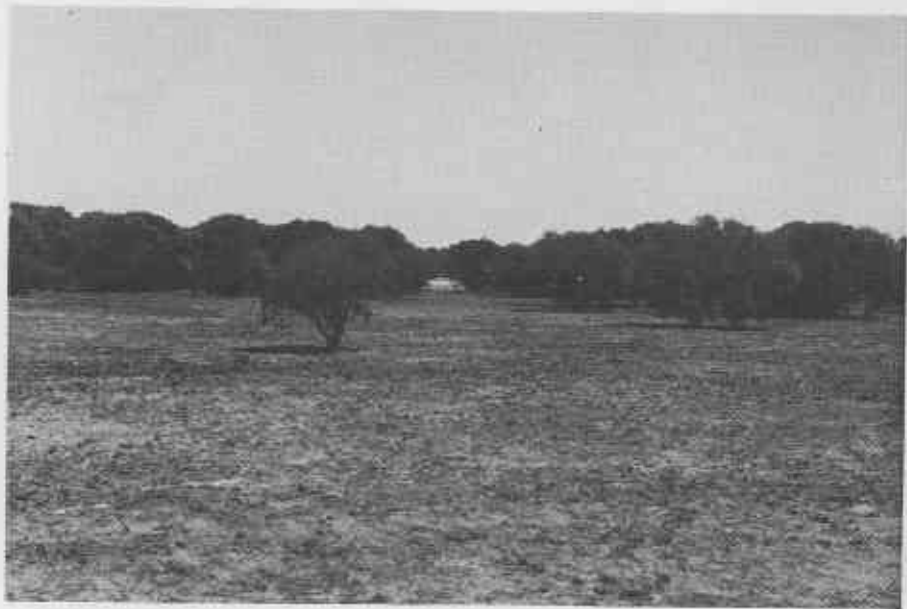
1. The central pool of Lake Chandala in late summer.



2. Low closed forest of Melaleuca raphiophylla and Eucalyptus rudis, the main nesting habitat for Straw-necked Ibis.



3. Closed scrub of Melaleuca raphiophylla
and M. hamulosa.



4. Six-year old regrowth of M. raphiophylla.



5. Samphire herbland with closed scrub and low closed forest in the background.



6. A group of Little Black Cormorant's nests in low closed forest.

7. A typical ibis
nest in a tall
paperbark.



8. A portion of the Straw-necked Ibis population in
the breeding season of 1975. (Photo: A. Fewster)



9. Eastern drain dug in the early 1950's.



10. Southern drain dug in the early 1970's.
(Photo: A. Fewster)