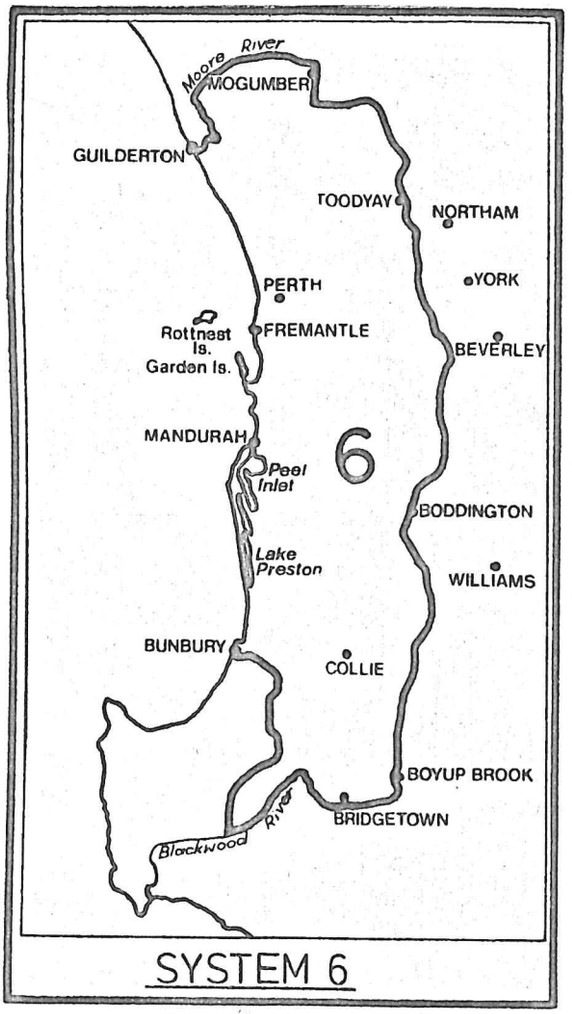
THE VALUE TO AGRICULTURE OF THE WETLANDS OF SYSTEM 6



SYSTEM 6

by

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SUMMARY

Agriculture uses wetlands for crops, pasture and for reclamation. In evaluating these uses this study places a net annual value on the agricultural produce estimated to come from the wetlands. It also records separately the financial expenditure incurred in this production as this can be viewed as income for the region.

Under the assumptions presented in the following pages the estimated value of agricultural produce from the wetlands is $3.2 million. In producing this an estimated $1.5 million is expended by farmers. The following table summarises the break-up of these figures.

Wetland use	Area (ha)	Net value of produce ($/year)	Cost of production ($/year)
Vegetables	140	87 500	532 000
Fodder crops	250	47 500	12 500
Perennial pastures	12 380	2 778 100	742 800
Annual/Volunteer	7 230	318 100	144 600
	20 000	3 231 200	1 431 900
Reclamation		15 000	15 000
TOTAL		3 246 200	1 456 900

INTRODUCTION

Ideally agricultural use of wetlands should be related with wetlands at a specific level, perhaps using the system set up by Tingay and Tingay (1976). However, as they indicate, there is much more work to be done before their system is complete to that extent.

As an unsatisfactory second best one is thrown back on estimates for which there is little factual foundation. However, the assumptions made here have been made as explicit as possible so adjustments for improved information can be made.

AREAS OF WETLAND AVAILABLE FOR AGRICULTURE

According to Tingay and Tingay (1976) the total area of System 6 is 25 470 km^2. Unfortunately their report makes no estimate of the area of wetlands in System 6. For an estimate of wetland area one is forced to turn to the more limited survey of Riggert (1966) which covered only about a third of System 6 (see Map 1) and also included part of System 1. His classification system and classification are reproduced in Appendix 1.

The U.S. Fish and Wildlife Service classification adopted by Riggert has a special classification 1A for flooded agricultural land. While this is unlikely to contain all the wetlands suitable for agricultural use it will exclude wetlands on crown land (not available to agriculture) and is thus a useful guide to agricultural wetlands on the Swan Coastal Plain. In addition classification numbers 1 (Seasonally flooded basins or flats) 2 (Inland fresh meadows) and 3 (Inland shallow fresh marshes).

According to Riggert these four classifications had a total area of 300 km^2 on the Swan Coastal Plain in 1966. However, he indicates in his Table 5 that some 1 100 hectares of wetland had been reclaimed in the eleven years from 1955 to 1966. On the assumption that reclamation has continued at a similar rate since then (since it is almost eleven years since 1966) it is estimated (Appendix 2) that a further 52 km^2 have been reclaimed (largely for agriculture) since 1966. Consequently the area of wetlands in classifications 1, 2 and 3 has been reduced by about 30 km^2. Part of Riggert's zone C is excluded from System 6. System 6 also includes areas of the Darling Range ignored by Riggert. Adjusting for these differences it seems reasonable to estimate that the area wetlands in System 6 which could be used by agriculture is about 480 km^2.

Of this area under half (200 km^2) would be classified as flooded agricultural land (1A)by Riggert. Of the rest much (say half) would have unsuitable soil-types.

On a loose extrapolation from Riggert's study it is estimated that System 6 contains 20 000 ha (200 km^2) of agricultural land which could be classed as wetland and a further 10 000 ha (100 km^2) of wetland which could be used by agriculture in the future without drainage.

USE OF WETLAND BY AGRICULTURE

Agriculture's uses of wetland are very diverse, from intensive cropping of swamps for vegetables to range grazing of cattle and sheep. It is assumed here that, due to flooding the wetlands are only available to agriculture from August-September to late May.

Vegetables

In System 6 there are about 720 vegetable growers with an average crop area of about 3.8 hectares; total crop 2 736 hectares. Of this, Mr J. Fallon (W.A. Department of Agriculture) estimates no more than 5 per cent would be grown on wetland. On this basis about 140 hectares of vegetables are grown on wetlands in System 6.

Fodder Crops

Extrapolating from A.B.S. rural statistics (Appendix 3) it seems likely that about 560 hectares of fodder crops are grown in System 6. A proportion of this fodder crop area (estimated at 160 hectares) would be irrigated and a further proportion (estimated at 150 hectares) would be sown on dry land. The rest would be sown on wetlands to capitalize on their summer moisture. The estimated area of fodder crops grown on wetlands in System 6 is 250 hectares.

Perennial Pasture

There are no statistics available to give the area of wetlands sown to perennial pasture species. The following assumptions were made:-

(a) Irrigated pasture receives a total of 1 tonne of fertiliser (of all types) each year

(b) Wetland perennial pasture receives a total of 0.7 tonnes of fertilizer

(c) Dryland pasture is fertilized at a rate which varies with the area in which it is grown. In

System 6 rates of application vary from 0.12 tonnes per hectare to 0.22 tonnes per hectare. (These are estimates of what is actually done, not recommendations).

(d) pasture fertilizer not used on irrigated pasture at the rate assumed in (a) or on dryland pasture at the rates assumed in Appendix 4 is used on wetland perennial pasture at the rate assumed in (b).

Using these assumptions it is estimated (Appendix 4) that the area of wetland perennial pasture in System 6 is 12 380 hectares.

Annual and Volunteer Pasture

It is assumed that the remainder of the agricultural wetlands (7 230 hectares) are utilised in the form of sown annuals or volunteer pasture.

VALUE OF WETLANDS TO AGRICULTURE

Vegetables (140 ha)

Potatoes are the major vegetable crops grown in Western Australia. The Department of Agriculture used a survey of growers in 1971/72 to estimate the cost of production of potatoes. Indexing the result, the current cost of production is likely to be about $3 800 per hectare on a crop which yields 29.5 tonnes of marketable potatoes. The current price for potatoes is around $150 per tonne (4 425 for 29.5 tonnes).

If the whole 140 hectares of wetland were planted to potatoes, growers would have to spend about $532 000 to grow the crop and they would receive, at current prices and a yield of 29.5 tonnes per hectare, $619 500 for their produce, a margin of $87 500.

Fodder Crops (250 ha)

The yield from fodder crops is highly variable but of the order of 20 tonnes per hectare from summer crops grown on wetlands. The total area of 250 hectares would, on this basis, yield about 5 000 tonnes of feed from the summer fodder crop. This feed would be worth about $12 a tonne, giving a total value of produce from the land of $ 60 000.

The costs of production including seeding, fertilizer, and harvesting, would amount to about $50 per hectare or $12 500 for the 250 hectares. The net value of the produce would then be $47 500.

Perennial pasture (12 380 ha)

Perennial pasture is only of value when it is utilized by animals whose produce is subsequently sold. Wetland perennial pasture may be used for dairying - in which case it is capable of carrying about 2.5 cows per hectare from September to late May. To the extent that its capacity is not fully utilized, its value to agriculture is somewhat less - say 2 cows per hectare over the same period. Mr R. Bettenay (Department of Agriculture) estimates that to hand-feed these cows over the same period would require an average of 15 kg of hay per day plus 15 kg of a grain mixture. The total amount of feed required to hand-feed would thus be 3.6 tonnes of day (valued at $35 per tonne) and 3.6 tonnes of barley/lupin mix (valued at $80 per tonne); a total cost of $414 for feed equivalent to that provided by a hectare of wetland perennial pasture. To gain this feed the farmer would have to spend about $60 a year on fertilizers, spreading and pasture renovation, so the net value to the farm would be $354 per hectare.

However, not all the perennial pasture is used to feed milking cows. Some is used to fatten livestock for slaughter and much is used to carry drystock over summer. An alternative feed source for fattening would be similar to that for milking (though the stocking rate on the pasture would differ). For carrying livestock over summer the realistic alternative would be an all-hay ration. A hectare of pasture for this use should thus be valued at the cost of 7.2 tonnes of hay ($252) less pasture costs ($60); a net value per hectare of $192.

Probably about a fifth of one wetland perennial pasture is used for milking or fattening, the rest being used for carrying livestock over summer. Under these assumptions here is the estimated value of wetlands bearing perennial pasture:-

Pasture use	Area (ha)	Net value ($/ha)	Total net value ($/ha)	Costs $/ha	Total costs $/ha
Milking/fattening	2 476	354	876 504	60	371 400
Carry-over	9 904	192	1 901 568	60	371 400
TOTALS	12 380		2 778 072		742 800

Annual and volunteer pasture (7 230 ha)

The value of annual or volunteer pasture grown on wetlands is more than that of dryland pasture but less than that of perennial wetland pasture. At one third the value of their perennial counterparts ($192), annual wetland pastures are assumed to be worth $64 per hectare. In growing these pastures farmers would spend on average about $20 per hectare per year, making the net value of the feed $44 per hectare.

The area of such pastures has been estimated at 7 230 hectares, so the total net value to agriculture is $318 120 and an estimated $144 600 is spent to produce the feed.

Reclaimable land

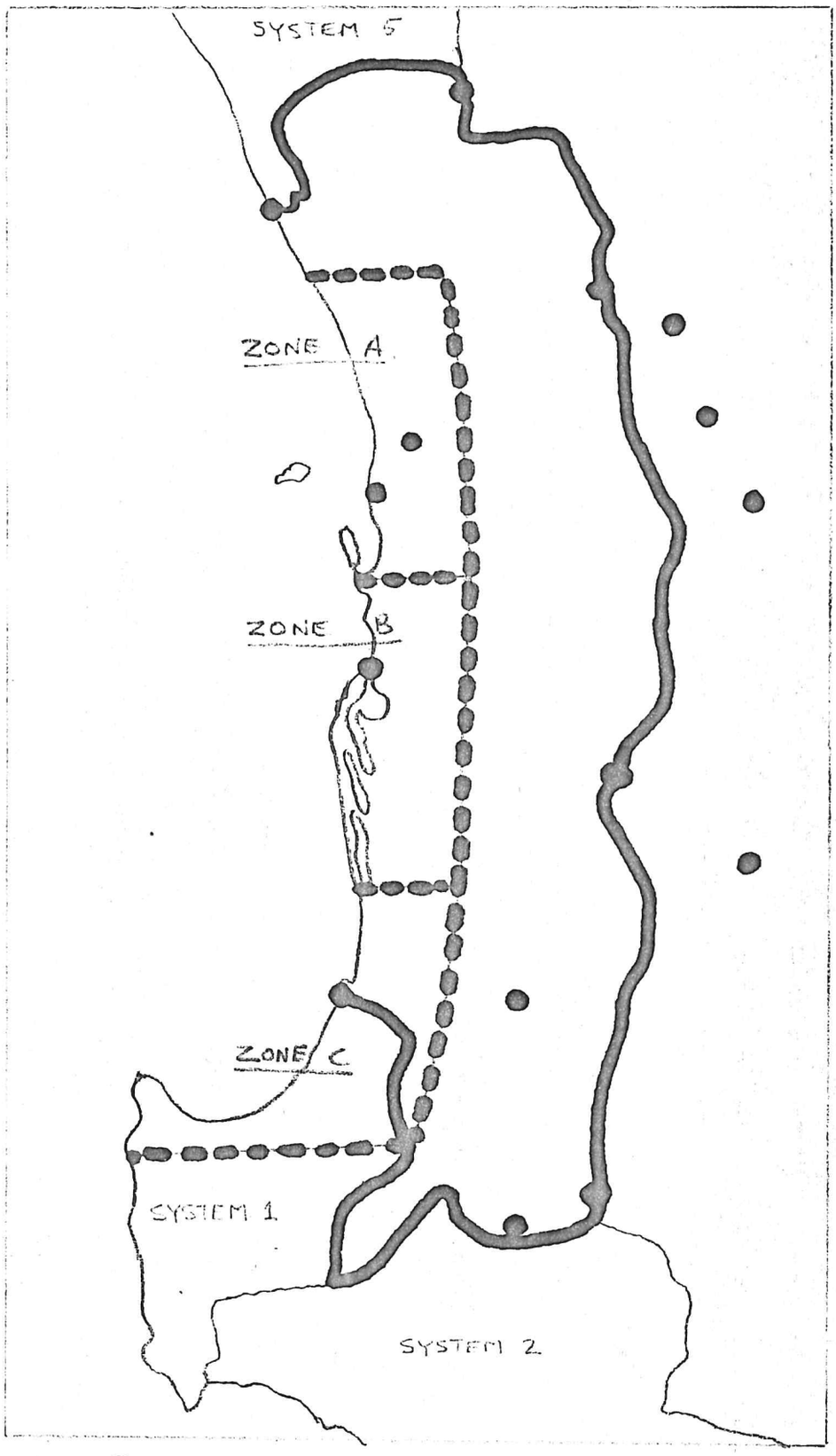
In addition to being used as wetland, wetlands also provide a source of reclaimable land which may be drained. According to Appendix 2 about 16 000 hectares of wetlands have been reclaimed - probably mainly for agriculture - since 1955. Despite a diminishing supply, agriculture is likely to continue reclaiming wetlands by drainage at the rate of about 150 hectares per year for some time yet. The added value of such land when reclaimed would be about $200 per hectare. Costs of reclamation vary widely but a mid-point estimate, including drainage, and pasture establishment is $100 per hectare. The net value of the land is thus $100 per hectare or $15 000 per year for 150 hectares at a cost of $15 000 per year. This analysis excludes any Public Works Department drainage which may be necessary to enable land to be drained or to alleviate flooding problems elsewhere, caused by draining land for agriculture.

REFERENCES

AUSTRALIAN BUREAU OF STATISTICS (Western Australian Office) — Rural Industries 1973-74

RIGGERT, T.L. — Wetlands of Western Australia 1964-66
Department of Fisheries and Fauna of Western Australia, 1966

TINGAY, A. and S. — The Wetlands of System 6
Environmental Protection Authority, Western Australia, 1976

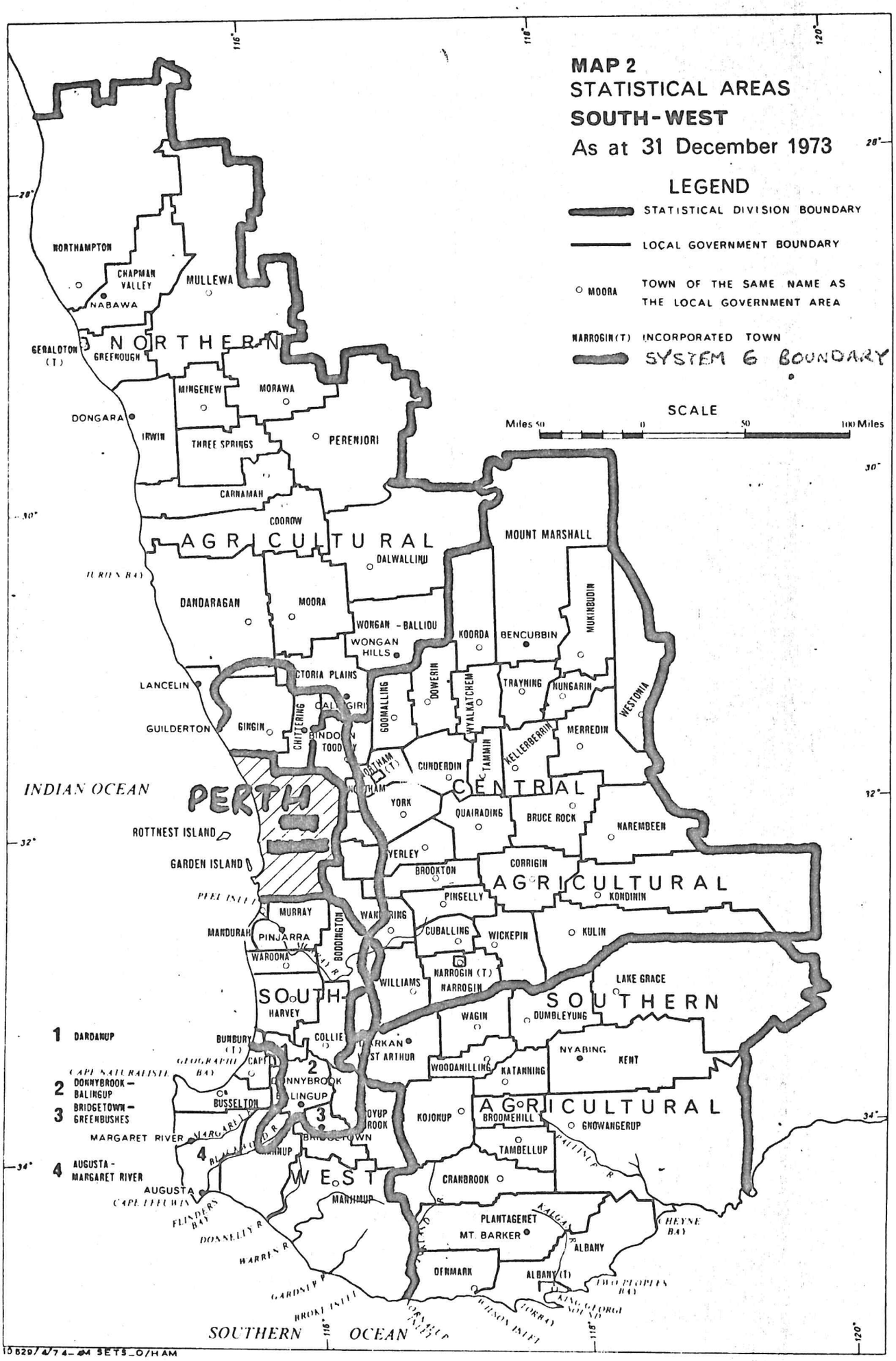


MAP 1 SYSTEM 6 AND THE SWAN COASTAL PLAIN

LEGEND

BOUNDARY OF SYSTEM 6

BOUNDARY OF RIGGERT (1966) SWAN COASTAL PLAIN STUDY ZONES



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Source :- A.B.S. op. cit.

APPENDIX 1

Table 1: Classification of wetlands of the Swan Coastal Plain (Riggert 1966)[1]

Category	Type[2]	Zone	Drainage	Area (1966) (km^2)	No. of wetlands	Average area (km^2)
Inland Fresh	1	A	*[3]	45.80	296	0.154
		B	*	45.30	187	0.242
		C	*	4.60	73	0.063
	1-A	A	-	38.07	27	1.410
		B	-	60.29	12	5.025
		C	-	51.32	14	3.666
	2	A	*	11.65	42	0.277
		B	*	14.08	1	-
		C	*	0.11	1	-
	3	A	*	10.02	119	0.084
		B	*	12.48	139	0.090
		C	*	5.94	8	0.742
	4	A	*	5.14	34	0.151
		B	*	8.71	6	1.452
		C	*	0.08	1	-
	5	A	*	13.07	7	1.867
		B	*	10.74	5	2.148
	5-P	A	-	12.85	4	3.212
		B	-	12.69	3	4.233
		C	-	20.06	2	10.030
Inland Saline	11	B	*	42.71	9	4.745
Coastal Fresh	12	A	*	13.31	8	1.664
	13	A	*	3.44	7	0.491
		B	*	3.32	13	0.255
	14	A	*	5.50	2	2.752
Coastal Saline	15	C	*	0.32	1	0.324
	18	C	*	2.48	1	2.485
	19	A	-	36.15	2	18.073
		B	-	127.46	2	63.731
		C	-	27.89	4	6.972

[1] Adapted from Tables 2-9 of Riggert (1966)

[2] For Types see Table 2

[3] * indicates drainable wetlands

- indicates non-drainable wetlands

Table 2: Wetlands classification of United States Fish and Wildlife Service (1953)[1]

Wetland category		Type	Water Depth
Inland Fresh Areas	1.	Seasonally flooded basins or flats	Few inches in upland; few feet along rivers
	1A.	Flooded agricultural land	Few inches in upland; few feet along rivers
	2.	Inland fresh meadows	Few inches after heavy rains
	3.	Inland shallow fresh marshes	Up to 6 inches
	4.	Inland deep fresh marshes	Up to 3 feet
	5.	Inland open fresh water	Up to 10 feet, marshy border may be present
	5P.	Permanent Open Water (Reservoirs)	Up to 10 feet
	6.	Shrub swamps	Up to 6 inches
	7.	Wooded	Up to 1 foot
	8.	Bogs	Shallow ponds may be present
Inland Saline Areas	9.	Inland saline flats	Few inches after heavy rain
	10.	Inland saline marshes	Up to 2 feet
	11.	Inland open saline water	Up to 10 feet; marshy border
Coastal Fresh Areas	12.	Coastal shallow fresh marshes	Up to 6 inches at high tide
	13.	Coastal deep fresh marshes	Up to 3 feet at high tide
	14.	Coastal open fresh water	Up to 10 feet; marshy border often present
Coastal Saline Areas	15.	Coastal salt flats	May have few inches at high tide
	16.	Coastal salt meadows	May have few inches at high tide
	17.	Irregularly flooded salt marshes	Few inches at wind tide
	18.	Regularly flooded salt marshes	Up to 1 foot at high tide
	19.	Sounds and bays	Up to 10 feet at high tide
	20.	Mangrove swamps	Up to 2 feet

[1] Adapted from Riggert, T.L. (1966). A study of the Wetlands of the Swan Coastal Plain. Department of Fisheries and Fauna, Western Australia.

APPENDIX 2

Estimated reclamation since 1966 (after Riggert (1966) Table 5 Drainable wetlands - Zones A,B,C.)

Category Number	Description	Area of Wetlands (Hectares)			
		Present 1955	Reclaimed 1955-1966	Reclaimed(a) 1966-1976	Remaining 1976
1	Seasonally flooded	9 626	38	38	9 550
2	Fresh meadows	2 664	-	-	2 664
3	Marshes-shallow	7 980	5 136	2 844	-
4	-deep	6 159	4 765	1 394	-
5	Open water-fresh	2 384	-	-	2 384
11	-saline	4 274	-	-	4 274
12	Coastal marshes-fresh	1 538	206	206	1 126
13	-deep	1 467	791	676	-
14	Coastal open water	551	-	-	551
15	Coastal salt flats	32	-	-	32
18	Regularly flooded salt marshes	331	82	82	167
TOTAL		37 006	11 018	5 240	20 748

(a) Assuming same rate of reclamation as in 1955-1966

APPENDIX 3

Estimation of the area of fodder crops grown in System 6.

Local Government Area (L.G.A.)		Proportion of L.G.A. in System 6(e)	Area of fodder crops for green feed in System 6 - 1973/74					
			1	2	3	4	5	6
			Forage Sorghum(a)	Other(a)(b)	Total	Total Irrigated(c)	Grown on dryland(d)	Grown on wetland 3 - (4)+(5)
Perth								
S.W.	Boddington	.75	13	67	80	80		
	Boyup Brook	.5						
	Bridgetown	.25		19	19		15	4
	Collie			3	3			3
	Dardanup		15	26	41	6	15	20
	Donnybrook		34	3	37	14	13	10
	Harvey		60	103	163	39	24	100
	Mandurah							
	Murray		30	7	37	5	12	20
	Nannup	.5						
	Waroona		20	42	62	13	19	30
Sthn	West Arthur	.5		43	43		35	8
Central	Beverley	.5						
	Northam	.25		20	20		20	
	Wandering	.5						
	Williams	.5						
	York	.5						
Nrthn	Chittering		2		2			2
	Gingin		10		10			10
			41		41			41
							TOTAL	248

(a) Australian Bureau of Statistics, op.cit., pp 19-20

(b) Includes millet, vetches, grain sorghum, maize and vegetables and rape for stockfeed

(c) Estimated from A.B.S., op. cit., p37 "Other crops" - less an allowance for irrigated vine crops

(d) Estimate

(e) See Map 2

APPENDIX 4

Estimation of area of wetland sown to perennial pasture species

		1	2	3	4	5	6	7	8	9	10
		Land under sown pasture (Table 3)(a)	Pasture Irrigated (Table 19)	Non-irrig Pasture 1 - 2	Total Fertiliser used on pasture (Table 18)	Fert. Irrig Pasture @ 1t/ha	Fert. on non-irrig Pasture 4 - 5	Dryland pasture Fert.rate t/ha (est)	Fert. need if all non-irrig pasture were dryland 3 x 7	Extra Fert. assumed applied to wetland pastures 6 - 8	Area of wetla (if fertilise at 0.7 t/ha) 9 ÷ (0.7 - 7
Perth		75 692	555	75 137	16 186	555	15 631	.20	15 027	604	(.50) 1 208
S.W.	Boddington	25 312		25 312	5 042		5 042	.17	4 303	739	(.53) 1 394
	Boyup Brook	56 808	3	56 805	9 564	3	9 561	.17	9 657	(- 96)(b)	(.53) (- 181
	Bridgetown	11 684	4	11 680	2 165	4	2 161	.18	2 102	59	(.52) 113
	Collie	11 771	34	11 737	2 604	34	2 570	.19	2 230	340	(.51) 667
	Dardanup	23 383	2 509	20 874	7 909	2 509	5 400	.22	4 592	808	(.48) 1 683
	Donnybrook	44 509	193	44 316	9 386	193	9 193	.19	8 420	773	(.51) 1 516
	Harvey	56 969	8 216	48 753	19 336	8 216	11 120	.21	10 238	882	(.49) 1 800
	Mandurah	2 760	298	2 462	418	298	120	.20	492	(-372)	(.50) (- 744
	Murray	58 978	265	58 713	13 313	265	13 048	.20	11 743	1 305	(.50) 2 610
	Nannup	9 402	8	9 394	2 076	8	2 068	.22	2 067	1	(.48) 2
	Waroona	25 920	1 882	24 038	7 048	1 882	5 166	.21	5 048	118	(.49) 241
Southern	West Arthur	65 328		65 328	10 718		10 718	.16	10 452	266	(.54) 593
Central	Beverley	49 883		49 883	5 557		5 554	.12	5 986	(-432)	(.58) (- 745
	Northam	15 463		15 463	1 981		1 981	.13	2 010	(- 29)	(.57) (- 51
	Wandering	25 825		25 825	3 963		3 963	.13	3 357	606	(.57) 1 063
	Williams	51 908		51 908	8 032		8 032	.14	7 267	765	(.56) 1 366
	York	39 634		39 634	4 143		4 143	.12	4 756	(-613)	(.58) (-1 057
Northern	Chittering	50 202	8	50 194	8 898	8	8 890	.17	8 533	357	(.53) 674
	Gingin	79 330	210	79 120	13 781	210	13 571	.17	13 450	121	(.53) 228
										TOTAL	12 380

(a) Table numbers refer to A.B.S. op, cit

(b) These negative amounts are due to rounding errors and errors in over-estimating column 7
Carrying them through helps account for rounding and under-estimation errors elsewhere