A guide to identifying wetland management objectives in the Perth metropolitan area

Environmental Protection Authority
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Acknowledgements

The original concept of 'evaluating' wetlands to improve their protection and management in Western Australia was published as a draft document (Environmental Protection Authority Bulletin 227 1986) containing an 'evaluation' questionnaire.

In excess of 30 public submissions were received regarding the document and these are acknowledged in Appendix 1.

The considerable efforts of Dr Frank Murray, staff and students of Murdoch University, and Joan Payne and Jan Rodda of the Conservation Council of Western Australia in field testing the questionnaire are acknowledged. They also provided valuable feedback on the structure and composition of the document.

Garry Middle of Murdoch University is credited with the design and improvements to the layout of the field survey sheet (Appendix 5). His input into the fine tuning of the questionnaire is also acknowledged.

Funding for the broad scale testing of the questionnaire at several locations has been provided by the Water Authority of Western Australia. The ongoing financial, scientific and technical contribution to this and related wetlands programmes by the Water Authority is recognised.

Section 1 Introduction

1.1 Background

In 1986, the Environmental Protection Authority received a proposal from the Water Authority of Western Australia to abstract large volumes of water from the Gnangara Mound. As this proposal had the potential to adversely affect wetlands by lowering the water table it was necessary to place controls over the level of water abstraction. The controls imposed a limit to the volume of water that could be abstracted from the mound through constraints to the levels to which lakes would be allowed to fall as a result of the water abstraction.

Consequently, it was necessary to examine the wetlands on the mound and to determine the purpose for which individual wetlands should be managed.

The Environmental Protection Authority developed a procedure for assessing individual wetlands and placing them into one of five management categories according to their biological, geological and/or social attributes. As the management objectives for each category are defined, it is then possible to set appropriate management criteria.

The approach also had the advantage of resolving conflict between government authorities, community groups and individuals about the 'value' of individual wetlands by making it possible to decide objectively the purpose for which they should be managed. Changes can then be made to relevant district and town planning schemes to prevent and eliminate incompatible land uses in the catchment. This gives the wetland long term security and permits the formulation of effective management plans.

During the formulation of the assessment process for the Gnangara Mound, it was recognised that the basic principle of evaluating wetlands and assigning them to management categories could be used elsewhere in the State. In 1986, the Environmental Protection Authority produced Bulletin 227 "Draft Guidelines for Wetland Conservation in the Perth Metropolitan Area" and released the document for public comment. This Bulletin contains a wetland evaluation questionnaire formulated for the Swan Coastal Plain along with supportive text.

Over the following months submissions suggesting improvements to the document were received from community groups, wetland researchers, local and State government administrators and private individuals (see Appendix 1). Changes were required to enhance the practical application of the questionnaire, to meet the objectives of the recently completed State Conservation Strategy and to provide more information to the user about wetland management.

The present, substantially revised document (Bulletin 374) thus evolved from Bulletin 227. The revised questionnaire was extensively field tested over the past two years by the Shire of Jarrahdale, the Water Authority of Western Australia and staff and students of Murdoch University. A list of wetlands evaluated is presented in Appendix 2. It is now appropriate to complete the evaluation process for the remaining wetlands on the Swan Coastal Plain using this approach and to formulate questionnaires for other regions of the State.

1.2 Who should use Bulletin 374?

Bulletin 374 has been written for a wide range of people including community groups, state and local government authorities and private landowners. A detailed technical knowledge of wetlands is not required and users should be able to determine the management category of a wetland by using the enclosed questionnaire.

The document is especially useful to developers to assist in their planning and to identify issues that they will have to address to obtain statutory approvals.

1.3 Structure of the document

Bulletin 374 has two main sections. Section 1 provides basic information of which the reader should be aware prior to using the questionnaire. This includes the definition of a wetland, a description of the five wetland management categories and an overview of the structure and limitations of the questionnaire. A brief discussion of the rationale for protecting and managing wetlands is presented in Appendix 4 for those unfamiliar with this issue.

Section 2 contains the Swan Coastal Plain questionnaire. An explanation of how to use the questionnaire is provided.

1.3.1 Definition of wetlands

For the purposes of this document, a wetland is defined as an area of permanent, seasonal or intermittent inundation, whether natural or otherwise; fresh, brackish or saline; static or flowing. Typically wetlands include lakes, swamps, marshes and dams; estuaries, rivers, streams and springs; and intertidal sand flats, mud plains and mangroves.

Excluded from this definition are areas which typically do not support water-dependent plant and animal life such as flooded playing fields or roadways. It should be noted that the above definition includes areas of land which are intermittently waterlogged and where surface water may or may not be present. These areas are commonly known as damplands and are of ecological importance in supporting vegetation and habitats which differ from other wetland types.

1.3.2 The management categories

The five management categories are:

i High conservation (Category H)

These wetlands possess a high degree of naturalness and there is a high level of interest in using the wetlands for various human purposes. This category is recognised as having the highest priority for establishment and implementation as regional park wetlands.

Management objectives:

- Active management to maintain and enhance the wetland attributes, particularly natural attributes. Where there is no active management at present it should be put in place as a matter of highest priority.

Active management requires that a detailed management plan is prepared and implemented, with sufficient resources to maintain or improve the wetland's current condition.

Examples: Loch McNess, Cooloongup, Thompsons Lake.

ii Conservation (Category C)

These wetlands possess a high degree of naturalness.

Management objectives:

- To maintain and enhance natural attributes and functions.

Examples: Forrestdale Lake, Gnangara Lake, Star Swamp.

iii Conservation and recreation (Category O — for open space)

These wetlands have been modified but are considered to play important roles in their urban and/or rural settings.

Management objectives:

- To provide for human uses whilst maintaining and enhancing the existing natural attributes.

Examples: Lake Carine, Lake Claremont, Lake Gwelup.

iv Resource enhancement (Category R)

These wetlands have been modified and do not have clearly recognised human uses in their urban or rural settings. Some of the wetlands in this category will be the focus for controversy if uncontrolled developments begin to impinge upon them.

Management objectives:

- To maintain and enhance the existing ecological functions.

  See Appendix 4 for the ecological functions of wetlands, and refer to the questionnaire to determine these.

A development may be recommended for approval provided:

a the wetland function is retained within the development, or

b an equivalent area of wetland of a similar type is constructed or rehabilitated to fulfil equivalent functions.

The term 'resource enhancement' has been used to indicate that opportunities may exist for commercial developments to enhance the conservation values of wetlands (ie the wetland resource) in this management category.

Examples: Hazelmere Lakes, Mariginiup Lakes, Tamworth Hill Swamp.

v Multiple use (Category M)

Wetlands in this category are significantly degraded, possessing few natural attributes and limited human use interest. Despite this, wetlands in this category can be a focus for controversy if developments impinge upon them. For example, attempts to alter Jackadder Lake, which falls into this category, would be closely scrutinised by the surrounding residents. Despite having few natural attributes, some of these wetlands may provide valuable waterbird habitat.

Management objectives:

- should be considered in the context of catchment and land use planning (especially drainage, nutrient enrichment, surface and groundwater pollution), in terms of the current value of the wetland and the potential value to the community if rehabilitated.

Therefore, uses may be proposed that involve significant alterations to the wetland, provided the considerations noted above are addressed. The Environmental Protection Authority may be satisfied with a well prepared environmental report for developments affecting these wetlands, but a higher level of assessment may be determined if the situation requires it.

Examples: Jackadder Lake, Queens Gardens, Wright Lake.

It is important to understand that **no single wetland category is of greater importance than another**. All wetlands are of value regardless of the purpose for which they are managed.

Any development or land use change affecting a wetland in all management categories will require an environmental report. The Environmental Protection Authority will determine the appropriate level of assessment (See Appendix 3).

1.4 The structure of the questionnaire

The questionnaire consists of three parts:

Part I - Natural Attributes

Part II - Human Use

Part III - Supplementary Questions

Questions in Part I and II can be answered for all wetlands. It is possible to complete the evaluation with a single visit to the site in conjunction with information from air photos, maps and council records. The results of this process will place the wetland into a management category. The role of the supplementary questionnaire is explained in Section 2.1 (Step 6).

A more detailed explanation of the questionnaire is provided below.

The Natural Attributes questionnaire score provides an indication of the current 'naturalness' of the wetland. This questionnaire is in turn divided into two broad sections in recognition of the diverse nature of Perth's wetlands.

The first sub-section (Part 1A) is for permanent and seasonal wetlands with well defined boundaries. The second (Part 1B) is for seasonal and episodic wetlands with poorly defined boundaries, which are called damplands.

Seasonal and episodic wetlands with poorly defined boundaries are common on the eastern regions of the coastal plain and in the Serpentine region.

The Human Use questionnaire scores the number of human uses for which the wetland area is perceived as important. This gives an indication of the degree of management (or negotiations) that may be necessary in determining the future of the wetland. Therefore the score for human use includes beneficial, conflicting and detrimental human uses.

1.5 The geographic limitations of the questionnaire

The questionnaire in Bulletin 374 applies to an area of the Swan Coastal Plain extending from Gingin Brook in the north, to the foot of the Darling Scarp in the east, to the Peel Inlet, Murray River and South Dandalup River in the south and to the coast in the west. This area encompasses the unconfined groundwater systems of the Gnangara Mound north of the Swan River, the Jandakot Mound south of the Swan-Canning rivers, and a number of smaller unconfined flow systems, including the Safety Bay Mound, the Stake Hill Mound, and those in the Serpentine, Byford and Armadale areas.

The questionnaire was designed specifically for this region and should not be used elsewhere. Other questionnaires will need to be developed in the future for regions of the State outside the Swan Coastal Plain. Responsibility for this task lies with the relevant State and local government decision making authorities and with developers. However it may be possible in some circumstances to adapt the Swan Coastal Plain questionnaire for this purpose and the Environmental Protection Authority would be willing to provide advice on this issue. The Authority may also choose to modify the structure and composition of questionnaires in the future as new information becomes available.

The questionnaire does not work in the following situations:

- Wetlands above the foot of the Darling Scarp.
- Streams, channels and drains, but it may be applied to associated wide floodplains.
- Farm dams and similar structures or pits (eg gravel pits) without emergent vegetation.

1.6 Functional limitations

The assessment of management categories and objectives through this questionnaire should be perceived as a first cut, broad brush assessment. It should not be taken as the final assessment; subsequent detailed investigations may reveal a different set of management objectives.

The questionnaire provides only a 'snapshot' of the wetland's current condition. Active management, rehabilitation or lack of management can change the assessment and subsequent management category. Each question has management notes which explain the basis for the scoring applied.

In conclusion, any attempt to provide a simple assessment of wetland systems which are biologically diverse and which can be affected by human use in many ways requires thoughtful consideration as to which wetland characteristics warrant scoring.

Section 2 The Swan Coastal Plain questionnaire

2.1 How to use the questionnaire

Step 1

Obtain aerial photographs and maps. Aerial photographs should be at a scale of 1:20,000 or better. The Metropolitan Road Guide colour aerial photographs are suitable. If the wetland has poorly defined boundaries, stereoscopic coverage is useful. Maps should show property boundaries, roads, service corridors and land tenure.

Step 2

Read the whole questionnaire and make notes about the information to be collected during the field visit. The management notes associated with each question give hints about what you need to look for.

Step 3

Determine the boundaries of the wetland being assessed using maps and aerial photographs in combination. The local hydrology and vegetation is generally used to delineate the wetland from surrounding areas*.

This task is often difficult in the case of seasonal and episodic wetlands. These wetlands are generally located in areas of low relief so only a small rise in the water table is needed to join a myriad of small wetlands into one large flooded area.

In some cases it is almost impossible to determine wetland boundaries once the vegetation has been cleared. Caution is required when using aerial photography as it is easy to mistake a piece of remnant vegetation in a cleared area for a distinct wetland.

To overcome this problem artificial boundaries such as fence lines and roads can be used. However as the choice of boundaries has a major influence on the outcome of the questionnaire, it is important to clearly state the boundaries chosen.

Step 4

Answer as much as you can from the aerial photographs and maps for the relevant Natural Attributes questionnaire (IA or IB) and the Human Use questionnaire (II) using the field questionnaire provided as Appendix 5. Answer the Supplementary questionnaire if possible.

It should be noted that the format and wording of some questions in the field questionnaire has been altered to simplify the collection of data in the field and to enable the entire questionnaire to be condensed on to a single double sided sheet. Users should therefore be familiar with the substance of the text prior to using the field questionnaire.

Step 5

Undertake the field investigation(s) and visit the local government authority or relevant government department making sure you know what you are going to look for before you get there (Refer back to Step 2 and unanswered questions from Step 4).

* The physical boundaries of many wetlands on the Swan Coastal Plain have been identified and mapped in recent years as part of on-going research. Details of areas covered can be obtained from the Environmental Protection Authority.

Step 6

Reassess all your answers after the field visit and tally up the scores for each section.* Use the appropriate graph from Appendix 6 to determine the management category for your wetland. If you used the Natural Attributes questionnaire IA refer to graph A, and use graph B if you used questionnaire IB to determine your management categories.

Where the final score falls in the "transition" zone in the graphs, the Supplementary questionnaire (or further consideration of local issues) should be used to decide the appropriate wetland category.**

Step 7

It is important to present sufficient information to enable others to understand how the wetlands management category was determined. Information should be provided on the boundaries used in the assessment as well as the individual scores for the Natural Attributes, Human Use and Supplementary questionnaires. If the Supplementary questionnaire was used to determine the final outcome, the letter **S** should be written and circled adjacent to the wetlands name on the field questionnaire. Additional information which may be of use during the formulation of management plans should also be recorded.

*Although it can be argued that it is best to consider the score for each subsection of the questionnaire rather than the final score, the system for using the final score was found to provide satisfactory results for determining management categories.

If a wetland is recognised by international agreement because of its importance to waterbirds or the presence of rare fauna and flora **it automatically becomes a Category H wetland. No further assessment is required.

2.2 The natural attributes questionnaire

2.2.1 Part 1A: Permanent and seasonal wetlands with well defined boundaries

For wetlands with poorly defined boundaries go to Part IB (Page 12)

i Environmental geology classification

Does the wetland occur on the Quindalup Dunes or on a geological unit confined to a river/estuary floodplain?

YES	Score	5	
NO	Score	1	
	Score		[ ]

Source: Refer to 1:50,000 Environmental Geology Series (see Gozzard 1982).

Management Notes: Geological origin is one of the bases for wetland classification systems. In the metropolitan area wetlands within these geological units are rare.

ii Adjacent wetlands

Are there wetlands within a 2km radius?

YES	go to question iii		
NO	Score	3 — go to question (iv)	
	Score		[ ]

Source : Aerial photos.

Management Notes: Refer to question (iii).

iii Habitat diversity

Is the composition and structure of the vegetation significantly different to that found at nearby wetlands?

YES	Score	3	
NO	Score	1	
	Score		[ ]

Source: Refer to question (vi) for a listing of habitat types. Use aerial photos and field visits.

Management Notes: A high diversity of habitats is desirable from an ecological perspective. In some cases this diversity is not expressed in an individual wetland, but in a series of adjacent wetlands.

iv Drought refuge

What is the importance of the wetland as a drought refuge for birds?

MAJOR IMPORTANCE	Score	5	
MINOR IMPORTANCE	Score	2	
NO IMPORTANCE	Score	0	
	Score		[ ]

Source: Refer to Appendix 7 and local branch of RAOU.

Management Notes: Although waterbirds can move long distances to find suitable habitat when lakes dry out, it has been shown that Perth's wetlands provide a valuable drought refuge during the summer.

v Area of wetland

Estimate the area of the wetland:

>100ha	Score	5
50-100ha	Score	4
25-50ha	Score	3
10-25ha	Score	2
<10ha	Score	1
	Score	[ ]

Source: Map of appropriate scale in conjunction with a grid overlay. The edge of the inundated area (often indicated by fringing vegetation or summer grass) should be used as the wetland perimeter for this calculation.

Management Notes: As a general rule large wetlands are capable of supporting a larger variety of species and have a greater capacity to absorb the detrimental impacts of nearby land uses than small wetlands. Where a wetland chain is severed by urban development, species diversity within individual lakes often declines due to a reduction in habitat diversity (see management notes Question (vi).

vi Habitat type

Using the list below score 1 for each habitat type represented.

a Vegetation over 0.1 hectare in area

- large paperbarks (> 2.5m tall) in dense clumps
- low thickets (ie < 2.5m tall). These are often *Melaleuca*, *Astartea* or *Kunzea* spp
- paperbark fringe
- fringing rushes and sedges (often *Baumea* and *Juncea* spp.)
- fringing *Typha* (bullrush)
- samphire or saltmarsh
- extensive inlake beds of sedges
- extensive inlake beds of *Typha* or other rushes
- scattered dense clumps of rushes or sedges

b Other habitats

- flooded grassland in winter/spring
- mud flats or seasonally dry open water
- islands — natural or human made
- fringing woodland or heath (eg eucalyptus nodes or non-wetland species)
- permanent **shallow** open water < 50cm deep
- permanent **deep** open water > 50cm deep

Score 1/2 point for:

- scattered paperbarks
- scattered rushes

Score [ ]

Source: Field visit and aerial photos.

Management Notes: The composition, density and structure of the vegetation around a wetland has a major influence on the size and diversity of bird and other animal populations. The more complex the vegetation associations, the greater the habitat diversity.

vii Emergent vegetation

How much of the wetland is covered with emergent wetland vegetation?

If 40-60%			Score	5
If 30-40%	or	60-70%	Score	4
If 20-30%	or	70-80%	Score	3
If 10-20%	or	80-90%	Score	2
If <10%	or	>90%	Score	1

Score [ ]

Source: Aerial photos and field visit.

Management Notes: A wetland which provides both open water and emergent vegetation is likely to fulfil the biological requirements of a greater range of species. For example, waterbirds need emergent vegetation for breeding and open water areas for feeding.

viii Adverse water quality

Has adverse water quality been reported in the last two years or observed on the current inspection? For example the presence of oil slicks, algal blooms or botulism in waterbirds.

No aspect observed or reported	Score	5
A single event/aspect observed or reported	Score	2
Several aspects observed or reported	Score	1
Three or more aspects observed or reported	Score	0
	Score	[ ]

Source: Field survey, discussion with local residents, and local government authority.

Management Notes:

1 *Water quality varies significantly throughout the year with problems most evident in summer and often undetectable during winter.*

2 *The presence of macroalgae and/or large numbers of epiphytes is often an indication of poor water quality. An epiphyte is a non parasitic plant that relies on other plants for physical support.*

3 *Good water quality is important, particularly for invertebrates. If there is evidence of pollution (from heavy metals, pesticides and nutrients etc) measures should be taken to alleviate the problem.*

ix Drainage

a Are there drains directing water into or out of the wetland?

YES go to (b), (c) and (d)

NO Score 5 — go to question (x).

b If the drain(s) only directs water into a wetland, use the table below to determine the lake's susceptibility to nutrient pollution. This is achieved by:

i calculating the surface area of the wetland (refer to question v);

ii selecting the 'wetland surface area category' in the left hand side of the table* below that most closely approximates the lake being studied; and

iii note the 'drainage catchment area' value for that category (right hand side of table).

If the area of the catchment for the wetland being assessed exceeds the specified value in the right hand side of the table:

Score 1 — go to (c)

If the area is less than the catchment area value:

Score 4 — go to (c)

Wetland surface area category (ha)	Drainage catchment area (ha)
200	700
100	350
75	263
50	175
25	88
10	35

c If the drain(s) was constructed to maintain water levels in the lake or to support wetland vegetation

Score 3 — go to (d)

d If the drain(s) was constructed to dry out the wetland

Score 0

Score (a + b + c + d) [ ]

Source: Field inspection and visit to local government authority.

Management Notes: Surface water run-off entering wetlands via drains is often polluted. Nutrient inputs from this source should ideally be monitored for several years before determining the most appropriate means of managing algal and insect problems.

x Adjacent nutrient sources

a Are there alternate nutrient sources that could affect the water quality in the wetland?

For example, rubbish tips or landfill; lawns and/or grazing property fertilised on a seasonal basis; septic tanks within 100m of the wetland; agricultural development with high nutrient output such as feedlots and sheep holding yards nearby etc.

If YES go to (b) and (c)

NO Score 5 — go to question (xi)

* The table was prepared on the basis of a phosphorus assimilative capacity of 0.35 grams of phosphorus per square metre of wetland water area per annum, and a runoff rate of 1kg of phosphorus per hectare of catchment per annum. Further details about the table can be obtained from the Environmental Protection Authority.

b If there is only one source?

Score 2

c If more than one source?

Score 0

Score [ ]

Source: Field inspection and visit to the local government authority.

Management Notes: Recent research has demonstrated that large quantities of nutrients enter wetlands via surface water drains.

xi Area of wetland modified

What proportion of the wetland, within boundaries taken as 50m from the edge of the inundated area, has been modified by landfill, paving, cultivated gardens/playing fields, irrigated agriculture, grazing, weed invasion, mining etc?

0 - 10 %	Score	5
11 - 20%	Score	4
21 - 30 %	Score	3
31 - 40%	Score	2
> 40%	Score	1
	Score	[ ]

Source: Aerial photos and maps.

Management Notes: See question (xiii)

xii Reserve area

Is the size of the (potential) reserve containing the wetland large enough to ensure that conservation values can be protected from the impacts of surrounding land uses. To determine this divide the area of the wetland by the area of the reserve surrounding the wetland. If the outcome of the computation is:

< 0.1	Score	5
0.1 - 0.25	Score	4
0.25 - 0.5	Score	3
0.5 - 0.75	Score	2
0.75 - 1.0	Score	1
	Score	[ ]

Source: Aerial photos and maps — If there are not formal boundaries around the wetland use fence lines, roads or natural features of the landscape for the calculation (see management notes below).

Management Notes: Wetlands with large buffer zones are less likely to be degraded by the impact of surrounding land uses than those with small buffer zones. The size of buffer zones should be determined according to the physical and ecological properties of the individual wetland and the purpose for which it is being managed. Property or reserve boundaries used in the above computation should be at least 50m from the wetland edge. If less than 50m make a note in the report.

xiii Native vegetation buffer

What percentage of the wetland perimeter has a buffer of native vegetation 50m or wider along it?

100 - 90%	Score	10
89 - 80%	Score	8

89 - 70%	Score	6	
69 - 60%	Score	4	
59 - 50%	Score	2	
<50%	Score	1	
	Score		[ ]

Source: Aerial photos.

Management Notes: Native vegetation has a beneficial effect on water quality and aesthetics and is essential for wetland fauna. A clear management objective for all wetlands should be to ensure there is vegetation cover where it would normally occur. Limited clearing may be acceptable at some sites if management procedures ensure that weed invasion is controlled and applied nutrients are prevented from leaching into the ground water or reaching the wetland through surface flow.

2.2.2 Part 1B: Seasonal and episodic wetlands with poorly defined boundaries

i Environmental geology classification

Does the wetland occur on the Quindalup Dunes or on a geological unit confined to a river/estuary floodplain?

YES	Score	5	
NO	Score	1	
	Score		[ ]

Source: Refer to 1:50,000 Environmental Geology Series (see Gozzard 1982).

Management Notes: Geological origin is one of the bases for wetland classification systems. In the metropolitan area, wetlands within these geological units are rare.

ii Adjacent wetlands

Are there wetlands within a 2km radius?

YES	go to question iii		
NO	Score	3 — go to question (iv)	
	Score		[ ]

Source : Aerial photos.

Management Notes: Refer to question (iii).

iii Habitat diversity

Is the composition and structure of the vegetation significantly different to that found at nearby wetlands?

YES	Score	3	
NO	Score	1	
	Score		[ ]

Source: Refer to question (iv) for a list of habitat types. Use aerial photos and field visits.

iv Habitat type

Using the list below score one for each habitat type represented

(maximum score 10).

a Vegetation over 0.1 hectare in area.

- large paperbarks (>2.5m tall) in dense clumps
- low thickets (ie <2.5m tall). These are often *Melaleuca, Astartea* or *Kunzea* spp
- paperbark fringe
- fringing rushes and sedges (often *Baumea, Juncea* spp)

- fringing *Typha* (bullrush)
- samphire or saltmarsh
- extensive inlake beds of *Typha* or other rushes
- scattered dense clumps of rushes or sedges

b Other habitats

- flooded grassland in winter/spring
- mud flats or seasonally dry open water
- islands — natural or human made
- fringing woodland or heath (eg eucalyptus nodes or non-wetland species)
- permanent **shallow** open water < 50cm deep
- permanent **deep** open water > 50cm deep

Score 1/2 point for

- scattered paperbarks
- scattered rushes

Score [ ]

Source: Field visit and aerial photos.

Management Notes: The composition, density and structure of the vegetation around a wetland has a major influence on the size and diversity of bird and other animal populations.The more complex the vegetation associations, the greater the habitat diversity.

v Drainage

Are there drains directing water into or out of the wetland?

YES	Score	0
NO	Score	5
	Score	[ ]

Source: Field inspection and visit to local government authority.

Management Notes: Surface water run-off entering wetlands via drains is often polluted. Nutrient inputs from this source should ideally be monitored for several years before determining the most appropriate means of managing algal and insect problems.

vi Area of wetland modified

What proportion of the wetland, within boundaries taken as 50m from the edge of the inundated area, has been modified by landfill, paving, cultivated gardens/playing fields, irrigated agriculture, grazing, weed invasion, mining etc?

0 - 10%	Score	5
11 - 20%	Score	4
21 - 30%	Score	3
31 - 40%	Score	2
> 40%	Score	1
	Score	[ ]

Source: Aerial photos and maps.

Management Notes: See question (vii)

vii Native vegetation buffer

What percentage of the wetland perimeter has a buffer of native vegetation 50m or wider along it?

100 - 90%	Score	5
89 - 80%	Score	4
79 - 70%	Score	3
69 - 60%	Score	2

59 - 50%	Score	1	
< 50%	Score	0	
	Score		[ ]

Source: Aerial photos.

Management Notes: Native vegetation has a beneficial effect on water quality and aesthetics and is essential for wetland fauna. A clear management objective for all wetlands should be to ensure there is vegetation cover where it would normally occur. Limited clearing may be acceptable at some sites if management procedures ensure that weed invasion is controlled and applied nutrients are prevented from leaching into the ground water or reaching the wetland through surface flow.

2.3 Human use questionnaire

i Aesthetics

Does the wetland possess any of the following attributes? (score appropriately)

Little, if any, artificial noise	Score	2	
Understorey mostly intact	Score	2	
Few, or no, roads or buildings obvious from wetland	Score	2	
Steep ridge visible as part of the scenery	Score	1	
Ridge accessible giving view of wetland	Score	1	
Wetland is a lake and open water easy to view	Score	1	
A section of wetland exists where few people visit	Score	1	
	Score (total of above)		[ ]

Source: Field survey.

Management Notes: A management plan should try to ensure that these attributes are preserved or enhanced by proposed developments.

ii Historical and archaeological features

Does the wetland have any of the following historical or archaeological features?

- registered Aboriginal relics or sacred sites
- pioneer relics/operations
- National Estate/Trust listings

If two or more (of the above)	Score	5	
If one	Score	3	
Otherwise	Score	0	
	Score		[ ]

Source: Field survey, local government authoritys, National Trust, WA Museum — Department of Aboriginal Sites.

Management Notes: Strategies for the protection and/or preservation of historical and archeological features should be clearly defined in the management plan for the wetland.

iii Security of wetland

What is the current vesting of the land containing the wetland ?

A Class Reserve for conservation and recreation or Metropolitan Region Scheme reserve for Parks and Recreation owned by the Department of Planning and Urban Development or local government authority	Score	5

Other class of reserve — vested System Six recommendation unvested or on private property	Score	3	
Other class of reserve — unvested	Score	2	
Other (eg private or vacant Crown land)	Score	1	
	Score		[ ]

iv Protection groups

Does the wetland have active protection groups?

One or more	Score	5	
No groups	Score	5	
	Score		[ ]

v Passive recreation

Is the wetland used for any of the following passive recreation activities?

If yes, score 1 for each

- nature study/bird watching
- education (school or other educational interest within 500m)
- picnic and /or barbecue facilities
- conservation of flora (refer to maps)
- conservation of fauna (refer to maps)
- protection and preservation of other attributes
- recognised research site
  - — biological
  - — archaeological
  - — other
- recognised tourist venue

Score [ ]

Source: Field surveys, maps, road directories, State and local government department and residents.

Management Notes: Damage such as trampling, erosion and destruction of vegetation should be noted during the field visit.

vi Active recreation

Is the wetland used for any of the following active recreational activities? If yes, score 1 for each.

- walking/jogging or cycling
- horse riding
- trail bike riding
- playground
- sports grounds
- model boats
- golf course
- canoeing/rowing
- power boating/skiing
- swimming

Score [ ]

Source: State and local government recreation departments.

Management Notes: Damage from current activities should be recorded during the field survey and reported to the appropriate authority/s.

vii Other human uses

Is the wetland used for any of the following purposes? (Score 1 for each)

- agricultural activities (grazing, horticulture etc)
- mining (check for mining leases)
- existing/proposed service corridors (SECWA, roads, etc)
- water supply
- proposed urban/housing use
- private purposes other than described above

Score [ ]

Source: Field survey, maps and State and local government departments.

Management Notes: The compatibility of the above activities with conservation values should be considered during the formulation of a management plan. It may not be practical to achieve all management objectives, and land use priorities will have to be decided.

2.4 Supplementary questionnaire

This questionnaire is used to determine the most appropriate management category for a wetland where the natural attributes and human use score falls in the "transition zones" in the graph in Appendix 6.

If the answer is YES in question i (below) the wetland should be moved to the management category to the right.

If NO, move to left.

If the answer to either ii or iii is YES, move upwards; if NO move downwards.

i Species rarity

Are rare species of animals or plants present or are there communities represented which have a limited distribution?

Source: Department of Conservation and Land Management, local government authorities, conservation groups, literature searches.

Management Notes: Wetlands supporting rare and endangered species should be given priority when allocating resources for the formulation of management plans and implementation of field works.

ii Effect on land values

Does the wetland significantly enhance real estate values and land rates around it? ie, does the wetland add more than 10% to the value of nearby houses?

Source: local government authoritys, estate agents.

Management Notes: The enhancement of real estate values is a legitimate reason for increased expenditure on the active management of a wetland.

iii Human use

Do more than 100 people visit the wetland each week?

Source: Extended field surveys, State and local government recreation departments.

Management Notes: This question provides a good measure of the need for human use management.

References

Environmental Protection Authority (1986). Draft Guidelines for Wetland Conservation in the Perth Metropolitan Area. Department of Conservation and Environment, Perth, Western Australia. Bulletin 227

Gozzard, J R (1982). Perth Sheet 2034 11 and part 2034 111 and 2134 111 Perth Metropolitan Region Environmental Geology Series. Geological Survey of Western Australia.

Department of Conservation and Environment (1980). Guidelines for the Conservation and Management of Wetlands in Western Australia. Perth, Western Australia. Bulletin 79

Appendix 1

Public submissions on Bulletin 227

Public submissions on Bulletin 227

The following individuals and organisations provided comment on Bulletin 227 "Draft Guidelines for Wetland Conservation in the Perth Metropolitan Area".

Commonwealth and State government authorities/universities:

Department of Agriculture
Department of Sport and Recreation
Western Australian Tourism Commission
Dr Malcolm Hollick — University of Western Australia
Water Authority of Western Australia
Main Roads Department
Gary Middle — Murdoch University
CSIRO Division of Groundwater Research
Department of Local Government

Local government authorities

Shire of Kalamunda
City of Canning
City of Cockburn
Shire of Rockingham
City of Stirling
Shire of Serpentine - Jarrahdale
City of Melville
City of South Perth

Consultants and professional planning bodies/individuals

Royal Australian Institute of Parks and Recreation
Kinhill Engineers Pty Ltd
Australian Association of Planning Consultants
LeProvost, Semeniuk and Chalmer

Conservation/interest groups

Wetlands' Conservation Society
RAOU
Conservation Council
Busselton Naturalists' Club
Waterbird Conservation Group
Western Australian Field and Game Association

Private individuals

Sonia Graham
R Barnes
David Hides
B C Hoff
Otto Mueller

Appendix 2

Wetlands on the Swan Coastal Plain assessed using Bulletin 227

Wetlands on the Swan Coastal Plain assessed using Bulletin 227

The table is structured into two parts according to the clarity of the wetland boundaries. The data contained in this table was used to formulate the graph presented in Appendix 6.

i Wetlands with well defined boundaries

Wetland Number	Wetland Name	Natural Attribute Score	Human Use Score	Category
41	Adams	22	8	R
58	Alfred Cove	33	25	0
57	Anstey Swamp	44	7	C
15	Banganup	43	16	C
13	Bennet Brook	41	17	C
43	Beonaddy	26	9	R
23	Bibra	38	22	C
30	Blue Gum	19	15	R
46	Bollard Bullrush	23	9	R
29	Booragoon	30	18	O
2	Brownman	48	12	C
59	Canning River	41	34	H
39	Carabooda	25	4	R
37	Careniup	19	7	M
26	Carine	29	23	O
19	Claremont	29	25	O
24	Coogee	32	6	R
54	Coogee Springs	32	6	R
5	Cooloongup	56	19	H
8	Forrestdale	38	22	C
36	Gnangara	42	21	C
38	Goollelal	32	18	O
27	Gwelup	34	19	O
50	Hazelmere	22	17	R
28	Herdsman	30	23	O
63	Heirisson Island	26	16	O
64	Interchange	21	4	M
17	Jackadder	19	9	M
7	Jandabup	25	19	O
6	Joondalup	41	34	H
47	Little Rush	35	17	C
9	Loch McNess	56	31	H
21	Manning	32	25	O
35	Mariginiup	22	10	R
33	Mary Carroll	25	16	O
31	McDougall	21	11	R
48	Mindarie	19	4	M

Wetland Number	Wetland Name	Natural Attribute Score	Human Use Score	Category
16	Monger	26	20	O
3	Mt Brown	47	11	C
40	Neerabup	24	13	R
25	North	31	26	O
11	Nowergup	39	18	C
18	Perry Lakes	27	22	O
45	Piney	33	21	O
55	Pinjar	21	5	M
42	Pipidinny	38	10	C
63	Queen's Gardens	19	15	R
22	Richmond	49	22	H
48	Roe Swamp	32	16	O
20	Shenton Park	18	18	R
44	Spectacles	29	21	O
1	Star Swamp	37	24	C
56	Tamworth Swamp	32	7	R
14	Thomsons	47	21	H
32	Tomato	25	21	O
4	Walyungup	43	20	C
47	Wilgarup	43	11	O
49	Wright	21	8	M
24	Yangebup	35	19	C
10	Yonderup	49	19	H

ii Seasonal and episodic wetlands with poorly defined boundaries

Wetland Number	Wetland Name	Natural Attribute Score	Human Use Score	Category
4	AMB Ref 3 91800 64 33700	18	10	C
5	Banjup Lake	6	6	M
6	Balannup Lake	3	2	M
7	Yule Brook Reserve	18	5	C
8	Twin Swamps Nature Reserve	17	8	C
10	AMG Ref 3 97700 64 45000	15	10	C
11	AMG Ref 4 01300 64 39100	11	2	R
12	Yangedi Swamp (east)	11	3	R
13	Yangedi Swamp (west)	5	3	O
14	AMG Ref 3 97600 64 42100	5	2	O
15	AMG Ref 3 94000 64 18000	5	2	O

Appendix 3

Environmental Protection Authority of Western Australia's impact assessment process

Environmental Protection Authority of Western Australia's impact assessment process

This is a brief explanation of the various levels at which a development affecting a wetland can be assessed in Western Australia.

Where a development has the potential to impact on a wetland, the proponent should (initially) prepare a brief environmental report describing the proposal and its likely impact on the environment. Measures proposed to ameliorate detrimental effects and to improve the environment should also be described. On the basis of this information, the Environmental Protection Authority sets the level of assessment.

Most developments affecting wetlands would be assessed on one of three formal levels: Consultative Environmental Review (CER); Public Environmental Review (PER) and Environmental Review and Management Programme (ERMP) .

A CER is used for proposals with environmental impacts which are less complex or likely to be of interest only to the local public and/or special interest groups. A period of up to four weeks would normally be allowed for public review.

A PER is required for proposals with significant environmental impacts in which the wider public is likely to have an interest. Eight weeks are allowed for public review.

An ERMP is used for proposals with major environmental impacts in which there is a clear public interest. Such proposals require comprehensive, detailed and sophisticated environment assessment. A public review period of 10 weeks is provided.

The documentation for all three formal levels of assessment must be prepared by the proponent in accordance with guidelines issued by the Environmental Protection Authority. The proponent should also consult EPA Bulletin 79, "Guidelines for the Conservation and Management of Wetlands in Western Australia".

A thorough report, as mentioned above, will expedite the assessment process significantly. To achieve this, early informal discussion with Environmental Protection Authority officers is invited.

Where the environmental impact of a proposal is minor and formal assessment is not required, the Environmental Protection Authority may nevertheless review the project informally and provide advice to the proponent and the public.

The Authority may also decide not to assess a project if its environmental impact is considered not significant.

Appendix 4

Rationale for conserving and managing wetlands

Rationale for conserving and managing wetlands

Since European settlement more than two thirds of wetlands on the Swan Coastal Plain have been destroyed or degraded through landfilling, changes in drainage or water quality, or destruction of vegetation.

During the past 15 years the need to conserve wetlands has been recognised in district planning schemes and water resource planning. However, these measures have only been partially successful and there is an urgent need to intensify conservation and management efforts.

There are many ways of justifying the retention and conservation of wetlands. The importance of wetlands is outlined below under three headings: hydrological, social and ecological.

Hydrological

Wetlands on the Swan Coastal Plain are surface expressions of the groundwater table. In some situations they play an important role in the local surface drainage system by collecting water during storm events.The destruction or degradation of these wetlands through landfill, clearing and pollution results in changes in the local water balance and in some situations, flooding down stream.

Social

Wetlands provide opportunities for recreation, nature study, education, access to wildlife and aesthetic considerations. These benefits are reflected in land values and, in turn, in the value of rates to local authorities. Opportunities for tourism and other aspects of the recreation industry are also enhanced.

Ecological

Wetland ecosystems comprise complex networks of biological and chemical processes. It is possible to consider these processes as 'ecological functions' which, among other things, can be valued as 'services'.

Ecological functions of the wetlands of the metropolitan region include:

- a limited capacity to assimilate loads of dissolved and suspended materials, including nutrients and pollutants, sediment and litter;
- support of the complex of plants, animals and micro-organisms which make up the wetland food webs;
- provision of drought refuges for waterbirds affected by reduction in availability of fresh water in more arid areas resulting from the combined effects of summer drought and catchment salinisation;
- provision of summer feeding areas for trans-equatorial migratory wading birds which are the subject of international agreement. It is worth noting that Australia is committed to protect the habitats of waterbirds and migratory waders under international agreement. Hence there is a need to preserve a range of wetland types and to control development on adjacent land; and
- provision of habitats for plants, animals or communities considered to be rare or of restricted occurrence or distribution.

In addition, wetlands perform a valuable function as an 'index of environmental quality'.

The shallow groundwater is a key factor in the environment of the region and, because the wetlands are effectively 'windows' on the groundwater, they will be the earliest features to demonstrate the effects of stress on the system. For example:

- falling water levels in wetlands indicate high use of shallow groundwater and/or reduced replenishment of the groundwater resource;
- elevated water levels indicate a change in the water balance due to changed land use;
- nutrient enrichment of wetland catchments will be reflected in increased nutrient loadings of surface runoff and groundwaters and in turn by symptoms of increased productivity in wetlands such as algal blooms; and
- changes in wetland vegetation can indicate one or more of the following: physical disturbance of the wetland; nutrient enrichment of its waters; and changes in the water levels reflecting alterations to the local or regional water balance.

Appendix 5

Field survey questionnaire

Field survey questionnaire

The field questionnaire has been designed to simplify the collection and processing of the field information.The majority of questions are contained within single and double boxes. The questions within the **single** boxes can be answered by referring to maps, aerial photography, the System 6 Red book or local government information, without the need for field checking.

Questions within **double** boxes are best answered after the completion of the field investigations. Question 2b (habitat diversity) should not be attempted until the relevant field data has been collected for nearby wetlands. Question 14 (historical and archaeological features) is best answered after considering the wetland system as a whole.

The questionnaire can be used for wetlands with or without well defined boundaries. If the wetland has a well defined boundary **all** questions should be answered. If the boundary is poorly defined, answer only those questions marked with a @

Do not fill out the scoring section until all the data has been collected for the wetlands in the study area and has been entered on the sheets. The additional information collected (eg geology, soil type, System 6 recommendation number etc) will be used during the formulation of management plans or a regional wetland policy. Provision is also made for miscellaneous comments at the end of the questionnaire.

FIELD QUESTIONNAIRE AND SCORE SHEET

A. RESOURCE DATA

WETLAND NAME _____

IS THE BOUNDARY WELL DEFINED OR POORLY DEFINED? (Underline correct response)

LOCATION (nearest road or junction) _____

DATE(S) VISITED _____ FIELD WORKER _____

LOCAL GOVERNMENT AUTHORITY _____

MAP REFERENCE _____

AERIAL PHOTOGRAPH RUN _____

NUMBER _____

B. NATURAL ATTRIBUTES

SCORE

※1 Environmental geology classification.

Geology _____ Soil type _____ Distribution restricted? Yes/No

※2a ADJACENT WETLANDS

Are there wetlands within a 2 km radius? Yes/No

2b HABITAT DIVERSITY

Is the composition and structure of the vegetation significantly different to that found at nearby wetlands? (refer to Q5) YES/NO

3. DROUGHT REFUGE

Is the wetland important as a drought refuge for water birds? (Tick appropriate box) Major [ ] Minor [ ] None [ ]

4. AREA OF WETLAND

Estimate the diameter of the wetland [m],

and/or its length [m] and breadth [m],

or calculate the area of the wetland. and tick the appropriate box.

0-10ha [ ] 10-25ha [ ] 25-50ha [ ] 50-100ha [ ] >100ha [ ]

※5. HABITAT TYPE

No. of habitat types visible from the aerial photo _____

Tick the appropriate boxes for habitat types present.

a. Vegetation over one hectare in area.

Large paperbarks (>2.5m tall) in dense clumps	[ ]
Low thickets of *Melaleuca, Kunzea* or *Astartea* spp.	[ ]
Paperbark fringe	[ ]
Typha	[ ]
Extensive inlake beds of sedges	[ ]
Extensive beds of *typha* or rushes	[ ]
Scattered 'clumps' of rushes or sedges	[ ]
Fringing rushes and sedges	[ ]
Samphire or saltmarsh	[ ]

b. Other habitats

Flooded grasslands in winter/spring	[ ]
Mud flats or seasonally dry open water	[ ]
Islands — natural or human made	[ ]
Fringing woodland or heath	[ ]
Permanent shallow open water (<0.5m deep)	[ ]
Permanent deep open water (>0.5m deep)	[ ]
Scattered paperbarks	[ ]

SCORE

6. EMERGENT VEGETATION

How much of the wetland is covered with emergent vegetation?

Calculate AREA OF EMERGENT VEGETATION x 100

AREA OF WETLAND

Tick the appropriate box

40-60%	[ ]	30-40% or 60-70%	[ ]
20-30% or 70-80%	[ ]	10-20% or 80-90%	[ ]
<10% or >90%	[ ]		

7. ADVERSE WATER QUALITY

Have any of the following been observed/recorded by fieldworkers or locals?

Algal blooms (free-floating)	[ ]	Algal mats (filamentous)	[ ]
High nutrient levels	[ ]	Pollution slicks	[ ]
Botulism	[ ]		

※8. DRAINAGE

Are there any drains coming in or out? (circle correct response)

Drains in drains out No drains

If drains come into the wetland what is the catchment area for that/those drain(s)? _____ ha

9. ADJACENT NUTRIENT SOURCES

Note the presence of any of the following:

Septic tanks within 100m	[ ]
Unbunded rubbish tips/landfill	[ ]
Seasonally fertilised lawns or grazing areas	[ ]
Agriculture with high nutrient output	[ ]

10. AREA OF WETLAND MODIFIED

What percentage of the wetland and buffer has been modified within the boundaries you have chosen? To determine this you may need to calculate

TOTAL AREA MODIFIED x 100

AREA OF WETLAND + BUFFER

Tick the appropriate box

0-10%	[ ]	11-20%	[ ]	21-30%	[ ]
31-40%	[ ]	>40%	[ ]		

11. RESERVE AREA

Wetland area (refer to question 10) _____

Calculate the area of reserved land containing the wetland, AND/OR area of private land allocated to the wetland by the landowner(s) _____

(Show calculation in margin)

✠12. NATIVE VEGETATION BUFFER

SCORE

What is the total perimeter of the wetland?_____ m

What percentage of the property boundary chosen is at least 50m from the wetland edge and is covered with native vegetation?

100-90%	[ ]	69-60%	[ ]
89-80%	[ ]	59-50%	[ ]
79-70%	[ ]	<50%	[ ]

C. HUMAN USE

✠13. AESTHETICS

Record any of the following aspects related to aesthetics:

Little if any artificial noise	[ ]
Steep ridge visible as part of scenery	[ ]
Ridge accessible giving view of wetland	[ ]
Wetland is a lake & open water easy to view	[ ]
Understorey mostly intact	[ ]
Few or no roads or buildings obvious from wetland	[ ]
A section of wetland exists where few people visit	[ ]

✠14. HISTORICAL/ARCHAEOLOGICAL FEATURES

Note the presence of any of the following:

Aboriginal site	[ ]	Pioneer relics	[ ]
National Trust site	[ ]	National Estate listing	[ ]

✠15. SECURITY OF WETLAND

Total No. of owners _____

Using the codes below list the owner types

PO - private; LA - local authority; VA - vested res or DPUD land;

CL - vacant Crown land

Owner 1 _____ Owner 2 _____ Owner 3 _____

Major owner _____

Reserve class and number _____

Reserve purpose:

a In full

b Summary: tick the appropriate box.

A Class Reserve for conservation/recreation	[ ]
MRS owned by local authority or government department	[ ]
other vested reserve	[ ]
other (eg private or vacant Crown land)	[ ]

System 6 Recommendation No._____MRS Zone_____(use codes below)

PAR - parks & recreation; PUB - public purposes; RRL - rural; SF - State Forest; IND - industry & special industry:

TRS - transport (road and rail); URB - urban, urban deferred, civic and cultural

✠16. PROTECTION GROUPS

SCORE

Are there active protection groups for this wetland? Yes/No

If yes give the details below.

NAME(S) _____

CONTACT PERSON(S)_____

_____

ADDRESS(ES) _____

_____

_____

PHONE NUMBER(S) _____

✠17. PASSIVE RECREATION

Is the wetland used or has it facilities for the following — tick the appropriate box(es)?

nature study/bird watching	[ ]	education (school < 500m)	[ ]
picnic/barbecue facilities	[ ]	recognised tourist venue	[ ]
conservation of flora	[ ]	conservation of fauna	[ ]
recognised research site	[ ]	protection/preservation of other attributes	[ ]

✠18. ACTIVE RECREATION

Is the wetland used or has it facilities for any of the following active recreational pursuits:

walking, jogging or cycling [ ] horse riding [ ] trail bikes [ ]

playground [ ] oval [ ] other [ ]

✠19. OTHER HUMAN USES

Is the wetland used for any of the following? - tick box(es)

agriculture	[ ]
mining (check for mining leases)	[ ]
water supply	[ ]
existing/proposed service corridors (roads, SEC)	[ ]
proposed urban/housing	[ ]
private purpose other than above	[ ]

✠20 MAKE A ROUGH SKETCH OF THE AREA, BELOW OR ATTACHED, INCLUDING IF YOU CAN THE BOUNDARIES YOU CHOSE, DIMENSIONS, NORTH DIRECTION, RESERVES, WATERBODY, VEGETATION ZONES, TRACKS, ROADS, FENCES, ETC.

MISCELLANEOUS COMMENTS

Appendix 6

Management category graphs

Management category graphs

The graphs on the following page are used to determine the management category of wetlands using the data obtained from parts 1 and 2 of the questionnaire. This is done by plotting the results of the Natural Attributes and Human Use questionnaire on the Y and X axes respectively, which results in the wetland being placed in one of the five management categories.

The numbers in the graphs below identify wetlands already assessed using Bulletin 227 or 374 (see Appendix 2 for names of individual wetlands).

Appendix 7

Summer drought refuge index

Summer drought refuge index

The table below provides information on the relative importance of metropolitan wetlands as drought refuges for waterbirds and water depths during summer. The table is based on the records of the Water Authority of Western Australia (1982-89) and the Royal Australasian Ornithologists Union's waterbird project. As the majority of Perth's wetlands dry out during the summer, wetlands which do not appear on the list below probably do not contain any water at this time of year.

Wetland	Permanent Open Water <50cm deep	Permanent Open Water >50cm deep	Drought refuse importance
Adams	x		None
Beonaddy	x		Minor
Bibra	x		Major
Blue Gum			Minor
Bollard Bullrush	x		Minor
Booragoon		x	Major
Canning River	x	x	Minor
Carabooda	x		Minor
Careniup	x		Minor
Carine	x		Minor
Claremont			Minor
Coogee	x		Minor
Coogee Spring	x		Major
Cooloongup	x		Minor
Forrestdale			Minor
Goollelal	x		Minor
Gwelup	x		Major
Hazelmere	x		Minor
Herdsman	x	x	Major
Heirisson Island	x	x	None
Interchange	x		Minor
Jackadder	x		Minor
Jandabup			Minor
Joondalup	x		Major
Loch McNess	x	x	Major
Mariginiup	x		Minor
Mary Carroll	x		Minor
McDougall Park	x		Minor
Mongers		x	Major
Neerabup	x		Minor
North	x		Major
Nowergup	x	x	Major
Perry Lakes			Minor
Pipidinny	x		Minor
Queen's Gardens	x	x	Minor

Wetland	Permanent Open Water <50cm deep	Permanent Open Water >50cm deep	Drought refuse importance
Richmond		x	Major
Shenton Park	x		Minor
Spectacles	x		Minor
Thomsons			Minor
Tomato '	x		Minor
Yangebup	x		Major
Yonderup	x		Major