Herdsman Lake Regional Park

Management Plan

2004-2013

Conservation Commission of Western Australia

DEPARTMENT OF Conservation AND LAND MANAGEMENT
Conserving the nature of WA

WATER CORPORATION

City of Stirling

Herdsman Lake Regional Park

2004 - 2013

PLANNING TEAM

This plan was coordinated by a consultancy team led by ERM Mitchell McCotter working closely with the managers of Herdsman Lake Regional Park – the Department of Conservation and Land Management (CALM) and the City of Stirling. The Planning Team prepared the plan for the Conservation Commission of Western Australia.

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How to Use This Plan

This plan is divided into sections as set out in the table of contents. A goal is stated at the beginning of each section. Within each section are subsections. Each subsection begins with the objectives to be achieved by management, followed by a discussion of the main issues, and then strategies, accompanied by the agencies responsible for achieving each objective and a priority rating. Priority ratings provide an indication of the relative importance of a strategy. The management agencies names have been abbreviated and a list of all abbreviations used and their meaning is listed in Appendix A. Key Performance Indicators are listed in the plan and outline performance measures, targets, reporting requirements and the response required to target shortfalls.

A number of issues raised in this Plan are interrelated and are dealt with under more than one section. Where this is the case, the discussion refers the reader to other related sections.

ACKNOWLEDGEMENTS

Numerous individuals and groups have contributed valuable ideas and information in the preparation of this management plan and their efforts are gratefully acknowledged. In particular, the contributions of members of the planning team, the Herdsman Lake Regional Park Community Advisory Committee and workshop attendees for this management plan have been most appreciated.

NOMENCLATURE

Inclusion of a name in this publication does not imply its approval by the relevant nomenclature authority.

THE CONSERVATION COMMISSION OF WESTERN AUSTRALIA AND CALM

All national parks, conservation parks, nature reserves, and other conservation reserves in Western Australia are vested in the Conservation Commission of Western Australia. These reserves are managed on behalf of the Conservation Commission of Western Australia by CALM.

As the controlling body, the Conservation Commission of Western Australia is responsible for having management plans prepared for all lands that are vested in it. A Draft Management Plan for Herdsman Lake Regional Park was prepared by CALM and issued for public comment in June 2001. Thirty-four submissions were received and were considered in the preparation of this Final Plan prior to its approval by the Conservation Commission of Western Australia and the Minister for the Environment.

Preface

Regional parks are areas of Regional Open Space that are identified by planning procedures as having regionally significant conservation, landscape and recreation values. Regional parks provide the opportunity for a consortium of management agencies and private landowners to develop coordinated planning and management strategies.

Regional parks were first proposed in the Stephenson - Hepburn Report of 1955, which was the basis of the Perth Metropolitan Region Scheme in 1963. Since then, State planning agencies have been acquiring land in anticipation of the time when regional parks would be formally created.

In 1997, the State Government announced a commitment to introduce legislation to give regional parks legal standing and vesting in the former National Parks and Nature Conservation Authority, now the Conservation Commission of Western Australia. Eight regional parks were recognised as formal identities with the coordination of their management progressively transferred to the Department of Conservation and Land Management (CALM).

This management plan is a commitment by CALM and the City of Stirling to manage Herdsman Lake Regional Park. The role of CALM in managing the park is two-fold. Firstly, it is to manage the areas of the park that are vested in the Conservation Commission of Western Australia. Secondly, it is responsible for co-ordinating the management of the park. The latter is initiated through the preparation of this management plan. The City of Stirling will manage the areas vested in it.

Herdsman Lake Regional Park is important in terms of conservation values and the recreational opportunities it encompasses within a highly urbanised environment. This management plan, which is based on previous ecological, recreation and historical studies, as well as community input, seeks to establish a long-term vision, goals and management strategies for the Park.

While Herdsman Lake is a significant wetland and wildlife sanctuary located within the Perth metropolitan area, it faces a number of management problems such as polluted and nutrient enriched stormwater and groundwater inputs, areas of disturbance, significant weed invasion and the presence of introduced animals.

This management plan cannot solve all of the ecological problems facing Herdsman Lake, especially those which are whole of catchment issues. Initiatives of integrated catchment management will need to be established for the Herdsman Lake water catchment area to minimise the effects of water pollution and nutrients entering the wetland system.

Work by the managing agencies with valuable assistance from volunteers such as local community groups, associations and schools has begun to reverse the negative impacts on the Park. It should be acknowledged however, that past and present land uses make it impossible to reinstate a pristine natural environment for the Park. This management plan aims to protect the existing natural areas and provide for the restoration of degraded areas, whilst allowing for recreation activities that will not compromise the natural values of the Park.

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A. INTRODUCTION

1. Purpose and Status of the Management Plan

PURPOSE OF THE PLAN

This management plan ("the Plan") provides broad direction for protection and enhancement of the conservation, recreation and landscape values of Herdsman Lake Regional Park ("the Park"). It does this by developing strategies aimed at conserving the special features of the Park and providing for future community requirements. The Plan helps ensure the Park is managed appropriately and is capable of sustaining its high nature conservation and cultural values as well as use by the community.

Given the strategic nature of this Plan, more detailed planning (referred to as subsidiary plans) is required prior to significant operational works taking place within the Park. Examples of subsidiary plans identified in this Plan include a weed management plan, a rehabilitation plan and site development plans for specified Park areas (see Section 41).

STATUS OF THE PLAN

This Plan has been prepared in accordance with the *Conservation and Land Management Act 1984*. It provides statutory direction over all lands and waters of the Park vested in the Conservation Commission of Western Australia and managed by the Department of Conservation and Land Management (CALM). The Plan acts as an "umbrella" document, coordinating existing plans for specific areas of the Park. The implementation of existing plans will need to be consistent with the overall direction of this Plan. The Conservation Commission of Western Australia and CALM will seek to ensure that future plans for areas within the Park are consistent with the overall direction and principles of this Plan.

CALM has the responsibility for co-ordinating the management of the Park. In consultation with CALM, the Western Australian Planning Commission (WAPC) will use this Plan to assist with the assessment of development proposals on lands within and adjoining Herdsman Lake Regional Park.

The City of Stirling has worked closely with CALM in the preparation of this Plan and its Council has formally endorsed the strategies within it. In partnership with the CALM, the City will use the Plan to manage the areas of the Park vested in it, and the many issues that have an overall impact upon the Park.

The Water Corporation has also agreed with the Plan and believes the conservation and protection of the Park, in so far as the management of its infrastructure, aligns inseparably with its environmental policy.

2. Regional Parks

WHAT IS A REGIONAL PARK?

Regional parks are areas of Regional Open Space that are identified by planning procedures as having regionally significant conservation, landscape and recreation values. Regional parks are a land management system that provides the opportunity for a coordinated planning and management strategy by different land management agencies and private landowners.

Regional parks may comprise Crown lands vested in State Government agencies and local governments as well as private lands where the agreement of the landowner is obtained.

As such regional parks could be comprised collectively of lands with a variety of tenures and reserve purposes. They could be a package of multi-purpose, multi-vested reserves drawn together for coordinated management by CALM. Herdsman Lake Regional Park for example consists of land comprising Crown reserves vested in the City of Stirling and the Conservation Commission of Western Australia as well as freehold land owned by the WAPC.

Those lands that have been acquired by the WAPC for inclusion into the Park are now to be transferred to either the City of Stirling or the Conservation Commission of Western Australia for management as part of the Park.

It is intended that the overlaying regional park concept will be put in place while maintaining the high level of protection currently existing for lands already vested in the Conservation Commission of Western Australia (such as nature reserves) that are found within regional parks.

THE REGIONAL PARK CONCEPT

The concept of Regional Open Space was first introduced to Western Australia by the Stephenson - Hepburn Report in 1955, which recommended a statutory region plan be prepared for Perth which reserved private land required for future public purposes. In 1963 the Perth Metropolitan Region Scheme (MRS) was established and land was reserved for "Parks and Recreation." This land (subject to amendments of the MRS) has been gradually acquired by State planning authorities with the intention to protect open space of regional significance for conservation and recreation.

The Environmental Protection Authority's (EPA) publication *Conservation Reserves for Western Australia, The Darling System – System 6* (Department of Conservation and Environment, 1983), identified areas with regionally significant conservation, landscape and

recreation value. It also recommended areas of land to be managed as regional parks. A system of regional parks was envisaged which included the land reserved for "Parks and Recreation" in the MRS which surrounded Herdsman Lake (System Six Recommendation M43).

In 1989, the State Government decided that the responsibility for regional park management be established within CALM and that the responsibility for planning the acquisition of lands for regional open space be retained by the former Department of Planning and Urban Development (DPUD) now Department for Planning and Infrastructure (DPI) on behalf of the WAPC.

A task force report (1991) was prepared by DPUD and CALM outlining proposed administration, planning and management of regional open space.

The EPA's Red Book status report (Department of Conservation and Environment, 1993) describes the transformation of regional parks from concept to reality as being difficult because of the range of land tenure involved and the funding requirements for continual management of the parks.

In June 1997, the State Government announced a commitment to introduce legislation to give regional parks legal standing and vesting in the former National Parks and Nature Conservation Authority (NPNCA) now the Conservation Commission of Western Australia. The coordination of management of eight metropolitan regional parks would be progressively transferred to CALM.

REGIONAL PARK PLANNING

Planning for regional parks occurs at a number of levels. Regional park management plans are a part of a broad suite of planning undertaken by the relevant managing agencies. Figure 1 illustrates the planning levels typically undertaken for regional parks.

Source: ANZECC 2000.

Figure 1 – Regional park planning hierarchy

3. Herdsman Lake Regional Park

The process of establishing Herdsman Lake Regional Park has evolved since the *Stephenson - Hepburn Report (1955)* which recommended that the Lake and surrounding area be reserved for "Parks and Recreation". This was subsequently implemented in the 1963 Perth MRS (Metropolitan Region Planning Authority, 1976).

In 1976, the Metropolitan Regional Planning Authority (MRPA) produced a "Plan for Herdsman Lake" which, after review by various organisations, was modified and officially adopted by the State Government as the *Herdsman Lake Concept Plan.* The general intent of the Concept Plan was to develop the Herdsman Lake area for conservation, wildlife, recreation and drainage management. Construction of a moat around the perimeter of the lake was proposed in order to separate the central wetland conservation area from the peripheral recreation area. It was envisaged that dredging the moat would supply sand fill for adjacent real estate developments and create open water for birdlife.

In 1985, the State Planning Commission (SPC) prepared *Improvement Plan No. 21* for Herdsman Lake which updated the original Concept Plan and provided more detail. The Improvement Plan was gazetted in 1986 and provided the SPC with the mandate to complete all works proposed in the Concept Plan.

In 1988, a Public Environmental Review for the Floreat Lakes Residential Development which adjoins the Park to the northwest was completed for the SPC in accordance with *Improvement Plan No 21.* This included provision for the dredging of the moat to be completed around the internal conservation area of Herdsman Lake.

In 1997, the State Government proposed that a management plan for Herdsman Lake Regional Park be prepared by CALM in conjunction with the City of Stirling.

OVERVIEW

Herdsman Lake Regional Park is currently one of eleven regional parks in the Perth metropolitan area. It is located approximately 7 kilometres northwest of the central business district of Perth (Figure 2) and, at approximately 400 hectares in size, it is the largest wetland within Perth's inner metropolitan region.

Herdsman Lake is part of a chain of wetlands that extends north to south parallel to the coast in the Spearwood Dune System. The Park comprises a variety of landscapes including permanent water bodies, seasonally dry wetlands and open parklands.

Herdsman Lake contains an inner wetland (approximately 160 hectares in area) which is dominated by Bulrush (*Typha orientalis*) and a dredged outer moat consisting of four deep permanent water bodies (Floreat Waters, Popeye Lake, Powis Lake and Floreat Lakes – see Figure 10, page 46) joined by small channels restricting access to the central conservation area.

In the past, areas of Herdsman Lake have been used for rubbish disposal, sanitary landfill and agriculture. Despite these impacts Herdsman Lake is an extremely important wetland on the Swan Coastal Plain, as it supports a wide diversity of wildlife species, serves as an important bird breeding ground and is a summer refuge for transequatorial migratory birds.

Herdsman Lake is also a catchment basin for the surrounding urban and industrial areas. The Lake receives drainage waters from both the regional and local drainage systems. In relation to the regional drainage system, Herdsman Parade and Flynn Street Branch Drains discharge directly into the Lake while the Balgay Branch Drain and Osborne Park Branch Drain, which carry water from Perth's northern suburbs, flow into the Herdsman Main Drain which discharges into the Indian Ocean at Floreat Beach.

Numerous smaller drains which form part of the local drainage system discharge directly into the Lake from a catchment area which contains housing and light industry.

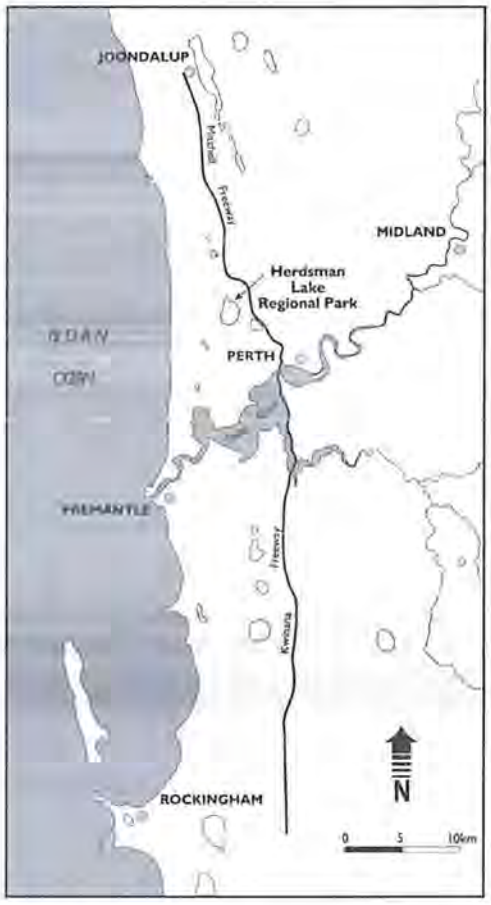

Figure 2 - Park location

The main threats to the biodiversity conservation values of the Lake are water pollution and increasing nutrients in the wetland system, sustained changes in water levels and weed invasion.

A range of recreation opportunities are provided for Park visitors. The natural features of the Herdsman Lake in association with the grassed areas of Maurice Hamer Park and Glendalough Open Space attract many people to the Park. The Herdsman Lake Wildlife Centre is also a popular attraction in the Park for environmental education.

Many visitors to Herdsman Lake Regional Park are local residents who live nearby and use the Park for fitness and recreational purposes (Barnes, 1998). The urban development in close proximity to the Park has created external pressures on the Park. It will be the role of the managing agencies, with support from the community, to implement this Plan to effectively manage these issues.

PARK VALUES

Natural Environment Value

Herdsman Lake is the largest wetland in the inner metropolitan area and has high nature conservation value, supporting a diversity of wildlife.

Herdsman Lake and its surrounds are of significance as a bird breeding and summer refuge supporting many waterfowl, bushbirds and birds of prey (Department of Conservation and Environment, 1983). Over 100 species of birds have been recorded at Herdsman Lake, of which about one third breed at the lake (Curry, 1981). Some of these birds are transequatorial migratory waders. Such an abundance and diversity of birdlife in an urban setting is very uncommon and provides the opportunity for visitors to appreciate the wildlife and habitat values of the Park.

Cultural Heritage Value

Stone chips and flakes found on the higher ground to the north of Herdsman Lake indicate past Aboriginal use. Aboriginal people call the area Ngurgenboro and used it as a food source.

Listed Aboriginal sites within or near Herdsman Lake Regional Park are as follows:

- S02411 - Herdsman Lake;
- S00681 - Herdsman Lake North; and
- S00682 - Herdsman Lake North East.

The Herdsman Lake Settlers Cottage is of significant European heritage value. It provides an example of an early settler's cottage and has been acquired and renovated under the direction of the National Trust of Australia (WA) (Heritage & Conservation Professionals, 1992). The National Trust has furnished the cottage in keeping with the era of the 1930s and established a small vegetable garden. An interpretive display has also been developed on the site presenting the social and natural history of Herdsman Lake.

Landscape Value

Herdsman Lake Regional Park provides significant landscape value to the inner metropolitan area of Perth.

Scenic views over the wetland can be enjoyed from the Wildlife Centre on the southern shore, while observation of wildlife on the open water can be made from two bird hides and most sections of the Lake's edge. The Park's visual qualities are presented through a diversity of landscapes ranging from expansive views over open waters, to dense wetland rushes, fragments

of remnant bushland and well maintained open grass parklands.

The high-rise buildings of Perth's central business district also provide a scenic backdrop to the Park. The close proximity and imposing contrast of the city buildings against the Park's open spaces highlights the Park's impressive landscape qualities.

Additionally, the open space and water bodies of the Park provide significant landscape amenity value within the developed urban and industrial surrounds.

Recreation Value

The Park provides for a range of recreation opportunities and its urban locality and accessibility enhances the area as a leisure resource. Of particular significance is the opportunity to recreate in a natural environment within an urban area. A variety of natural features such as the lake, wetlands and wildlife, provide visitors with a range of experiences and recreation opportunities.

The Park contains a number of smaller recreation nodes offering a diversity of settings and a variety of facilities. These are illustrated in Figure 9 - Recreation Masterplan (page 41). The Park also presents recreation value in terms of interpreting its natural environment and cultural heritage. The Herdsman Lake Wildlife Centre is located at the corner of Selby and Flynn Streets and presents some of the conservation and biodiversity values of Herdsman Lake. The Herdsman Lake Settlers Cottage, located on the west side of the Park, presents a history of the Park and is open to visitors.

Commercial Value

There are opportunities for the establishment of commercial operations, which enhance recreational opportunities within the Park without adversely affecting other park values. These could range from seasonal refreshment stands at activity nodes around the Park, to a cafe or kiosk, to educational facilities providing a commercial component.

Research Value

Herdsman Lake Regional Park has significant research and scientific values. On the one hand, it contains rich, dynamic ecosystems with seasonal and periodic variations, subject to considerable external pressures and inputs. Conversely, it has areas with recreational demands requiring an understanding of human use, landscape design, and changing social use of natural areas for recreation.

In particular, the extraction of technical data on wetland habitats, water quality and water levels make it an extremely valuable resource in gaining technical and managerial expertise that can be applied to other wetlands across the Swan Coastal Plain.

The Herdsman Lake Wildlife Centre currently provides environmental education and information to schools, universities, TAFE and the general public, in the areas of wildlife, wetlands, ecosystems, human impacts and the effects of drainage systems in urban environments. The opportunity exists to further enhance the community's understanding of these issues.

4. The Management Plan and Community Involvement

COMMUNITY INVOLVEMENT IN THE PREPARATION OF THIS MANAGEMENT PLAN

The community was made aware of the preparation of this management plan through liaison, newspaper advertising, articles and publications produced by the Park's managing agencies.

A community workshop was held in July 1998 as part of the management planning process. The workshop was attended by people representing broad community interests as well as representatives from the City of Stirling and CALM.

CALM also undertook specific consultation in the preparation of the plan, with the City of Stirling and the Water Corporation. The Herdsman Lake Regional Park Community Advisory Committee also commented on the draft plan prior to its release for public comment (Section 42).

MANAGEMENT PLAN PREPARATION

This management plan has been prepared in five phases:

1. The first phase was aimed at identifying the relevant planning and management issues. This was achieved by undertaking a literature review, analysing the existing condition of the Park and organising a community workshop. Public involvement in this phase was encouraged through newspaper articles and canvassing key stakeholders for the community workshop.

2. The second phase was the preparation of the Draft Management Plan. This involved identifying values and preparing planning strategies to protect those values and address the issues identified in phase one. Within this phase, CALM, the City of Stirling and the Water Corporation provided advice on the development of the Plan.

3. The third phase involved presenting the Draft Management Plan for public comment. Its availability for review was widely advertised, the draft was open for public comment for a period of three months, after which public submissions were analysed.

4. The fourth phase covered the acknowledgement and analysis of public submissions.

5. The fifth phase involved the preparation of this final management plan incorporating issues or comments raised within submissions. The revised Plan was submitted for adoption by the Conservation Commission of Western Australia and for approval by the Minister for the Environment.

B. PRINCIPAL MANAGEMENT DIRECTIONS

5. The Vision for the Park

The long-term vision for the Park is:

"Herdsman Lake Regional Park will be a quality wetland supporting biodiversity and a range of habitats. As a wildlife refuge it will be a successful example of human - wildlife interaction within an urban setting. The Park will accommodate environmental education, cultural interpretation and sustainable recreation use."

GOALS

Goals have been set for each major part of the Plan, while objectives designed to achieve these goals have also been identified. The following management goals are proposed for the Park.

Conservation
Protect, conserve and enhance the Park's biota and natural ecosystems as well as its physical, cultural and landscape resources.

Recreation
Provide for a range of quality recreation and tourism opportunities in a manner that minimises conflict between visitors, and is consistent with other management objectives and Park values.

Commercial
Allow for and manage concessions within the Park that service visitor requirements, do not adversely affect other park values and contribute positively to regional park management costs.

Research
Seek a better understanding of the natural, cultural and social environments, as well as the impacts of visitor use, park management and external influences on the Park.

Community Relations
Promote informed appreciation of the Park's natural environment, cultural values and recreation opportunities and facilitate liaison with the community about its management.

Integration of Management
Further develop and maintain integrated and coordinated management arrangements between the participating managing agencies and planning authorities.

Strategy

1. **Manage the Park for conservation and environmental enhancement and allow recreation and other uses of the Park to occur to the extent that they do not impair the values of the Park. (CALM, CS) [High]**

6. Legislation and Management Policies

The objective is for CALM to manage the Park in accordance with the Conservation and Land Management Act 1984 and to integrate the policies of the management agencies to support the vision for the Park.

LEGISLATION

This Plan has been prepared in accordance with the *Conservation and Land Management Act 1984*. CALM will utilise the provisions of the *Conservation and Land Management Act 1984* and the *Wildlife Conservation Act 1950*, and associated regulations in managing the Park

The *Conservation and Land Management Act 1984* will need to be amended to specifically include the management of regional parks

MANAGEMENT POLICIES

CALM
This Plan is consistent with CALM policies. These policies provide direction and guidance for the application of the *Conservation and Land Management Act 1984* and the *Wildlife Conservation Act 1950*, and associated regulations.

CALM policies specifically mentioned in this Plan relate to the management of weeds; fire; rehabilitation; visitor risk; recreation, tourism and visitor services; and community involvement. These policies are listed in the References and Bibliography Section and are available to the public.

City of Stirling
The policies and management actions of the City of Stirling in relation to the management of the Park will be consistent with this Plan.

Water Corporation
The policies and actions of the Water Corporation in managing the regional drainage systems affecting Herdsman Lake will be consistent with this Plan.

Strategies

1. **Apply CALM policies in managing the Park. (CALM) [Ongoing]**

2. **Assist the City of Stirling in preparing a local government policy statement that reflects the intent of this Management Plan. (CALM) [High]**

3. **Assist the Water Corporation in preparing a policy statement that reflects the intent of this Management Plan. (CALM) [High]**

7. Park Boundary

The objective is to clearly define the park boundary for the implementation of this Plan.

The Herdsman Lake Regional Park boundary has been determined by the Department for Planning and Infrastructure (DPI) and reflects the existing Metropolitan Regional Scheme (MRS) under which the entire Park is reserved as "Parks and Recreation". The existing Park boundary is shown in Figure 3 (Page 9).

Strategy

1. **Adopt the Park boundary as shown on Figure 3. (CALM, CS, DPI) [High]**

8. Land Tenure

The objective is to ensure that the values of the Park are protected by security of tenure and reserve purpose.

Land within the Park consists of reserves administered under the *Land Administration Act 1997* and vested in a number of State Government agencies and the City of Stirling, as well as unallocated Crown land and freehold land owned by State Government agencies and private organisations. The land tenure at the commencement of this Plan is shown in Figure 3.

The Plan identifies the most appropriate tenure arrangements for the land comprising the Park and proposes to vest it in either the Conservation Commission of Western Australia, or the City of Stirling.

Crown reserves will be created using the management areas outlined in the Plan's Park Management Zones as a guide (Figure 4 – Page 10). The precise boundaries of new reserves in the Park will be determined following an on-ground survey.

Should additional land be included within the boundary of the Park during the term of this Plan, its tenure arrangements will be consistent with the protection and enhancement of the Park's values.

Transfer of WAPC-owned freehold land

Freehold lands owned by the WAPC will be converted into reserves under the *Land Administration Act 1997* and vested in the Conservation Commission of Western Australia or the City of Stirling and managed in accordance with this Plan.

Reserves created from WAPC freehold land and vested in the Conservation Commission of Western Australia will be afforded an appropriate purpose for the protection and enhancement of Park values and will be classified as class A under the *Land Administration Act 1997* (refer to Table 1, Page 11).

Reserves created from WAPC freehold land and vested in the City of Stirling (for example Area 11 – Maurice Hamer Park) will be reserved for the purpose of "Recreation" and afforded similar tenure arrangements as reserves vested in the Conservation Commission of Western Australia (see Table 1 and Figure 4).

The Stirling City Council will accept the vesting of Maurice Hamer Park (Area 11) subject to the receipt of Area Assistance Grants Scheme funding for upgrading of infrastructure. The WAPC has agreed to the City's funding request.

Crown Reserves and Unallocated Crown Land

Existing Crown land reserved for utilities or services such as drainage will retain their existing reserve purpose and tenure arrangements where appropriate.

The purpose and tenure arrangements of other reserves within the Park will be reviewed and their extent and management modified in accordance with Table 1 and Figure 4. For example, the purpose of Reserve 31906 (Area 1), which contains the Herdsman Lake Wildlife Centre, is to be changed from a nature reserve with a reserve purpose of environmental education and conservation of flora and fauna to a conservation park. Given the values of the site and existing land use, conservation park is considered a more appropriate reserve purpose. Please note a description of nature reserve and conservation park is listed at the bottom of Table 1.

The Stirling City Council has agreed to have Area 3 – Glendalough Open Space (West) re-vested with it on the condition that CALM funds and constructs the proposed multi-purpose path linking the eastern end of Moondyne Drive to Jon Sanders Drive. This resolution has been agreed to by CALM.

Road reserves in the Park considered unnecessary by planning and management agencies will be closed and afforded an appropriate reserve purpose and tenure arrangements consistent with the protection and enhancement of Park values (refer to Table 1 and Figure 4).

Unallocated Crown land is to be created as reserves and transferred to the Conservation Commission of Western Australia. These reserves will also be afforded an appropriate reserve purpose and tenure arrangements consistent with the protection and enhancement of Park values (refer to Table 1 and Figure 4).

Reserve 28763

Reserve 28763 includes the Perth Horse and Pony Club as well as bushland comprising wetland vegetation communities. It is currently vested with the City of Stirling for the purpose of recreation.

The future tenure arrangements of the reserve have been the subject of discussions between CALM and the City of Stirling.

Stirling City Council has resolved that it prefers not to retain future management of the reserve.

At this stage, the Department is prepared to accept future management of the eastern (bushland) portion of Reserve 28763 as well as a car park (constructed by the City), which adjoins the reserve.

Further planning is required in relation to the future use and tenure arrangements of the horse riding area,

storage sheds and clubhouse area (Area 6). For further information, please refer to Section 35.

Private property
This Plan is not the mechanism by which freehold land, held by private individuals or organisations, is to be acquired by the WAPC. The Department for Planning and Infrastructure on behalf of the WAPC will continue its voluntary land acquisition programme within regional parks.

Until acquired by the WAPC these lands will remain protected under Perth's MRS by their "Parks and Recreation" reservation.

This Plan will not dictate the management of privately owned freehold land held by organisations in the Park. However, when the land is acquired by the WAPC, management will be in accordance with the Plan's Park Management Zones (Section 10).

Access by Park visitors to areas of private property owned by individuals or organisations in the Park is not available until it is acquired by the WAPC. Negotiated settlements are required in order to obtain the remainder of private land within the Park boundary.

Strategies

1. **Liaise with the Department for Planning and Infrastructure to create reserves for vesting in the relevant management agency in accordance with Table 1 and Figure 4. (CALM, CS) [Medium]**

2. **Support the WAPC in seeking to acquire the remainder of the private land within the Park as soon as practicable from willing landowners. (CALM) [High]**

3. **Liaise with the Department for Planning and Infrastructure to close road reserves in the Park considered unnecessary by the planning and management agencies. (CALM, CS) [Medium]**

Key performance indicators for land tenure
The success of the strategies will be measured by: 1. Changes in land tenure.
Target: 1. Complete all land tenure changes in accordance with the regional park management plan within ten years.
Reporting: 1. Every 5 years.
Response to target shortfalls: Investigate the cause and report to the Conservation Commission for action.

9. Interim Management

The objective is to ensure that interim management arrangements facilitate the appropriate management of the Park.

INTERIM MANAGEMENT ARRANGEMENTS

Prior to the gazettal of the Final Plan and subsequent transfer of lands to the relevant agencies, there is a need to clearly define interim management arrangements between the Park's managing agencies.

CALM will coordinate the interim management of the Park through the preparation of this Plan and by management agreements prepared for Crown reserves and freehold lands controlled by State and/or local government agencies involved in the Park.

A regional park management agreement for interim Park management may comprise either:

- a Section 16 Agreement under the *Conservation and Land Management Act 1984*; or
- a Memorandum of Understanding.

Interim management of WAPC owned land
Section 16 of the *Conservation and Land Management Act 1984* allows CALM to enter into agreements for the management of private (freehold) land.

Following June 1997, when the management responsibility for regional parks was progressively transferred to CALM, the WAPC and CALM agreed to enter into a Section 16 agreement under the *Conservation and Land Management Act 1984*. This formal agreement has been finalised and acts as an interim management arrangement prior to the land being vested in the Conservation Commission of Western Australia or the relevant local governments.

The agreement includes all WAPC lands within regional parks with the exception of leased land.

Interim management of Crown land and freehold land controlled by government agencies
The City of Stirling and other State Government agencies will be responsible for managing lands under their control. The interim management of unallocated Crown land and unvested Crown reserves will involve discussions between the land managing agencies involved in the Park and the Department for Planning and Infrastructure. CALM will coordinate an overall approach to the interim management of Herdsman Lake Regional Park through the preparation of this Management Plan.

Interim management arrangements for private property
Where individuals or organisations hold private property within the Park, the owner is responsible for its management. CALM may seek formal management arrangements with individual private landowners within the Park.

Strategies

1. **Implement the Management Agreement under Section 16 of the *Conservation and Land Management Act 1984* with the WAPC. (CALM, WAPC) [High]**

2. **Prepare management agreements for interim park management for areas controlled by State or local government as required. (CALM, CS) [Medium]**

10. Park Management Zones

The objective is to adopt a management zoning system that protects conservation values, provides for appropriate recreation and other uses, and provides for efficient management of the Park.

Management zones are a framework for protecting the Park by minimising existing and potential conflicts between uses and activities. They provide a broad guide to the uses and management activities which are appropriate in certain Park areas and indicate which management objectives have priority in a given area. A clear zoning scheme also helps to communicate management intentions to the public.

The management zones and areas for the Park are illustrated in Figure 4. They provide a guide for the future vesting of Park areas. However, given there are numerous service and utility reserves in the Park, they should not be used as a detailed schedule for changing land tenure arrangements in the Park.

Four zones have been identified for managing the Park:

a) Conservation and Protection;
b) Natural Environment Use;
c) Recreation; and
d) Area Subject to Further Planning.

Refer to Table 1 for the management emphasis and acceptable uses and facilities within each zone.

The zoning scheme does not direct the management of privately owned freehold land held by individuals in the Park. However, when the land is acquired by the WAPC, management will be in accordance with the Plan's Park Management Zones.

Strategies:

1. **Manage the Park in accordance with the zoning plan. (CALM, CS) [Ongoing]**

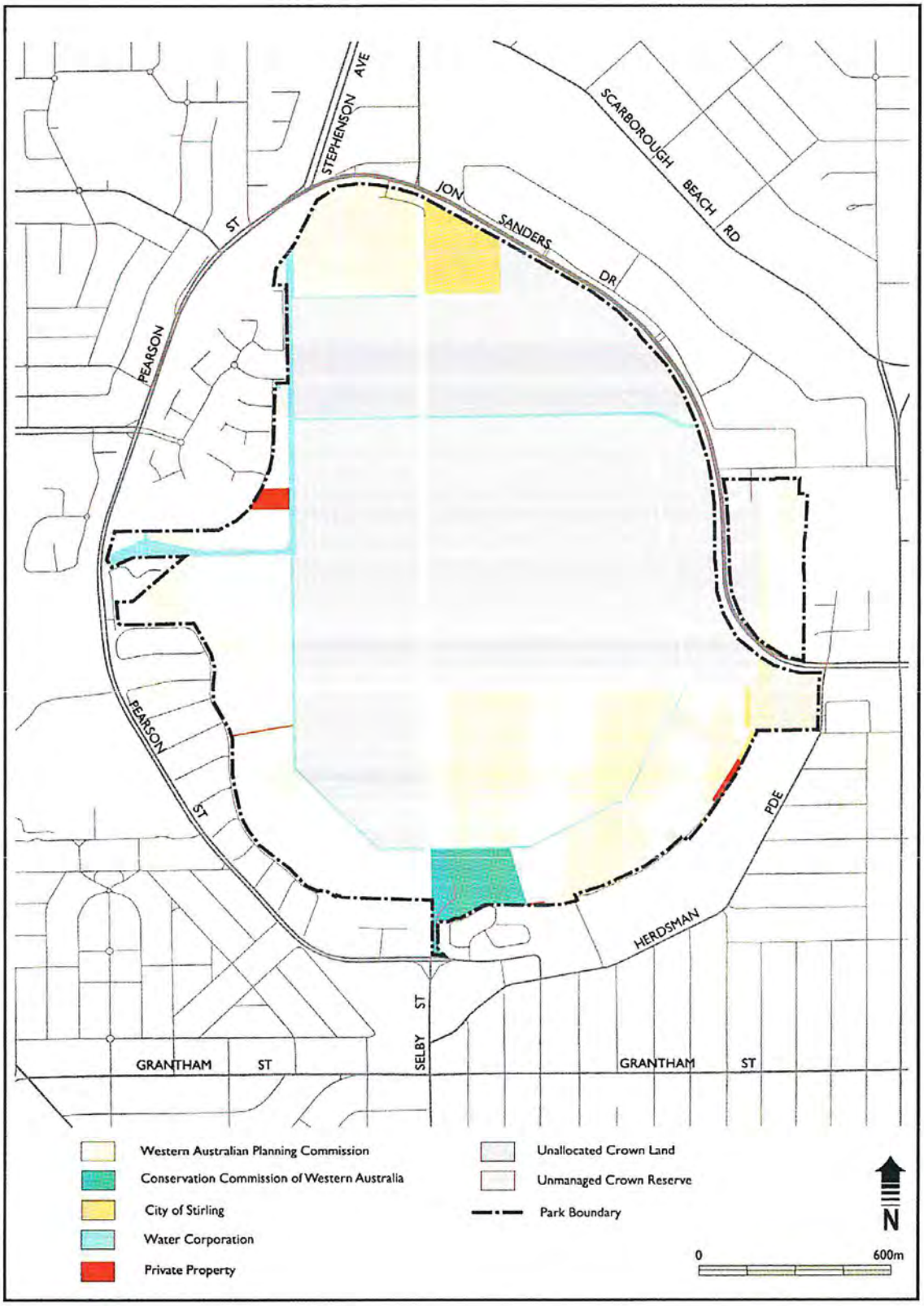

Figure 3 - Park boundary and land tenure

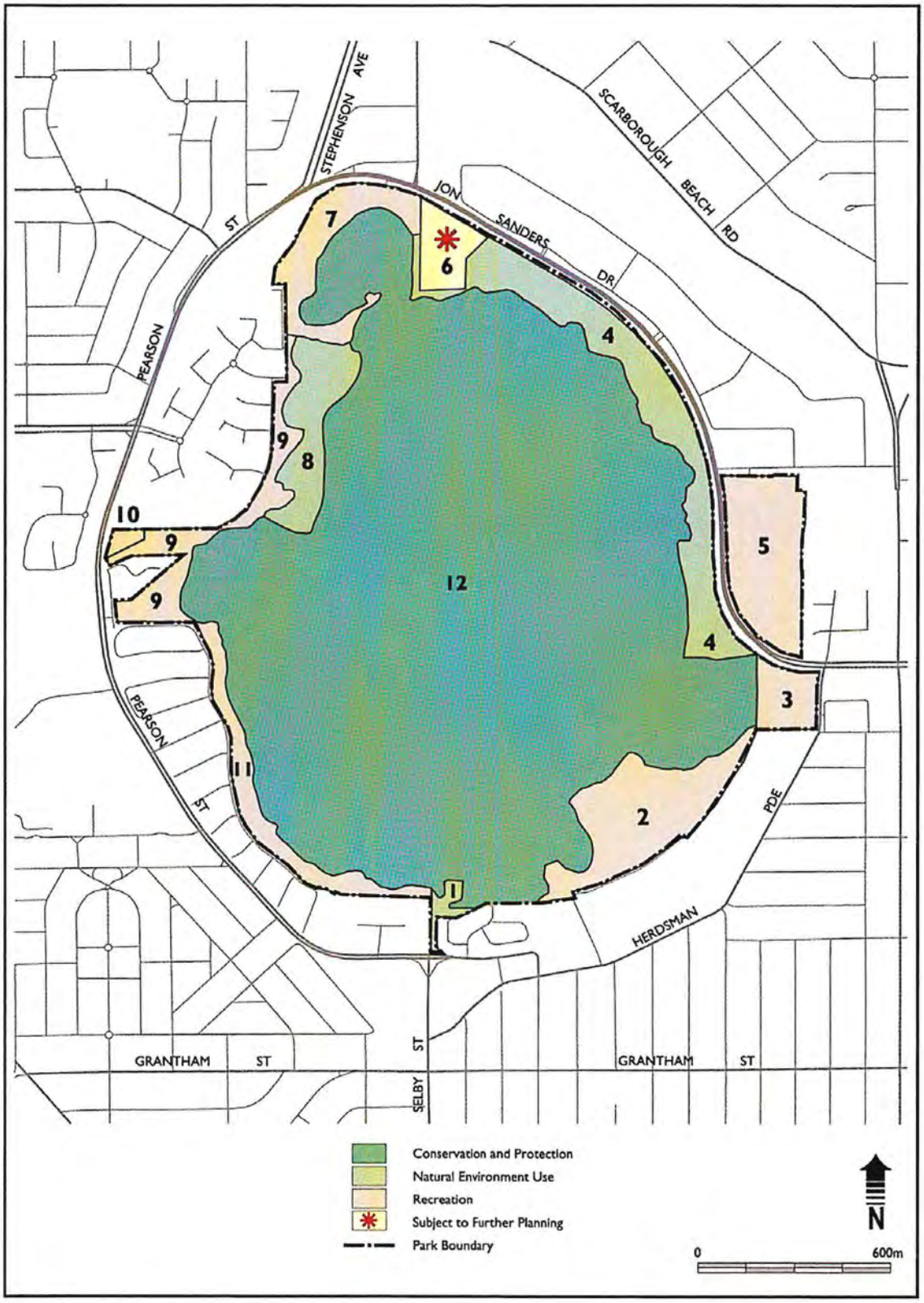

Figure 4 - Management zones and plan areas

Table 1 - Management Zones and Future Tenure Arrangements

MANAGEMENT ZONES					FUTURE TENURE ARRANGEMENTS		
Management Zone	**Plan Area**	**Management Agency**	**Management Emphasis**	**Acceptable Uses and Facilities**	**Plan Area**	**Reserve Purpose**	**Vested Authority**
Conservation and Protection	Area 12	CALM	The management emphasis of this zone is to protect and where possible enhance the biodiversity conservation values and landscape qualities of the Park. Priority will be given to maintaining the natural state of Conservation and Protection areas with a minimum of impairment. Visible evidence of management will be low.	Restricted public access to the central conservation area. Unauthorised watercraft and vehicles prohibited. Development of facilities such as boardwalks and observation platforms are acceptable in certain locations (see Section 28 - Recreation Masterplan). Rehabilitation of fringing vegetation. Protection and enhancement of natural habitats to ensure survival of wetland ecosystems. Education and research uses allowed.	Area 12	Nature Reserve – Conservation of Flora and Fauna	Conservation Commission
Natural Environment Use	Area 1 Area 4 Area 8	CALM CALM CALM	The management emphasis is to provide for appropriate uses of the natural environment. Areas will be managed jointly for public use, conservation and enhancement of flora and fauna, and improvement of landscape qualities. Public use must be compatible with the assigned purpose of the relevant reserve. Visible evidence of management may be moderate to high. Management will encourage uses and develop facilities that promote conservation and education.	Public access primarily by walking trails and cycle paths. Some development of facilities necessary. These may include education nodes and facilities associated with visitor nodes. The provision of facilities will depend on the values of an area. Rehabilitation and habitat protection may be necessary.	Area 1 Area 4 Area 8	Conservation Park Conservation Park Conservation Park	Conservation Commission Conservation Commission Conservation Commission
Recreation	Area 2 Area 3 Area 5 Area 7 Area 9 Area 10 Area 11	CALM City of Stirling CALM CALM CALM National Trust City of Stirling	The prime emphasis of management will be to provide a variety of recreation opportunities. The type and scale of facilities provided will depend on the values of any given area, community demand for recreation and the appropriate management of the Park. Public use must be compatible with the assigned purpose of the relevant reserve. Management involves minimising the impact of visitor activities through the sensitive placement and provision of access and facilities as well as through the provision of information and interpretive material. Visible evidence of management is likely to be high.	Public use may be high in these areas. Predominantly passive recreation pursuits, allowing for Park service and picnic facility development. Commercial concessions may be considered appropriate within this management zone. Rehabilitation, landscaping and reticulation are likely to be necessary.	Area 2 Area 3 Area 5 Area 7 Area 9 Area 10 Area 11	Conservation Park Recreation Conservation Park Conservation Park Conservation Park Heritage Purposes Recreation	Conservation Commission Stirling City Council Conservation Commission Conservation Commission Conservation Commission National Trust (WA) Stirling City Council
Area Subject to Further Planning	Area 6	To be determined	Long-term management depends on the outcomes of further planning.	Future uses and facilities depend on the outcomes of further planning. Current uses and facilities will be maintained in the interim.	Area 6	Subject to further planning	Subject to further planning

Note: Conservation Parks are reserves established to meet as much of the demand for recreation by members of the public as is consistent with the proper maintenance and restoration of the natural environment, the protection of indigenous flora and fauna and the preservation of any feature of archaeological, historic or scientific interest. Nature reserves are reserves established to maintain and restore the natural environment, and to protect, care for, and promote the study of, indigenous flora and fauna, and to preserve any feature of archaeological, historic or scientific interest *(Conservation and Land Management Act 1984)*.

11. Integrated Management and Planning of the Park and Adjacent Areas

The objective is to provide for the effective involvement of both the managing agencies and the community in the management of the Park.

THE PARK MANAGEMENT STRUCTURE

The joint managers of the Park are CALM and the City of Stirling, and their areas of responsibility are set out in the previous section on Management Zones. It is proposed that once this Plan is in operation, management will be in accordance with the strategies outlined in this Plan.

The State Government considers CALM the most appropriate agency to provide a strong integrated framework for the management of complex conservation and recreation areas. CALM is responsible for managing areas of the Park vested in the Conservation Commission of Western Australia and for the overall coordination of the Park's management. The City of Stirling will manage areas of the Park to be vested in the Stirling City Council, in accordance with the strategies outlined in this Plan.

Cooperation is required by the Park's managing agencies and the community for this Plan to be implemented efficiently and effectively. Strategic and management decisions will involve input from, and negotiation between, the land managing agencies. CALM will refer strategic and policy issues to the Conservation Commission of Western Australia for consideration as required. Joint working parties comprising representatives from CALM, the City of Stirling and other State Government agencies (for example the Water Corporation) will be established to facilitate the preparation of detailed subsidiary plans for the Park, in consultation with the community. The different levels of planning are illustrated in Figure 1 (page 2).

A common management direction

The establishment of a management structure, common goals and agreement on priorities are necessary for safeguarding this regional resource particularly where a number of landowners, the general public and interest groups are involved. The managing agencies will prepare annual project lists for the Park as a means of integrating park management and establishing a common management direction. The Herdsman Lake Regional Park Community Advisory Committee will have input unto the projects list.

INTEGRATED LAND USE PLANNING FOR AREAS ADJACENT TO THE PARK

Many impacts and threatening processes on Herdsman Lake emanate from surrounding land uses and activities from within the water catchment area.

Planning for areas surrounding the Park is determined at both the State and local government level. At the State level, the WAPC is responsible for administering the MRS. The MRS is a large-scale town-planning scheme for land use in the Perth metropolitan area. The Scheme defines the future use of land, dividing it into broad zones and reservations.

At the local level, the MRS requires local government town planning schemes to provide detailed plans for their part of the region. These town-planning schemes must be consistent with the MRS.

It is not the intent of this Plan to provide strategies to guide land uses and activities outside of the boundary of the Park. Planning mechanisms such as the MRS and local government town planning schemes as well as environmental assessment procedures have been established to guide land use decisions.

As stated in the Preface, this Management Plan cannot solve all of the ecological problems affecting the Park, especially those that are whole of catchment issues. A comprehensive catchment management plan for the wetlands within the Park needs to be prepared which integrates town planning and land use considerations, with the protection and enhancement of water resources (Section 15). The City of Stirling, Department of Environment (Water and Rivers Commission) and CALM should jointly prepare the integrated catchment management plan.

Strategies

1. **Establish, where appropriate, joint working parties for specific implementation plans. (CALM, CS) [High]**

2. **Consult with the Herdsman Lake Regional Park Community Advisory Committee when preparing annual projects lists for the Park. (CALM, CS) [High]**

3. **Refer policy issues to the Conservation Commission of Western Australia for consideration as required. (CALM) [Ongoing]**

4. **Prepare an integrated catchment management plan for Herdsman Lake, which integrates town planning and land use considerations, with the protection and enhancement of water resources. (CS, Water Corporation CALM) [High]**

12. Key Performance Indicators and Monitoring and Reporting

The objective is to set performance criteria for assessing and auditing the implementation of this Plan, in order to track the effectiveness of the Plan in meeting its objectives.

In order to establish an efficient and effective means for achieving this objective, key performance indicators have been defined. This reflects the need for Park managers to take an outcome-based approach, from which the effectiveness of management can be assessed.

The role of key performance indicators in this Plan is to provide an indication of:

1. ecosystem health in the Park;
2. use of the Park by the community; and

3. the performance of CALM in implementing this Plan.

Key performance indicators do not cover all objectives or strategies, but they have been selected to give a strategic indication of how well the values of the Park are being maintained through the implementation of key objectives and strategies. Key performance indicators therefore relate specifically to the key ecological and social values of the Park (see Table 2 - Page 58). They have been identified in the following sections of the Plan:

- land tenure;
- lakes and wetlands;
- flora and vegetation;
- fauna;
- weeds;
- visitor use;
- working with the community.

Key performance indicators underpin the audit process of this Plan (see Section 44).

MONITORING AND REPORTING

CALM will monitor the key performance indicators. Appropriate and valid monitoring methods, intervals and baseline data will be established for each key performance indicator. Monitoring will need to take into account natural variability.

CALM will periodically report to the Conservation Commission of Western Australia against the key performance indicators and including responses to any target shortfalls. The Commission will take action as appropriate where performance targets are not met.

CALM will coordinate monitoring undertaken in the Park to ensure an integrated approach that avoids duplication and allows programs to be assigned appropriate priorities.

Strategies:

1. **Establish baseline information and ongoing monitoring programmes within the Park, focusing on the Key Performance Indicators. (CALM) [High]**

2. **Monitor and measure the Key Performance Indicators and report findings to the Conservation Commission of Western Australia as required. (CALM) [High]**

C. CONSERVATION

13. Conservation Goal and Guiding Principles

Protect, conserve and enhance the Park's biota and natural ecosystems as well as its physical, cultural and landscape resources.

CONSERVATION GUIDING PRINCIPLES

1. Conservation and protection of the natural environment
Natural systems (including natural processes, the ecosystems of particular sites, biota and landscapes) will be managed to maintain their inherent values. External impacts from human use, the surrounding urban area and management practices will be minimised in order to maintain the biodiversity of natural systems over the long-term.

2. Park management priorities
The Park will be managed for conservation and environmental enhancement. Recreation and other uses will be allowed to occur to the extent that they do not impair the sustainability of the natural environment.

3. Restoration of the natural environment
Restoration of the natural environment will be undertaken to maintain biodiversity, and protect and enhance natural systems. Areas with high conservation significance will be considered priorities for restoration.

4. Features requiring special protection
Declared rare flora, priority flora species, threatened ecological communities, priority fauna and other specially protected fauna will be given priority for conservation and restoration.

5. Consistency of management policies
The land managers involved in the Park will apply consistent and coordinated management policy.

6. Reserve purpose appropriate to Park values
Reserves in the Park will be assigned an appropriate purpose for the protection and enhancement of Park values under the *Land Administration Act 1997*.

7. Recognition of cultural and social values
The Park will be managed in a way that delivers community benefits by maintaining cultural traditions and attributes and by providing opportunities for recreation, education and research.

8. Precautionary principle
If there are threats of serious of irreversible environmental damage, the lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

Strategy

1. **Apply the above principles as required in conserving the natural environment of the Park. (CALM) [Ongoing]**

14. Geomorphology and Soils

The objective is to protect and maintain the existing geomorphologic and soil associations of the Park.

GEOMORPHOLOGY AND SOILS

Herdsman Lake forms an interdunal depression in the Spearwood Dune system which comprises Quaternary-aged sediments parallel to the coast. The soils underlying the Park are of the Karrakatta soil association of this dune system (Seddon, 1972). Karrakatta soils are deep yellow brown sands. Within the Karrakatta association the larger swamp areas are classified as the Herdsman unit. The soils of this unit are black organic sands, peaty loams, black clays and true peats (Department of Conservation and Environment, 1980).

Teakle and Southern (1937) recognised three general soil types in Herdsman Lake: colloidal to peaty sands and loams around the Lake margins; acid to strongly acid colloidal, pulpy peats; and marly peats of the colloidal pulpy type formed as a result of mollusc and crustacean decomposition.

As described by Churchill (1956), Herdsman Lake was probably a large body of standing water that has gradually filled with sediment over time. The continued presence of water in the Lake has led to the formation of a "basin peat" throughout the lakebed and much of its surrounds. Peat has not been accumulating in recent times as its formation generally requires wetter conditions with higher rainfall and greater groundwater input. Different types of peat have been laid down in the Lake's basin indicating that they have been formed under varying conditions of inundation.

Two key threats to protecting the geomorphologic and soil associations of the Park have been identified:

1. dredging and reclamation activities; and
2. erosion;

Dredging and reclamation activities
During past dredging and reclamation activities both topsoil and peat have been removed from the Lake. The peat and in some areas peaty-sands, have been used within the Park to reclaim public open space areas, create islands and to re-line the submerged sand profiles exposed in the moats by dredging. Sand and topsoil have been used to provide a surface covering areas of open space. Soil inside the moat has not been disturbed (Maunsell and Partners, 1989).

As a result of dredging and reclamation, some changes to the levels of ground reclaimed with peat will occur with time due to consolidation. This has already occurred to some extent, resulting in subsidence of reclaimed areas around the Park. Jon Sanders Drive is also showing the effects of consolidation (Maunsell and Partners, 1989). The structural instability of backfilled peat areas is an important consideration in planning and constructing facilities around the periphery of Herdsman Lake.

The future dredging requirement in the Park is conceptually illustrated in Figure 5. This dredging will finalise the moat at Herdsman Lake and is in accordance with *Improvement Plan No. 21* prepared by the former State Planning Commission.

The rationale for the moat (as outlined in Environmental Protection Authority, 1988) includes:

- to protect the central conservation zone of Herdsman Lake;
- to contribute to water quality maintenance and compensation of drainage waters;
- as a landscape element, a loafing area for birds, and in providing habitats for other bird species; and
- as a source of sand fill for construction activities.

All dredging activities are to be in accordance with the detailed moat design plan approved by the Department of Environment.

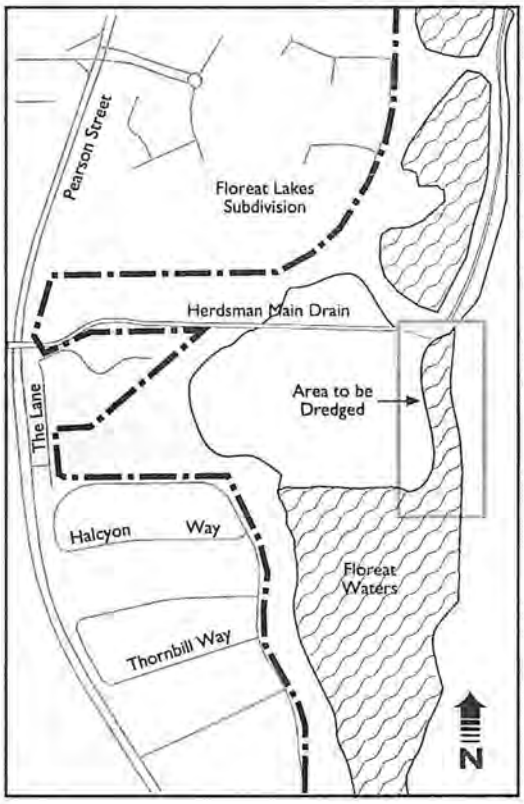

Figure 5 - Future dredging requirements

Erosion

Erosion is impacting upon the Park in a number of different ways. First, it is a localised problem occurring along the banks of wetland areas where uncontrolled access has caused damage to fringing vegetation.

Second, wind erosion is impacting upon the northwest section of the Park from a large stockpile of sand stored adjacent to the Park (within the Floreat Lakes residential development site). Sand from the stockpile and the general development site is being blown into the Park thereby impacting on natural systems and causing inconvenience to Park visitors. The wind erosion is particularly a concern for the National Trust as the sand is affecting the heritage values of the Settlers Cottage.

Soil contaminants

An issue, which needs to be considered in the management of the Park, is the presence of contaminants in the soil. Research has been conducted on the level of pesticides within the Lake's sediments. The *Herdsman Lake Pesticide Study* (Davis and Garland, 1986) investigated the effects of the 1986 Argentine ant treatment programme at the Lake by the Agriculture Protection Board. This study, plus additional sampling by CALM between 1986 and 1988, revealed dieldrin, chlordane, dichloro-diphenyl-trichloroethane (DDT) and heptachlor in the Lake's sediment and water.

Importantly, the study results indicated:

- both the surface waters and sediments of the bed of Herdsman Lake contained detectable levels of DDT and dieldrin, that were not applied during the 1986 spraying programme, suggesting that the compounds detected are residues from previous spraying programmes at the Lake (prior to 1970) or within the catchments of the drains that enter the Lake; and
- the presence of pesticides in Mosquito Fish (*Gambusia holbrooki*), Swamphens and Little Grassbirds indicates the bioaccumulation of pesticides is occurring within aquatic food chains within the Lake. (The presence of high levels of pesticides within the Lakes sediments indicates that bioaccumulation may continue to occur with the possible transfer of pesticides into the food chain when sediment dwelling organisms are consumed by other invertebrates, fish or waterfowl).

The presence of pesticides in sediments is a function of both the chemical structure of the soil and the intrinsic stability of the pesticide. Heavy clays for example retain pesticides and nutrients much longer than lighter sandier soils. The high organic content in the peaty soils of Herdsman Lake also increases pesticide and nutrient persistence.

The ability of soils to take up pesticides and nutrients has important implications for water quality since a portion of the pesticides and nutrients in standing waters can be absorbed into the soil. Given Herdsman Lake sediments are peaty and generally have a very high organic content, it would be expected that they act as a significant pesticide and nutrient sink. This phenomenon is supported by Kobryn (2001) who indicates that during 1992-93 more than 85% of total suspended solids, nutrients and heavy metals entering Herdsman Lake were retained in the wetland system.

Strategies

1. **Facilitate discussions to achieve the completion of the Floreat Lakes residential development allowing the proponent to finalise the moat and utilise the stockpile of sand adjoining the Park in the northwest section. (DPI, CALM) [High]**

2. **Liaise with the Department of Agriculture regarding the presence of pesticides in the soils of the Park prior to the development of recreation facilities. If pesticides exceed safe levels, refer the matter onto relevant authorities. (CALM, CS) [Ongoing]**

3. **Ascertain soil stability prior to the development of recreation facilities in the Park. (CALM, CS) [Ongoing]**

4. **Restrict access to areas at risk from erosion by implementing the Recreation Masterplan (Section 28) and providing signs and information (Sections 31 and 40). (CALM, CS) [Ongoing]**

15. The Lake and Wetlands

The objective is to manage the Park in a manner that protects and enhances the wetland environments of the Park.

Water enters Herdsman Lake via local and branch drains, direct runoff, rainfall and as groundwater. It leaves the Lake via evaporation, evapotranspiration, outflow to the groundwater and through the Herdsman Main Drain.

In discussing the management of Herdsman Lake and the other wetlands in the Park, it is necessary to briefly review past planning for the Park. As discussed earlier, in 1985, the SPC prepared *Improvement Plan No. 21* for Herdsman Lake. The Improvement Plan was gazetted in 1986 and provided the SPC with the mandate to complete all works proposed in the original *Herdsman Lake Concept Plan* in 1976.

The Floreat Lakes residential development which adjoins the Park to the northwest was designed in accordance with *Improvement Plan No 21*, which allowed for the dredging of the moat to be completed around the internal conservation area of Herdsman Lake. The Environmental Protection Authority (EPA) formally assessed the development and a number of ministerial conditions were placed on the development for it to proceed. One of the conditions was as follows:

"Prior to completion of the Floreat Lakes development, an overall water management plan for Herdsman Lake shall be prepared by the State Planning Commission in consultation with CALM, the Water Corporation, and the City of Stirling, to the satisfaction of the Environmental Protection Authority" (EPA, 1988). This plan is yet to be prepared.

The objective of the overall water management plan will be to provide a system of monitoring, reporting and containment of pollution events. The plan will detail management procedures for the containment of a pollution event in the immediate locality so that remedial measures can then be applied and the extent of the pollution contained (within either the drains or the moat areas) (EPA, 1988).

The containment of any pollution event is based on three factors:

1. that all responsible authorities have a detailed knowledge of the system;
2. that the necessary materials are available, or structures constructed, to block off piped or open drains when required anywhere within the catchment; and
3. that a co-ordinating and reporting system be established.

THREATS TO HERDSMAN LAKE AND THE WETLANDS IN THE PARK

The main threats to the wetlands in the Park are:

- water level changes (discussed below);
- pollution including eutrophication (discussed below);
- dredging and reclamation activities (Section 14)
- environmental weeds (Section 18); and
- aesthetic disruption (Section 24);

Changes to water levels in Herdsman Lake

In considering the water levels at Herdsman Lake it is necessary to examine the characteristics of its catchment area and groundwater recharge area.

Prior to the 1920s Herdsman Lake was primarily an expression of the groundwater with a considerable inflow of groundwater along its northern and northeastern boundaries from the Gnangara mound. In winter the water level of the Lake rose as the underlying aquifer was recharged, and in summer the Lake slowly dried out due to evaporation. Herdsman Lake flooded to depths of up to two metres in winter (Beckle, 1981), and had dried out to a "wet and puggy" condition by the end of each summer (Teakle and Southern, 1937). Surface runoff into the Lake was only a minor contributor to the Lake's water level.

The current situation however, is vastly different as Herdsman Lake now receives inputs from both local and branch drain systems and functions as a drainage compensation basin for a catchment area that is approximately 3,000 hectares and extends about 10

kilometres in a north easterly direction (see Figure 6 – page 19). Kobryn (2001) suggests that Herdsman Lake now receives most water by surface inputs, and that groundwater is a minor component of the Lake's water balance.

The main factors influencing the volume of stormwater runoff (and thus water levels in the Lake) are climate and catchment characteristics. Whilst climate variability over time is important, the greatest variability in runoff volume is generally due to differences in land use and cover characteristics of the catchment area (Kobryn, 2001).

The Herdsman Lake catchment has mostly sandy soils that are highly porous, however with more sealed surfaces in the catchment, runoff is increased and groundwater recharging is reduced (Kobryn, 2001). As such the groundwater table and the lake levels have fallen due to a smaller area available for recharge. Other factors contributing to the reduction in Lake levels include, the extensive drainage and lake level controls implemented by the late 1920s (when only 5% of the catchment had been urbanised) and the large number of domestic and commercial bores accessing the upper, unconfined aquifer (Kobryn, 2001).

The net result has been a slow, steady decrease in Herdsman Lake water levels until the 1970s and, since then, apart from seasonal variations, fairly stable levels (Kobryn, 2001).

There are numerous local government (City of Stirling) stormwater drains that discharge directly in the Lake. Additionally, Flynn Street Branch Drain and the Herdsman Parade Branch Drain (managed by the Water Corporation) also discharge directly into the Lake (see Figure 10 – page 46).

The Osborne Park Branch Drain and the Balgay Branch Drain were constructed to transfer stormwater from the Herdsman Lake catchment area, through Herdsman Lake, for discharge (via the Herdsman Main Drain) into the Indian Ocean at Floreat Beach. While the two Branch Drains transfer water across Herdsman Lake, drainage waters are not fully isolated from Herdsman Lake itself. Water overtops the levee banks of the Osborne Park Branch Drain and the Balgay Branch Drain and discharges directly into the Lake. Additionally, the levees of the two Branch Drains are not impervious and water moves between the drains and the Lake.

A key issue in managing water levels in Herdsman Lake is the functioning of the drains, their maintenance and the use of structures to control water movement between the drains and the moat system and vice-versa. The appropriateness and management of these structures will be reviewed through the preparation of an overall water management plan for Herdsman Lake.

Changes to water levels in the Lake may influence the germination of, survival and composition of fringing wetland vegetation communities. Additionally, changes in the Lake environment would favour some fauna species at the expense of others due to their different breeding and feeding requirements.

A permanent increase in the water level at the Lake would probably result in an increase in the area of open water while much of the shallow water and mudflats used by wading birds would be lost. Additionally, the rise in water level is likely to result in the loss of rush beds used by some species of birds for breeding.

Alternatively, if water levels were to fall permanently at the Lake, preventing the central wetland area from flooding in winter, there would be a substantial loss of seasonally inundated wetland areas required by some birds for habitat. It would be likely that only species that use the deeper areas of the moat; principally swans and ducks would remain common.

The responsibility for monitoring water levels is with the Department of Environment (Water and Rivers Commission).

Kobryn (2001) determined the water balance, flow rates and volumes of Herdsman Lake for the two-year period 1992-1993. This data, combined with Water Corporation modelling of catchment run-off and lake storage capacity, will be utilised in the overall water management plan when considering the management of water levels for conservation purposes, pollution containment, and the drainage requirements of the Water Corporation and City of Stirling.

Pollution including eutrophication

There is no published information on water quality for Herdsman Lake before 1981. In 1981 and 1983, ESRI reported on selected water quality data. In 1983, only the Floreat Waters section of the moat existed and water quality results indicated low oxygen concentrations below the thermocline and high concentrations of nutrients (ESRI, 1983).

A detailed pesticide study from 1986-1988 identified that the concentrations of the organochlorine pesticides dieldrin, chlordane, and heptachlor recorded in Herdsman Lake exceeded the maximum levels recommended for the protection of aquatic fauna (Clarke, Davis, and Murray, 1990). High concentrations of pesticides detected in fish and waterfowls resident at the Lake, and the low numbers of predatory invertebrates recorded at the Lake, were considered to indicate that the aquatic food chain was affected by high pesticide concentrations. Probable sources of pesticides include the Argentine ant control programme (which ended in 1986) and commercial and domestic pesticide applications within the catchment. High levels recorded in inflowing drains indicated that surface inflows played a large part in delivering pesticides to the Lake (Clarke *et al.* 1990).

The most comprehensive discussion of the water quality of Herdsman Lake is the *Herdsman Lake Water Quality Study* by Clarke, *et al* (1990) which analysed data collected by the State Planning Commission between 1982 and 1986. Water quality reporting by Clarke, *et al.* (1990) revealed problems with nutrient enrichment at Herdsman Lake. Floreat Waters, Powis Lake and Popeye Lake appeared to be intermediate in nutrient enrichment with Floreat Waters being the most nutrient enriched of the three deepened water bodies and could have been classed as eutrophic. The higher nutrient levels in Floreat Waters were attributed to the aging process of the water body and also to a probable higher

nutrient input loading in comparison with the other water bodies within the Herdsman Lake System (Clarke *et al.* 1990).

In 1989 and 1990, Herdsman Lake (Floreat Waters and Popeye Lake) was sampled on three occasions as part of a larger study of Swan Coastal Plain wetlands (Davis, *et al.* (1993). Testing indicated that Floreat Waters and Popeye Lake had high phosphorus concentrations (Schmidt and Rosich, 1993).

Kobryn (2001) monitored stormwater flowing in and out of Herdsman Lake for two years (1992-93) and measured the physical and chemical characteristics (including nutrients and heavy metals) of the water. Monitoring indicated that the large majority of nutrients entering Herdsman Lake do so via the stormwater drains and not groundwater. While groundwater quality was poor, the total load and contribution to the Lake from this source was minimal.

This is consistent with Davies (1993) who monitored a number of wells around nearby Jackadder Lake, which revealed that groundwater was a minor contributor of phosphorus. Since Herdsman Lake intercepts the same body of groundwater as Jackadder Lake, it can be assumed that in comparison to surface inputs, groundwater is a relatively insignificant contributor of pollutants.

Kobryn (2001) indicated that except for pH and conductivity, water in the drains at Herdsman Lake did not meet ANZECC water quality standards for freshwater wetland or coastal waters.

In relation to heavy metals, the high concentrations detected by Kobryn (2001) were consistent with Clarke *et al.* (1990) and all were above ANZECC water-quality guidelines most of the time. Storm events resulted in highest concentrations and loads, with the Lake system retaining, on average, 90% of incoming metals with the exception of copper (Kobryn, 2001).

The Water Corporation has also conducted water quality monitoring within the branch drain systems at the Lake. The results are consistent with Kobryn (2001) indicating that nutrient concentrations in the various drains were frequently very high and are likely to be a significant source of nutrients into the Lake's system. Data suggested that flushing of nutrients into the Lakes from the catchment by the first winter rains might result in an increased nutrient load in autumn and early winter (Clarke *et al.*, 1990). Kobryn (2001) however, suggests that late winter storms carry the same load and often-higher load than first winter storms. This suggests a high and steady availability of nutrients and other pollutants in the catchment throughout the year.

All of the water quality studies and monitoring programmes undertaken to date indicate that Herdsman Lake has elevated nutrient concentrations, especially nitrogen and phosphorus (Kobryn 2001). The adverse effects of nutrient enriched wetlands include algal blooms, the abundance of non-biting midges, algal toxicity and loss of amenity through odours and fouling of the shoreline.

Algal blooms that commonly occur at the Lake are considered to be a direct result of pollution entering via stormwater drains (Kobryn, 2001). The effects of eutrophication on wildlife and vegetation have not been fully determined, however there are concerns over nutrient-associated algal blooms. Should an algal bloom be sighted in Herdsman Lake or the other wetlands in the Park, the Department of Health will gather samples for analysis. If the samples are found to be of toxic algal blooms, warning signs will be installed.

Therefore, a major threat to the wetland ecosystems of the Park is pollutants or other hazardous material entering the Park through the inflowing stormwater drain system. As mentioned earlier, a response strategy for emergency pollution spills that may impact upon Herdsman Lake will be a part of the overall water management plan for the Park. When dealing with emergencies apart from fire (such as floods or chemical spills) the managing agencies are guided by the Western Australian Hazardous Materials Emergency Management Plan (FESA, 1998).

Clarke *et al. (1990)* indicated that the likely major sources of pollutants entering Herdsman Lake include local domestic pesticide, herbicide and fertiliser use, industrial wastes poured or flushed into drains; and incomplete fuel combustion products and particulate lead from roadways. Unless a number of best management practices are implemented in the catchment, water quality in the Lake and near ocean outfall – as well as the landscape values and quality of the wildlife habitat – will continue to deteriorate (Kobryn, 2001).

There are three main management options for improving stormwater quality at Herdsman Lake:

1. on-site treatment (including infiltration of rainfall and run-off, improved street cleaning practises and public education);
2. a reduction of non-point pollution sources; and
3. treatment in created wetlands.

On-site treatment and reduction of non-point sources form part of the responsibilities of individual landowners as well as integrated catchment management coordinated by local governments (Kobryn, 2001). The development of constructed wetlands and other pollution containment devices will be considered in the overall water management plan for the Park.

Integrated catchment management is a process to help coordinate the management of factors affecting water quality on a whole of catchment basis. Integrated catchment management is referred to in the City of Stirling's Wetland Protection Policy and the City has made an undertaking to initiate an integrated catchment management process for Herdsman Lake in conjunction with the Department of Environment, Water Corporation, CALM and the community.

In an effort to improve the water quality in Herdsman Lake the City has commenced work on improving the management of its stormwater drainage systems. These works are aimed at reducing pollution and nutrients entering the Lake.

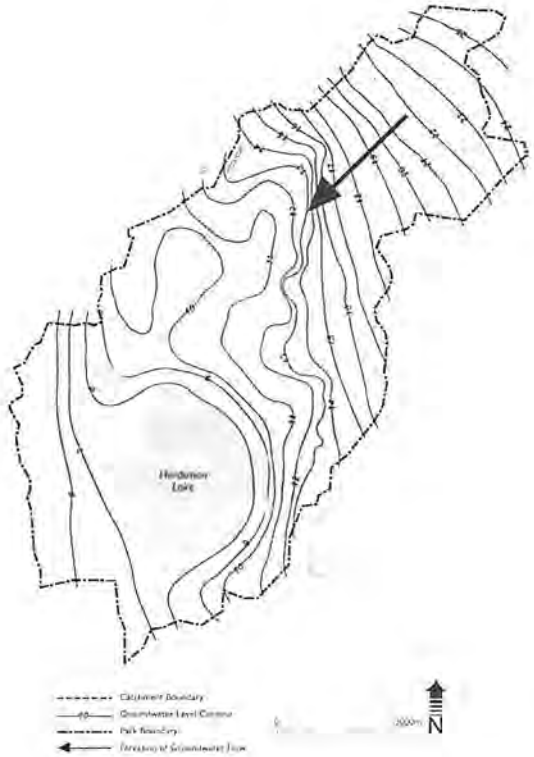

Figure 6 - Groundwater flow and catchment boundary

Another important consideration in water quality management is the protection of wetland fringing vegetation, which helps to maintain water quality by reducing the influx of nutrients through filtration and storage. The use of fringing wetland vegetation for trapping nutrients in drainage management is discussed in Section 33.

The feeding of water birds is a common recreation pursuit that has localised effects on water quality. Birds congregate in large numbers and often uneaten food and faeces sink to the bottom of the Lake. As a result, increased nutrient loading of the water occurs and blooms of algae may develop. Artificial feeding also has an adverse effect on the health of birds and will be discouraged (Section 17).

WETLAND MONITORING

The number of species of predatory invertebrates recorded at a wetland can be used as an indication of the state of the aquatic food chain (Rolls, Davis, Balla, and Bradley, 1990). An assessment of the health of the wetland ecosystems can be undertaken by considering higher taxonomic levels of invertebrates such as genus and family, rather than needing to identify individual species.

This type of assessment (rapid bio-assessment) means the costs of assessing wetland health are reduced and allows for the possible involvement of community or school groups in assessment. Davis and Christidis (1997) prepared *A Guide to Wetland Invertebrates of Southwestern Australia,* which provides appropriate taxonomic keys for assessment.

Given the concerns relating to the condition of Herdsman Lake, the following indicators of wetland health will be included as performance indicators for the proposed integrated catchment management plan for the Herdsman Lake catchment area:

- the level of nutrients and chlorophyll-a concentrations;
- the presence of blue-green algae cells,
- the species diversity and structure of aquatic macro-invertebrates and avian communities.

ANZEC guidelines will be used in reviewing the above indicators of wetland health. Additionally, consideration will also be given to water quality indictors such as heavy metals and other toxicants found in stormwater. If these water quality indicators are used, ANZECC guidelines will be followed.

Strategies

1. **Monitor naturally occurring macro-invertebrate populations as part of the Fauna Management Programme (Section 17). (CALM) [High]**

2. **Prepare and implement an integrated catchment management plan for the Herdsman Lake catchment area. The plan is to include environmental water provisions and performance indicators relating to water quality and wetland health. (CS, Water Corporation, CALM) [High]**

3. **Prepare and implement an overall water management plan for Herdsman Lake. The plan will:**
   - **review the existing drainage scheme for Herdsman Lake;**
   - **define pollution containment devices (including water control structures);**
   - **detail emergency pollution response procedures;**
   - **estimate water volumes entering and leaving the Lake;**
   - **detail drainage requirements of the Water Corporation and the City of Stirling;**
   - **establish a programme to manage water levels for the protection of wildlife habitat and other conservation values; and**
   - **outline works required to the drainage network or improve water quality entering Herdsman Lake.**

   (CS, Water Corporation, DPI, Sherwood Overseas, CALM) [High]

4. **Adopt management practices throughout the Park that do not add nutrients and pollutants to the wetland system. For example, fertilisation and irrigation management practices are to be based on minimal nutrient loss and irrigation run-off. (CALM, CS) [High]**

5. **Provide interpretive material to the community:**

- **outlining the effects of pollution on the wetlands;**
- **appropriate use of fertilisers; and**
- **discouraging the feeding of waterbirds.**

(CALM, CS) [Medium]

6. **Protect and re-establish wetland fringing vegetation in disturbed areas (Section 22). (CALM) [High]**

7. **Promote the implementation of wetland and water sensitive design techniques for developments within the Herdsman Lake catchment area. (CS, Water Corporation, CALM) [High]**

Key performance indicators for lakes and wetlands
The success of the strategies will be measured by: 1. Changes in abundance, species diversity and structure of naturally occurring aquatic macro-invertebrate populations. 2. Completion of an integrated catchment management plan for the Herdsman Lake catchment area.
Target: 1. No decline in the abundance or diversity of naturally occurring aquatic macro-invertebrate populations based on 2005 levels. 2. Integrated catchment management plan finalised within 5 years of the completion of the regional park management plan.
Reporting: 1. Every 3 years (note: seasonal variations). 2. Every 5 years - completed by 2008 and implementation reported by 2012.
Response to target shortfalls: Investigate the cause and report to the Conservation Commission for action.

16. Flora and Vegetation

To protect, conserve and rehabilitate local plant species and communities in the Park.

The vegetation of Herdsman Lake has changed a great deal since European settlement. Reports by early European settlers describe the Lake as an area of open water with fringing rushes and fresh water paperbarks (*Melaleuca rhaphiophylla*) giving way to swamp banksia (*Banksia littoralis*) and flooded gum (*Eucalyptus rudis*) with an understorey of shrubs (Bekle, 1981).

The Park has become very much isolated due to the loss of surrounding local vegetation and increased development. Considerable conservation gains however, can be made through integrated and coordinated weed control and rehabilitation operations. Additionally, the use of local species in landscaping projects around the Park as well as planning for corridors and links between the Park and other conservation areas can help to increase the Park's ecological integrity (see Section 25 – Greenway Corridors and Links).

There have been no Declared Rare Flora or Threatened Ecological Communities recorded in the Park.

The flora and vegetation of the Park can be broadly described as:

1. upland vegetation communities and assemblages;
2. wetland vegetation communities and assemblages; and
3. aquatic flora.

A description of the vegetation communities and aquatic flora present in the Park is described below and illustrated in Figure 7 (page 23).

UPLAND VEGETATION

Significant disturbances and other activities in the past such as agriculture, market gardening, drainage schemes, land filling and fire have removed much of the original upland vegetation within the Park. Upland areas of the Park are characterised by open parkland areas with isolated remnant trees.

WETLAND VEGETATION

The vegetation communities of the Park are primarily wetland communities that are either sedgelands dominated by *Typha orientalis* or woodlands with an overstorey of either *Melaleuca rhaphiophylla, Eucalyptus rudis,* or *Eucalyptus camaldulensis (Eucalyptus camaldulensis* has been introduced to Herdsman Lake and is not a naturally occurring species at this location. It will however, be retained given the habitat values it provides in the Park). The wetland communities in the Park are influenced by, and are dependent on, the hydrological zones within the lake system. Sedgeland communities dominate the fringing open-water areas; the wet-forest and woodland communities are in the seasonally inundated margins between the open water and the dryer recreation areas. The native sedgeland communities throughout the Park extend into the understorey of the forest and woodland. By contrast the *Typha orientalis* communities only occur where there is no shading overstorey (Regeneration Technology, 2002).

There are seven wetland communities in the Park:

1. *Baumea articulata/Typha orientalis* sedgeland;
2. *Schoenoplectus validus/Typha orientalis* sedgeland;
3. *Typha orientalis* sedgeland;
4. *Melaleuca rhaphiophylla* woodland;
5. *Melaleuca rhaphiophylla/Eucalyptus rudis* open forest;
6. *Eucalyptus rudis/Eucalyptus camaldulensis* open forest; and
7. *Eucalyptus rudis* open forest.

(Regeneration Technology, 2002).

There is little of the original remnant vegetation within the Park. The original *Baumea articulata* and *Schoenoplectus validus* sedgeland communities that fringe the main lake are threatened by the introduced *Typha orientalis* (Regeneration Technology, 2002).

The dominant and most extensive community within the Park is the *Typha orientalis* community that extends across the middle of the shallow lake forming a monoculture. There are small pockets of the original woodland communities on the western side of the Park near Floreat Waters, the southern end of the lake near the wildlife centre and on the eastern side along Jon Sanders Drive (Regeneration Technology, 2002).

The *Melaleuca rhaphiophylla* community at the southern end of the lake is the most intact remnant within the Park. This community is typical of the type of vegetation that would have originally existed across the wetland (Regeneration Technology, 2002).

AQUATIC FLORA

The shallow margins of the moat support rooted angiosperms such as fennel pondweed (*Potomogeton pectinatus*) and the prickly waternymph *(Najas marina).* The fruiting bodies of fennel pondweed serve as a food source for waterfowl. The water bodies within Herdsman Lake also contain a mixture of planktonic, benthic and filamentous algae.

THREATS TO FLORA AND VEGETATION

The threats to flora and vegetation within the Park are:

- the management of water levels and water quality (Section 15);
- weeds, particularly the invasion of (*Typha orientalis)*; (Section 18);
- unplanned fire (Section 19);
- importation of soil;
- insects; and
- urban interface issues and uncontrolled access.

Water quality and water levels in Herdsman Lake

As described in Section 15, the management of water quality and water levels are key issues in the context of conserving the natural processes associated with the wetland vegetation communities and aquatic flora in the Park. Outbreaks of blue-green algae (*cyanobacteria*) blooms, which can be attributed to increased nutrient levels in the Lake are relatively common during late summer and represent a significant threat to the local aquatic flora of Herdsman Lake.

Weeds

Weeds are a major problem in the Park and require immediate action by the managing agencies. Measures for the control of weeds in the Park are discussed in Section 18. The continued invasion of *Typha orientalis* is a threat to the ecological systems of the Park, not only in out-competing local plant species but it also constitutes a significant fire risk in late summer and early autumn when most of the mature leaves have died (see Section 19). The management of *Typha orientalis* is discussed in Section 18 – Weeds.

Unplanned fire

Increased urban development around the Park and greater visitor use of the Park is likely to increase the incidence of unplanned fire. Refer to Section 19 for the management of fire within the Park.

Importation of soil

The importation of soil into the Park will be restricted. When it is necessary to import soil into the Park, it is important that the soil is free of *Phytophthora* pathogens and weed seed, and is similar to the natural soil types of the area.

Phytophthora dieback refers to the deadly plant disease caused by the fungal pathogen *Phytophthora cinnamoni* and is considered to be a significant threat to a number of vegetation communities on the Swan Coastal Plain. No sampling for *Phytophthora* has been undertaken in the Park, however, it is not considered to be a major threat as existing plant communities in the Park have few susceptible upland species e.g. jarrah, banksias and grasstrees (*Xanthorrhoea).*

Phytophthora dieback could have an impact on revegetation programmes in the Park if the species planted are vulnerable to the disease. The risk of impact from *Phytophthora* dieback can be reduced by modifying activities that spread the pathogen, or by controlling access to high priority area. Modifying activities may involve cleaning machinery, vehicles or footwear, scheduling activities for dry soil conditions, or using materials that are free of *Phytophthora cinnamoni.*

Controlling access may involve track rationalisation, upgrading tracks, or restricting the access of off road or management vehicles (Dieback Working Group 2000).

Insects

A number of flooded gum (*Eucalyptus rudis*) around Herdsman Lake (especially along Moondine and Jon Sanders Drives) are in an unhealthy condition for much of the year. Their poor condition is attributed to being attacked by a range of leaf-eating insects. Research is being undertaken in the Park and at other locations throughout the south west of the State to investigate whether the disturbance is a natural phenomenon or human induced.

Urban interface issues and uncontrolled access

Maintaining the integrity of bushland adjoining urban areas raises many issues such as weed invasion, uncontrolled access, and rubbish dumping. These issues are addressed in Sections 18, 30 and 33 respectively.

The inappropriate clearing of vegetation and wilful damage to vegetation in upland areas has been a problem in the past. All native flora is protected under the *Wildlife Conservation Act 1950*. Any incidences of wilful damage to vegetation in the Park will be investigated and appropriate action taken by CALM.

Strategies

1. **Implement the *Herdsman Lake Regional Park Weed Control and Revegetation Plan*. The plan includes principles and priorities for weed control and rehabilitation works as well as a basis for monitoring selected local wetland species. (Section 22). (CALM) [High]**
2. **Reduce the frequency of fire, utilising strategies set out in Section 19. (CALM, CS) [Ongoing]**
3. **Continue research in the Park and across the southwest of Western Australia into the effects of leaf eating insects on *Eucalyptus rudis*. (CALM) [Medium]**
4. **Investigate any wilful damage to vegetation in the Park and take appropriate action. (CALM, CS) [Ongoing]**
5. **Reduce the risk of introducing and spreading plant diseases in the Park. (CALM, CS) [Ongoing]**
6. **Ensure local species are used for landscape and amenity plantings within the Park. If non-local species are required, non-invasive species are to be used. (CALM, CS) [Medium]**
7. **Provide information and interpretive material to the public that:**
   - **promotes an understanding and appreciation of the Park's flora and ecosystems; and**
   - **encourages the planting of local species in areas surrounding the Park.**

   (CALM, CS) [High]

Key performance indicators for flora and vegetation
The success of the strategies will be measured by: 1. Changes in the abundance of selected local wetland flora species. 2. Existence of a weed and rehabilitation plan.
Target: 1. No decline in the abundance of selected local wetland flora species from 2005 levels. 2. Implement the weed and rehabilitation plan.
Reporting: 1. Every 3 years. 2. Every 5 years - completed in 2003, implementation reported in 2007.
Response to target shortfalls: Investigate the cause and report to the Conservation Commission for action.

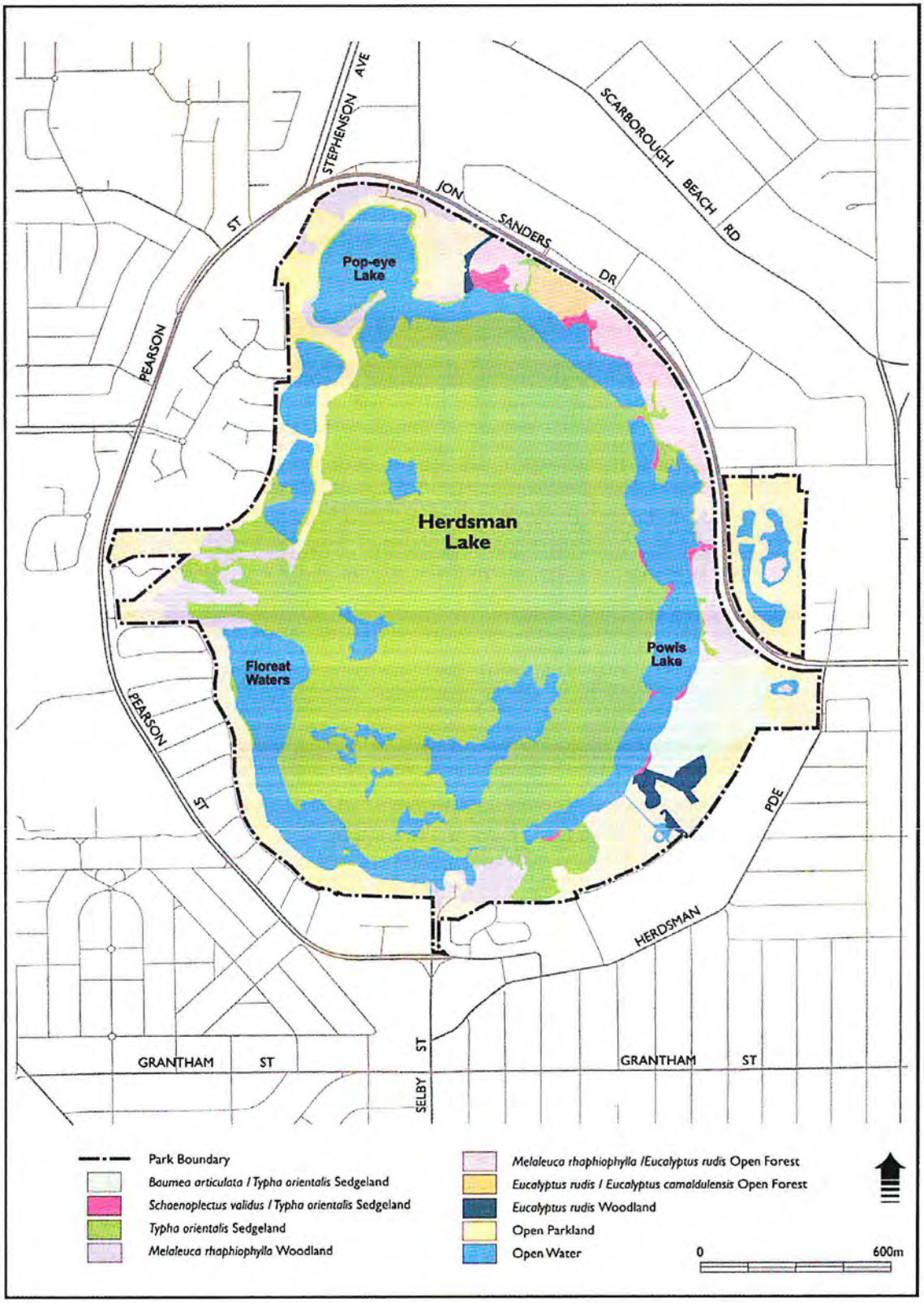

Figure 7 - Park vegetation
(Source: Regeneration Technology, 2002)

17. Fauna

To conserve naturally occurring fauna species in the Park, particularly threatened and priority avian fauna.

The main threats to fauna within the Park are the loss and fragmentation of habitat, which can be attributed to:

- weeds (Section 18);
- wildfire (Section 19);
- changing water levels and water quality (Section 15);
- competition and predation by introduced animals and pets (Section 21); and
- inappropriate recreation activities (Section 26).

Additionally, the loss of native habitat surrounding the Park has impacted significantly on the fauna of the Park. Native animals are killed or injured on the roads servicing the surrounding urban and industrial development. Greenway corridors and other links between the Park and adjoining areas of ecological significance are important to help maintain the diversity and vigour of the Park's ecological systems (Section 25).

AVIAN FAUNA

Avian fauna in the Park has been surveyed by Birds Australia, recording 107 bird species (RAOU - 1996D). The Gould League of Western Australia has also surveyed birds at Herdsman Lake and their records indicate the presence of 162 species since 1929 (pers. comm. P. Reiffer, 2001).

The abundance of bird species recorded at Herdsman Lake results largely from the mosaic of habitats present (Curry, 1981). The important components of the mosaic are:

- deep, open water (approx. 1.5 - 2.5 metres);
- shallow water, seasonally inundated areas (including mud flats and sedge lands);
- grassy banks of drains and the shoreline;
- dense stands of rushes; and
- trees.

The occurrence of particular birds changes according to season. Areas in the central wetland in summer provide habitat for bird species such as white-fronted chats (*Ephthianura albifrons*) and Richard's pipits (*Anthus novaeseelandiae*), while in winter, these areas are covered by deeper water and are used by ducks and other water birds (Maunsell and Partners, 1989).

Two species of birds recorded at the Park, the Australasian bittern (*Botaurus poiciloptilus*) and the peregrine falcon (*Falco peregrinus*), are listed as specially protected under the *Wildlife Conservation Act 1950*.

A number of migratory birds listed under the Japan-Australia Migratory Birds Agreement (JAMBA) and the China-Australia Migratory Birds Agreement (CAMBA) have been sighted at the Park. Australia is a signatory to these two international agreements which support the conservation of migratory birds and their habitats. The intent of the JAMBA and CAMBA migratory bird agreements will be applied in the management of the Park.

Waterbirds

Herdsman Lake contains one of the most varied and easily observed waterbird fauna of any Lake in southwestern Australia. It is also an important breeding site with at least 20 species breeding there, and provides an excellent opportunity to see birds nesting or raising broods (Maunsell and Partners, 1989).

Curry (1981) undertook an extensive survey of birds at Herdsman Lake and found that the Lake is a major breeding area for the black swan (*Cygnus atratus*), purple swamphen (*Porphyrio porphyrio*), little grassbird (*Megalurus gramineus*) and clamorous reed-warblers (*Acrocephalus stentoreus*). It is one of the few wetlands in southwestern Australia where the little bittern (*Ixobrychus minutus*) breed, preferring dense stands of *Typha orientalis*. Particularly visible are the three grebe species - the Australasian grebe (*Tachybaptus novaehollandiae*), hoary-headed grebe (*Poliocephalus poliocephalus*) and great crested grebe (*Podiceps cristatus*) - which construct floating nests on the open water. The Eurasian coot (*Fulica atra*) also breeds in abundance. Three bird species, which are rarely found breeding in the southwest, the blue-billed duck (*Oxyura australis*), hardhead (*Aythya australis*) and the Australasian shoveler (*Anas rhynchotis*) nest at Herdsman Lake. The pink-eared duck (*Malacorhynchus membranaceus*), musk duck (*Biziura lobata*) and dusky moorhen (*Gallinula tenebrosa*) are also present at the Lake. Freckled duck (*Stictonetta naevosa*) occasionally occur at the Lake.

Herdsman Lake is also used regularly by small numbers of freshwater migratory waders such as sharp-tailed sandpipers (*Calidris acuminata*), greenshanks (*Tringa nebularia*), wood sandpiper (*Tringa glareola*) and long-toed stints (*Calidris subminuta*) (Curry, 1981). Long-toed stints are uncommon in the area and their occurrence at Herdsman Lake is significant.

Several Australian waders also occur in the Park and four of them - the black-fronted plover (*Charadrius melanops*); red-kneed dotterel (*Erythrogonys cinctus*); red-capped plover (*Charadrius ruficollis*); and black-winged stilt (*Himantopus himantopus*), have been recorded as breeding at the Lake (Curry, 1981).

From a conservation viewpoint, the occurrence of species such as the buff-banded rail (*Rallus phillippensis*), Baillon's crake (*Porzana pusilla*), Australian spotted crake (*Porzana fluminea*) and spotless crake (*Porzana tabuensis*) is important (Curry, 1981).

Other birds

Grassland areas around the periphery of the Lake, together with sparsely vegetated areas within the central region, are used as hunting grounds by birds of prey. Ten species have been observed, including the black-shouldered kite (*Elanus axillaris*), peregrine falcon (*Falco peregrinus*) and brown goshawk (*Accipiter fasciatus*). The marsh harrier (*Circus aeruginosous*) breeds at Herdsman Lake (Curry, 1981).

Aerial insectivores including the tree martin (*Hirundo nigricans*) and the welcome swallow (*Hirundo neoxena*) are common.

A number of issues threaten the avian fauna and their habitat within the Park. These threats include fire (Section 19), pets and introduced animals (Section 21) as well as forms of intensive recreation activity (Sections 28 and 29). It is also acknowledged that other issues such as weeds (Section 18) are impacting negatively upon the habitat values of the Park. Additionally, the control of water levels at Herdsman Lake is critical to the preservation of habitat (Section 15).

Given the above threatening processes and the potential disturbance to birds during breeding seasons, visitors will be restricted from accessing the central conservation area. Visitor use for the Park will be guided by the Recreation Masterplan (Section 28) and protection of the central wetland area will be increased by finalising the construction of the moat (Section 14), which will in turn further limit access to the central area.

Another threat for the birdlife at Herdsman Lake is human interaction, which is presently concentrated around the fringe of the Lake. Human interaction usually ranges from casual bird observation to hand feeding of birds. It is recognised that the feeding of waterbirds is an activity that members of the public enjoy, especially children and visitors from other areas. Bird feeding has the positive advantage that it brings the public into close contact with populations of native birds in a natural setting and so builds up an appreciation of wildlife and the need for their conservation. There are nevertheless adverse effects including:

- selection in favour of more aggressive species, such as Silver Gulls which are not normally found in large numbers in such wetlands;
- unsightly food scraps in the water and on Lake surrounds; and
- the possibility that large amounts of organic material at feeding sites (from uneaten food and faecal material) may enhance conditions for the development of avian botulism.

For these reasons, the feeding of birds will be discouraged at Herdsman Lake.

Other activities such as model boats and canoeing have also been known to occur in the Park. Although it has been shown that the use of model boats does not significantly interfere with birds, it was found that boats used to retrieve model boats may scare birdlife and disturb their behavioural patterns (Bamford, Davies and Van Delft, 1988).

TERRESTRIAL AND AQUATIC FAUNA

Mammals

No native mammal species are known to regularly occur in the Park. According to White (1984), the western grey kangaroo (*Macropus fuliginosus*), western brush wallaby (*Macropus irma*), common brushtailed possum (*Trichosurus vulpecula*) and quenda (*Isoodon obesulus fusciventer*) have not been sighted at Herdsman Lake since the late 1960s. The loss of these species from the Park can be attributed to the loss of habitat within and surrounding the Park. The Swan Coastal Plain has nine species of insectivorous bats some of which are likely to use the Park for occasional foraging, if not as a permanent home.

Reptiles and Amphibians

There are several reptile species at Herdsman Lake with the mourning skink (*Egernia luctuosa*) considered significant. Numbers of the mourning skink have declined dramatically with the draining and reduction of wetland habitats on the Swan Coastal Plain (Government of Western Australia, 2000).

The long-necked or oblong tortoise (*Chelodina oblonga*) is found in the open water bodies of the Park.

Western tiger snakes (*Notechis scutatus occidentalis*) are common within the Park and are an important species in the Lake's ecosystem. Western tiger snakes are now considered uncommon in the metropolitan area and the isolated population at the Park is important in conservation and evolutionary terms. The presence of this species within the Park should be included in education programmes and interpretive material to help develop an appreciation for wildlife. It is also acknowledged that the presence of the western tiger snake, which is venomous, is a concern to some Park visitors and local residents. It is therefore proposed to provide contact details, within the Park, of wildlife carers and organisations that relocate dangerous or injured fauna.

Eleven species of lizard have been recorded at Herdsman Lake including Gould's sand goanna (*Varanus gouldii*), the marbled gecko (*Christinus marmoratus*) and the bobtail skink (*Tiliqua rugosa*) (Maunsell & Partners, 1989).

Numerous amphibians also inhabit Herdsman Lake. Six frog species have been recorded in the Park including the moaning frog (*Helioporous eyrei*), sandplain froglet (*Crinia insignifera*), Glauert's froglet (*Crinia glauerti*), western bell frog (*Litoria moorei*), slender tree frog (*Litoria adelaidensis*) and the pobblebonk frog (*Limnodynastes dorsalis*) (ESRI, 1983). The replacement of natural habitat with surrounding urban development has markedly reduced the habitat of most amphibian species. Pollutants that also find their way into aquatic systems can cause marked population declines (Government of Western Australia, 2000).

Fish

Of the three species of fish occurring at Herdsman Lake only one, the Swan River goby (*Pseudogobius olorum*) is native. The goldfish carp (*Carassius auratus*) and the mosquito fish (*Gambusia holbrooki*) have been introduced. The latter is an aggressive species introduced from Central America to control

mosquitoes throughout Australia. It has probably contributed to the demise of native fish, amphibians and aquatic invertebrates.

Davis, Halse and Ebell (1987) documented significant fish deaths associated with the spraying for Argentine ants, although the areas have recolonised rapidly. This can have serious implications as fish are an important food source for other Lake fauna, especially waterbirds such as cormorants, grebes, herons and egrets.

Invertebrates

There are no data on terrestrial invertebrates in the Park, but numerous insect species common in the metropolitan region are undoubtedly present. The Argentine ant, an introduced species that has been reported to have a pronounced effect on other ant species and perhaps other invertebrate species, is present (Majer and Flugge, 1984). Past attempts to control this species by pesticides has had considerable, undesirable environmental impacts including a high mortality of other invertebrate species (see Section 20 – Pest Control). Such strategies are no longer conducted at Herdsman Lake.

The aquatic macro-invertebrate fauna of Herdsman Lake was studied as part of a monitoring programme undertaken by Murdoch University in 1986/1987. The *Herdsman Lake Water Quality Study* (Clarke, Davis and Murray, 1990) details results from the monitoring programme.

The variety of species of macro-invertebrate fauna at Herdsman Lake is intermediate when compared with other metropolitan wetlands on the Swan Coastal Plain. The Lake's fauna is lacking in the two largest groups of predatory invertebrates, *Odonata* (dragonflies and damselflies), and *Coleoptera* (beetles) Clarke, Davis and Murray (1990). The number of species of predatory invertebrates recorded at a wetland can be used as an indication of the state of the aquatic food chain (Rolls, Davis, Balla and Bradley, 1990). Additionally, the presence of invertebrates is a useful indicator of wetland health.

It has been suggested that the lack of predatory invertebrates at Herdsman Lake is a result of high pesticide levels within the Lake's waters and sediments. Of the 10 wetlands studied in the Perth metropolitan area by Rolls *et al* (1990), only Lake Monger, which has excessive nutrient enrichment, high pesticide levels and heavy metal pollution had fewer predatory macro-invertebrates.

Strategies

1. **Prepare and implement a programme for fauna management within the Park. The programme will:**
   - **monitor the diversity of naturally occurring avian fauna in the Park;**
   - **identify selected avian fauna species for monitoring;**
   - **identify high conservation value avian fauna habitat;**
   - **specify appropriate management actions for fauna and habitat protection;**
   - **consider ways to minimise wildlife deaths on roads adjoining the Park; and**
   - **compare data with historical records to identify trends.**

   (CALM) [High]

2. **Ensure the management of wetland water levels in the Park takes into consideration waterbird and other fauna habitats and reflects historical regimes of inundation. (CALM, Water Corporation, CS) [High]**

3. **Ensure recreation uses are consistent with the protection and management of fauna, for example prohibiting the use of recreational watercraft in the Park (Section 30). (CALM, CS) [Ongoing]**

4. **Provide interpretive material which:**
   - **promotes an understanding and appreciation of the Park's fauna, particularly waterbirds and the western tiger snake;**
   - **discourages the artificial feeding of birds;**
   - **educates local residents about the effects of the dumping of 'exotic' animals and fish in the wetlands systems;**
   - **supports volunteer groups involved with the Park; and**
   - **informs the public about the adverse impacts of feral animals and domestic pets on native fauna in the Park. (Section 40) (CALM, CS) [High]**

5. **Identify seasonal mowing areas and areas not to be mown to preserve bird, reptilian, marsupial and other fauna habitat and breeding sites. (CALM, CS) [Ongoing]**

6. **Provide the contact details of wildlife carers for the relocation of injured or dangerous fauna where they constitute a significant risk to people. (CALM) [Low]**

Key performance indicators for fauna
The success of these strategies will be measured by: 1. Changes in species diversity of naturally occurring avian fauna. 2. Changes in the abundance of selected naturally occurring avian species. 3. Changes in high conservation value avian habitat. 4. Completion of a fauna management programme.
Target: 1. No decline in species diversity of naturally occurring avian fauna from 2005 levels. 2. No decline in the abundance of selected naturally occurring avian species from 2005 levels. 3. No decline in selected avian fauna habitat from 2005 levels. 4. Fauna management programme completed within 3 years of completion of regional park management plan.

Reporting:
1. Every 3 years (note: seasonal variations).
2. Every 3 years (note: seasonal variations).
3. Every 3 years.
4. Every 5 years - completed by 2006 and implementation reported by 2010.

Response to target shortfalls:
Investigate the cause and report to the Conservation Commission for action.

(Note: monitoring needs to take into account natural variability.)

18. Weeds

The objective is to minimise the impact of environmental weeds on the local plant species and communities in the Park.

Environmental weeds have been defined as plants that establish themselves in natural ecosystems (marine, aquatic and terrestrial) and proceed to modify natural processes, usually adversely, resulting in the decline of the communities they invade (CALM, 1999).

The invasion of weeds is a major threat to the conservation values of the Park and it is vital that measures are introduced to limit or control the degradation processes.

There are many reasons for the presence of weeds in the Park these include:

- past land uses such as clearing and market gardening;
- soil disturbance from vehicle access;
- construction of paths and other facilities or drainage channels which allow weeds to establish;
- frequent fires which promote the growth of weeds;
- drainage outlets that carry stormwater from adjoining areas and promote the spread of aquatic and terrestrial weeds in wetland areas;
- the dumping of aquarium contents in the Lake which can lead to the spread of aquatic weeds;
- the dumping of garden refuse in the Park which introduces many plants that vigorously compete with local vegetation; and
- grasses planted for amenity purposes in parkland settings invading wetland areas.

Another source of weeds, which spread into the Park, is the large stockpile of sand associated with the Floreat Lakes residential development on the northwest boundary of the Park. As discussed in Section 14, discussions lead by the DPI are required to achieve the completion of the residential development allowing the proponent to finalise the moat and utilise the stockpile of sand adjoining the Park in the north-west section.

WEED MANAGEMENT

Guidance for weed management in the Park is provided by CALM *Policy Statement 14 – Weeds on CALM Land, The Environmental Weed Strategy for Western Australia* (CALM, 1999) and the *Herdsman Lake Regional Park Weed Control and Revegetation Plan* (Regeneration Technology, 2002).

The *Herdsman Lake Regional Park Weed Control and Revegetation Plan (2002)* uses the principles of weed control as outlined in *The Environmental Weed Strategy for Western Australia (1999)* for weed control and considers the following priorities:

- recognise weed potential;
- maintain areas of the Park that have vegetation in good condition; and
- control weeds impacting on threatened species and communities.

The *Herdsman Lake Regional Park Weed Control and Revegetation Plan* (Regeneration Technology, 2002) also outlines the most effective methods for controlling priority weed species within the Park.

In accordance with the *Herdsman Lake Regional Park Weed Control and Revegetation Plan* there are a number of priority weed species that are significantly impacting on the ecology and visual amenity of the Park. The weed priority species are bulrush *(Typha orientalis)*, buffalo grass *(Stenotaphrum secundatum)*, pampas grass *(Cortaderia selloana)*, great brome *(Bromus diandrus)*, couch *(Cynodon dactylon)*, perennial veldt grass *(Ehrharta calycina)*, Geraldton carnation weed *(Euphorbia terracina)*, hares tail grass *(Lagurus ovatus)*, rose pelargonium *(Pelargonium capitatum)*, kikuyu grass *(Pennisetum clandestinum)*, black berry nightshade *(Solanum nigrum)*, arum lily *(Zantedeschia aethiopica)*. Visually prominent species (in addition to those listed above) are giant reed *(Arundo donax)*, flame tree *(Erythrina sykesii)*, cape lilac *(Melia azedarach)*, poplars *(Populus alba)*, willow tree *(Salix babylonica)*, and Japanese pepper *(Schinus terebinthifolia)*.

Eucalyptus camaldulensis has been introduced to the Park and is not a naturally occurring species at this location (it only occurs naturally immediately south of Geraldton). It will however, be retained given the habitat values it provides in the Park).

Bulrush (*Typha orientalis*)
Bulrush (*Typha orientalis*) is an aggressive coloniser, especially following disturbance, and is present in most wetlands in the Swan Coastal Plain. The two methods of colonisation, seeding and rhizomal growth, can convert extensive open areas into closed stands of *Typha orientalis* in a matter of years. Seeding is faster with large beds growing where the ground has been cultivated or in areas which have been burned. Seedlings only become established where water levels are low and the substrate dries out. *Typha orientalis* spreads more slowly in permanently inundated areas via rhizomal growth. (Maunsell & Partners, 1989).

The extent of *Typha orientalis* at Herdsman Lake is a direct result of past and continuing disturbances to, and modification of, the Lake's ecosystem. *Typha orientalis* is the most dominant and widespread weed at Herdsman Lake. It stretches across the middle of the lake and along shallow fringes around its perimeter. It poses a significant fire risk, particularly to adjacent native species (e.g. paperbarks) and has the potential to spread to large areas that it currently has not invaded. In many places it

also blocks views to the water (Regeneration Technology 2002).

Typha orientalis does however, perform a number of valuable functions. It provides shelter, nesting sites and is a food source for some avifauna and other wildlife. It also performs a nutrient stripping function, although its nutrient stripping capability is generally inferior to local species that grow in the same environment and are less seasonal in their growth cycle (Regeneration Technology 2002).

Controlling *Typha orientalis* can be demanding on management resources, particularly where it has spread over substantial areas. The control of *Typha orientalis* should target areas that will maximise the benefits of its removal. Its removal needs to be coordinated with the planting or revegetation works, and staged to provide realistic control areas and to help maintain fauna habitat. Creating shaded areas through revegetation and planting will assist in limiting the spread of *Typha orientalis*. An emphasis should be placed on defining practical areas for removal such as discrete wetland areas or drainage sumps (Regeneration Technology 2002).

Given that *Typha orientalis* appears to cohabit and be present in fairly narrow bands of fringing vegetation around the perimeter of the lake, control should target these areas and the wetlands isolated from the main lake (i.e. the less aggressive edge of its occurrences). There are a number of native species, such as *Schoenoplectus validus* and *Baumea articulata* that can successfully replace *Typha orientalis* if it is controlled (Regeneration Technology 2002). Further information on the control of *Typha orientalis* is contained in the *Herdsman Lake Regional Park Weed Control and Revegetation Plan* (Regeneration Technology, 2002).

Typha orientalis rapidly invades and can block newly constructed or cleared drains thus causing maintenance problems. Maintenance programmes should take into account the rapid colonisation of *Typha orientalis* in disturbed areas such as drainage outfalls and viewing platforms.

Community involvement

Weed control can greatly benefit from community involvement. The involvement of the community in volunteer works is critical to the successful implementation of this Plan. Managing agencies have limited resources and weed control can be very labour intensive. The managing agencies acknowledge the considerable efforts by the community in undertaking weed control works within the Park. Volunteer groups have completed weed control projects successfully within the Park for many years.

Members of the community are encouraged to be involved in weed control programs in the Park by establishing or joining community volunteer groups operating within the Park and participating in activities organised by the managing agencies.

Strategies

1. **Implement *Herdsman Lake Regional Park Weed Control and Revegetation Plan*. The plan:**
   - **maps the abundance and distribution of priority weeds, bushland condition and vegetation communities within the Park;**
   - **prioritises weed species according to invasiveness, distribution and environmental impacts;**
   - **specifies appropriate control techniques and timing for removal; and**
   - **includes revegetation strategies (Section 22).**

   (CALM) [High]

2. **Undertake weed control in drains that flow into the Park. (CS, Water Corporation) [Ongoing]**

3. **Set boundaries for grass areas used for recreation and control the spread of grasses outside these areas. (CALM, CS) [High]**

4. **Use interpretive and educational material to inform Park visitors and neighbours about:**
   - **the effects of dumping rubbish and garden refuse in the Park. Park neighbours will be informed that dumping aquarium contents in the local drainage system may lead to the proliferation of aquatic weed problems; and**
   - **invasive plants that pose a threat to the biodiversity of the Park.**

   (CALM, CS) [High]

5. **Encourage and support the community in becoming involved with weed control in the Park. (CALM) [Ongoing]**

Key performance indicators for weeds
The success of these strategies will be measured by: 1. Changes in the abundance and distribution of priority environmental weeds as outlined in the *Herdsman Lake Regional Park Weed Control and Revegetation Plan.* 2. Changes in populations of high priority weeds as identified in the *Environmental Weeds Strategy for Western Australia.* 3. Existence of a weed and rehabilitation plan.
Target: 1. No increase in the abundance and distribution of priority environmental weeds from 2005 levels. 2. No new populations of weed species rated high in the *Environmental Weeds Strategy for Western Australia* over the life of the Plan. 3. Implement the weed and rehabilitation plan.
Reporting: 1. Every 3 years. 2. Every 3 years. 3. Every 5 years - completed in 2003, implementation reported by 2007.
Response to target shortfalls: Investigate the cause and report to the Conservation Commission for action.

19. Fire

The objective is to manage fire for the protection of the Park's biodiversity and natural values as well as the protection of human life and community assets.

Wildfire is a significant threat within Herdsman Lake Regional Park. Wildfires can threaten biodiversity, human life, property and cultural values of the Park. Increased visitor use of the Park is likely to increase the incidence of unplanned fire as is experienced in other bushland areas in the Perth metropolitan area.

In the past, unplanned fires have been a regular occurrence in the Park. The development of surrounding areas and the construction of the moat have lead to a reduction in the frequency of fires. This can probably be attributed to increased site surveillance by local residents.

From a biological viewpoint, fire at Herdsman Lake Regional Park is considered undesirable due to the poor adaptation of wetland vegetation (Halse, 1985). Frequent fires will prevent the establishment of paperbark vegetation and lead to an even greater dominance of *Typha orientalis*.

Of considerable concern are fires in areas of the Park with heavy infestations of *Typha orientalis*. Fires in *Typha orientalis* are difficult to control and can cause severe damage to fringing wetland vegetation. Fire activity encourages the invasion of *Typha orientalis* in wetland areas because it regenerates far quicker than other local rush species. *Typha orientalis* is highly flammable in late summer and early autumn when most of the mature leaves have died. If a fire occurs during this period permanent damage to stands is minimal since the plants are dormant. Indeed *Typha orientalis* will regenerate within 12 to 18 months to a level where it again carries high fuel loads. Poor access to the central area at Herdsman Lake makes fire suppression difficult.

Wildfires that occur in the Park need to be quickly controlled. The Park is within the Gazetted Fire District and the Lead Combat Authority for fire suppression is the Fire Emergency Service Authority (FESA). The Fire Incident Controller is responsible for initiating post fire recovery strategies. Pre-suppression works and post-suppression follow-up works are the land managers' responsibility. When managing fire, CALM is guided by the *Bushfires Act 1954* and *Policy Statement No. 19 Fire Management*. (CALM's Fire Management Policy was under review at the time of writing this Plan, should there be any inconsistencies between this Plan and the revised policy, future management will be in accordance with the new policy).

An important consideration in pre-suppression works and post-suppression follow-up works should be the protection of environmentally sensitive areas. Measures should be initiated to minimise the spread of plant diseases and weeds.

A Fire Response Plan has been developed by CALM in conjunction with FESA and the City of Stirling to help ensure effective response to unplanned fire by the responsible agencies and outlines practices such as:

- fire control actions and strategies that protect environmentally sensitive areas from unplanned fire;
- undertaking pre-suppression activities including reducing fuel loads by mowing or slashing large open grassed areas. Mown or slashed areas should be delineated so that mowing practices do not adversely affect natural regeneration and fauna habitat;
- maintaining a fire record system of all fires in the Park including date and cause; and
- ensuring an effective network of firebreaks is maintained.

Strategies

1. **Implement and periodically update the Park's Fire Response Plan. (CALM, CS) [High]**

2. **Ensure that recreation planning takes into account fire prevention requirements. For example when constructing or upgrading paths in the Park consider building them to a standard that will carry fire control vehicles, so that access is improved for fire management (Section 30). (CALM, CS) [Ongoing]**

3. **Initiate measures in pre-suppression works and post-suppression follow-up works to minimise the spread of plant diseases and weeds in the Park. (CALM, CS) [High]**

4. **Coordinate weed control and rehabilitation works with fire prevention requirements. (CALM, CS). [Ongoing]**

20. Pest Control

The objective is to minimise the adverse effects of insect pest populations in a manner that has least environmental and social impacts.

ARGENTINE ANTS

Herdsman Lake supports a large population of Argentine ants (*Linepithema humile*) and acts as a source of infestation for surrounding land. Argentine ants have been a nuisance to local residents due to their high population density and their highly invasive nature. They have a deleterious effect on native ant and plant species (Majer and Flugge, 1984). Agriculturally they effect a wide range of industries including citrus orchards, vineyards, apiculture (bees), dairy and our export markets (Department of Agriculture, 1988).

Argentine ants were first discovered in Perth in 1941. Their control was centralised under the Health Department from 1949 until 1954 when the State Government initiated an eradication programme using organochlorine insecticides.

The perimeter of Herdsman Lake was sprayed every year between 1957 and 1983. In the past, a variety of

sprays were used at the Lake including dichloro-diphenyl-trichoroethane (DDT), mirexbait, diasinon, endosulphur and chlorpyrifos. Heptachlor replaced dieldrin in 1972, and chlordane was used up until 1973 (Maunsell & Partners, 1989).

The use of heptachlor for Argentine ant control was stopped in 1986 due to the widespread public objection and mortality amongst all invertebrates (Davis, Halse and Ebell, 1987).

In 1988, the EPA reviewed the use of organochlorine insecticides for Argentine ant control and recommended that the broad-scale use of heptachlor for the control of Argentine ants should cease. Due to these findings, the control/containment programme was abandoned (Department of Agriculture, 1988).

Since 1988, no control measures have been undertaken at Herdsman Lake with the control of Argentine ants being the responsibility of individual landholders.

The Social Insect Research Section of the Department of Agriculture has undertaken research into alternative methods of control, including the development of a bait suitable for use against Argentine ants. Any control works undertaken in the Park will need to be undertaken in consultation with CALM.

NON-BITING MIDGES

Herdsman Lake supports large numbers of non-biting midges (*Chironomid* spp.) (Halse, 1985) which at times in the past, have been a nuisance to local residents and visitors to the Park. Research undertaken by Pinder, Trayler and Davis (1991) indicates that midge densities vary in accordance with wetland nutrient levels and that midge problems are a symptom of a disturbed system and an effect of poor water quality. Given there are problems with nutrient enrichment with the dredged water bodies at Herdsman Lake which appear to be intermediate in enrichment (Clarke, Davis and Murray, 1990) it can be expected that midges will continue to be a problem in the Park. Poor water quality (nutrient enrichment) can be attributed to factors such as excessive fertiliser use occurring throughout the catchment of Herdsman Lake (see Section 15).

The nutrient load into Herdsman Lake needs to be substantially reduced to improve water quality within the Lake, which in turn should make the Lake less able to support high midge densities.

The preparation of an integrated catchment management plan plus nutrient reduction measures such as the conversion of stormwater outfalls to incorporate water-sensitive urban design principles, and improvement of fertiliser regimes on grassed areas adjacent to the Park needs to occur (see Section 15).

Community involvement in catchment management plus additional on-ground works to reduce nutrients entering the Lake is the only viable long-term approach to dealing with the midge problem.

A collaborative approach to midge monitoring will be established by CALM and the City of Stirling.

MOSQUITOES

Mosquitoes are present at Herdsman Lake and the City of Stirling monitors numbers and species on a fortnightly basis from October to May each year. Wetlands on the Swan Coastal Plain often require a management response to mosquito populations. It is the City of Stirling's responsibility to manage mosquito issues at Herdsman Lake Regional Park.

Mosquitoes may cause a nuisance to nearby residents and are a public health risk as some species have the potential to transmit diseases such as Ross River Virus. The Health Department of WA administers a mosquito control programme. This programme subsidises mosquito control to Contiguous Local Authority Groups in areas that have been identified as having locally contracted mosquito-borne viruses. The City of Stirling would therefore have to demonstrate known cases of locally contracted mosquito borne disease before qualifying for this assistance.

Strategies

1. **Liaise with the Department of Agriculture in relation to techniques and practices for controlling pests. (CALM) [Ongoing]**

2. **Prepare an integrated catchment management plan for the Herdsman Lake catchment area aimed at reducing the sources of nutrients entering the Lake, thereby reducing the presence of midge swarms (Section 15). (CS, Water Corporation, CALM) [High]**

3. **Encourage the formation of a community catchment group for the Herdsman Lake catchment area. (CS, Water Corporation, CALM) [High]**

4. **Do not use phosphorus-based fertilisers on grassed areas within the Park (Section 15). (CALM, CS) [High]**

5. **Establish a collaborative approach to midge monitoring (CS, CALM) [High]**

6. **Continue to monitor mosquitoes at relevant times of the year and undertake appropriate control practices in accordance with relevant standards. (CS) [Ongoing]**

21. Pets and Introduced Animals

The objective is to minimise the environmental and social impacts of pets and introduced animals in the Park.

PETS

The presence of domesticated animals in, or in close proximity to the Park may impact on the natural environment of the Park.

Domestic animals are not permitted in national parks, conservation parks and nature reserves, however provisions can be made to allow domestic animals in national parks and conservation parks in certain designated areas if they are under control and managed. Domestic animals are not permitted in nature reserves.

Domestic cats hunt for birds, reptiles, and other animals within the Park. Cat owners should be encouraged to keep their cats at home, especially at night and have them de-sexed to help control feral populations.

The City of Stirling has introduced *The Keeping and Control of Cats Local Law 1999*. The objectives of the Law are to:

(a) control the number of cats kept on premises; and
(b) protect native fauna.

The Keeping and Control of Cats Local Law 1999 enables Stirling City Council to declare:

- a Cat Prohibited Area by designating areas on which cats are prohibited from entering or remaining; and
- a Fauna Protection Buffer Zone, which is land extending 200m from the boundary of a Cat Prohibited Area and includes all of the properties within that Buffer Zone. A person shall not keep more than 1 cat on any premises in a Fauna Protection Buffer Zone except in accordance with a valid permit in relation to those premises.

Herdsman Lake Regional Park is considered a principal conservation reserve under this Local Law and as such is a Cat Prohibited Area. As part of implementing this law, the City of Stirling will ensure that all residents within affected areas are suitably advised of their obligations with regard to restriction of cat numbers per household and restriction of cat movement.

Given the Town of Cambridge is within close proximity of the Park, the implementation of a similar Local Law within that municipality is likely to have significant benefits for the native fauna residing and breeding within the Park.

Dog walking is a common activity in the Park and a legitimate activity in certain areas. However appropriate restraint of dogs is necessary if they are not to have an adverse effect on wildlife and activities of other Park visitors.

The City of Stirling is responsible for administering and enforcing the *Dog Act 1976* within its municipality. The Dog Act states –

A dog shall not be in a public place unless it is –

(a) held by a person who is capable of controlling the dog; or
(b) securely tethered for a temporary purpose, by means of a chain, cord, leash or harness of sufficient strength and not exceeding the prescribed length.

A dog is exempt from the above requirements if it is in an area specified by a local government as a Dog Exercise Area.

The *Dog Act 1976* enables local governments to make local laws in relation to dogs. The City of Stirling has established a local law in relation to dogs. Along with other matters, the law establishes Dog Exercise Areas and prohibited areas.

At the time of writing this plan, reserves vested in the Stirling City Council within the Park are classified as Dog Exercise Areas and as such dogs can be exercised without a leash attached. Owners however, must ensure that their dogs are under effective control at all times. The City of Stirling is however, reviewing dog management in all major conservation reserves within its municipality (including Herdsman Lake Regional Park). The City places a high value on wildlife protection in these reserves and dog control is being reviewed to ensure the most appropriate management strategies are adopted.

In relation to the areas of the Park managed by CALM, dogs will only be permitted if they are on a leash and under effective control at all times. Additionally, given the Park's high conservation value and the need to protect native fauna, dogs will not be permitted in areas surrounding the Wildlife Centre (Area 1), in Herdsman Lake itself (Area 12), or other wetlands or water bodies in the Park.

Pet fish should not be disposed of in the Lake, wetland areas or drains flowing into the Park.

The Perth Horse and Pony Club (Inc.) operates within an area in the northeast of the Park. Riding horses will only be considered within this area as it may degrade Park values elsewhere, and may conflict with other Park uses. For further information refer to Section 35.

INTRODUCED ANIMALS

Introduced animals such as mice, European red foxes, feral cats and black rats are present within the Park. All these animals have a detrimental effect on the Park's wildlife and their control and removal will help protect the integrity of the Park.

The presence of introduced and hybrid waterfowl, in particular mallards (*Anas platyrhynchos*), is also a concern to management. It is likely that hybridisation and competition between domestic and native waterfowl is adversely affecting the native species at Herdsman Lake. Introduced and hybridised waterfowl will therefore be removed.

Park visitors will be discouraged from feeding ducks and other birds through educational signs (see Section 17). Artificial feeding encourages greater numbers of birds than can be naturally supported. Uneaten food such as bread also increases nutrients (in already nutrient rich lakes) and decaying bread can also allow botulism to spread in bird populations.

Flocks of chestnut-breasted manikins (*Lonchura castaneothorax*), a northern Australian species, occur around the Park. This species has most likely escaped from aviaries and may compete for habitat and resources with local birds in the Park.

With regard to the removal of introduced animals in the Park, the managing agencies will need to determine the extent and impacts of introduced animals and then, where appropriate, implement control options. CALM will develop and implement a control plan for introduced pests and animals within the Park.

Strategies

1. **Use interpretive material to inform the community about the adverse effects of pets and introduced animals on native fauna. Include information explaining restrictions on pet access and encouraging responsible ownership in interpretive material. (Section 40) (CALM, CS) [High]**

2. **Exclude dogs from areas surrounding the Wildlife Centre (Area 1), Herdsman Lake itself (Area 12) and the wetlands or water bodies of the Park. For all other Park areas ensure dogs are on a leash and under effective control at all times. (CS, CALM) [High]**

3. **Review the current gazetted dog exercise areas within the Park in consultation with CALM and in light of strategies within this Plan. (CS) [High]**

4. **Consider dog excreta bins and dog excreta bags at appropriate sites within the Park. (CALM, CS) [Medium]**

5. **Implement the Cat Control Local Law for areas surrounding the Park. (CS) [Ongoing]**

6. **Develop and implement a pest animal control plan for the Park. (CALM) [High]**

7. **Remove introduced and hybrid avian fauna species from the Park. (CALM) [High]**

22. Rehabilitation

The objective is to restore degraded areas of the Park to a stable condition resembling the natural environment as closely as possible.

Past land uses have caused significant environmental degradation to Herdsman Lake Regional Park. Drainage systems, agriculture, fire, market gardening and surrounding urban development have resulted in severe modifications to vegetation communities and significant weed invasion.

Rehabilitation methods and techniques will vary according to the level of degradation that has occurred, the proposed use of an area and the type of vegetation community to be reinstated.

Where possible, plant material or seed used in rehabilitation works should originate from within the Park or the nearest viable seed source, in order to conserve the genetic integrity of the vegetation communities. It is important that mulch and soil used in rehabilitation works does not contain unwanted weed seeds, pollutants or pathogens (such as *Phytophthora* spp).

Seed collection from within the Park will generally only be permitted for rehabilitation projects within, or directly impacting upon the Park.

Given Herdsman Lake's urban surroundings, an important consideration in Park rehabilitation will be the maintenance of views. Views will be maintained where possible, however the principles of conservation should not be compromised. Lower vegetation types may be used to maintain views over the Lake. Local residents will be informed of significant revegetation works proposed for the Park.

Local residents, community groups and education institutions should be encouraged to be actively involved in rehabilitation works. Rehabilitation activities are to be guided by the *Herdsman Lake Regional Park Weed Control and Revegetation Plan* (Regeneration Technology, 2002).

The rehabilitation plan provides a guide for the long-term restoration of degraded areas within the Park. The plan identifies major disturbance sites within the Park and priorities for their restoration to a condition resembling the natural environment.

Rehabilitation can benefit greatly from community involvement. The involvement of the community in volunteer works is critical to the successful implementation of this Plan. The managing agencies acknowledge the considerable efforts by the community in undertaking rehabilitation works within the Park. Volunteer groups have completed rehabilitation projects successfully within the Park for a number of years.

When undertaking rehabilitation works within the Park, CALM is guided by *Policy Statement No. 10 – Rehabilitation of disturbed land.*

Strategies

1. **Implement the *Herdsman Lake Regional Park Weed Control and Revegetation Plan.* The plan identifies priorities for rehabilitation in the Park. (CALM) [High]**

2. **Coordinate rehabilitation with weed control, fire protection and recreational developments at the planning, design and implementation stages. (CALM) [Ongoing]**

3. **Inform local residents neighbouring the Park when proposing to undertake significant rehabilitation works within the Park. (CALM) [Ongoing]**

4. **Use seed collected from within the Park (where possible) for propagating plants or for direct seeding. Where seed is not available from the Park, other seed should be obtained from local provenance. (CALM) [Ongoing]**

5. **Encourage and support members of the local community including schools to participate in rehabilitation works. (CALM) [Ongoing]**

6. **Ensure mulch and soil used in rehabilitation works does not contain unwanted seeds, pathogens or pollutants. (CALM) [Ongoing]**

7. **Where appropriate, allow licensed seed collection from within the Park for rehabilitation projects within, or directly impacting upon the Park. (CALM) [Ongoing]**

23. Cultural Heritage

The objective is to identify, protect and appropriately manage sites with Aboriginal and non-Aboriginal cultural heritage value within the Park.

ABORIGINAL USE AND ASSOCIATION

Aboriginal people used the resources of *Ngurgenboro* (Herdsman Lake) as they knew it, for at least 5,000 years before European occupation of Western Australia. Similar to other wetlands on the Swan Coastal Plain, the Lake has important spiritual significance. It also provided a source of protein in the form of frogs, tortoises, crustaceans and waterfowl. The stems and roots of various wetland plants, including *yanget* or *cumbungi* (*Typha* species) were a staple supply of carbohydrates (Blyth and Halse, 1986).

A letter by anthropologist Daisy Bates makes reference to an Aboriginal burial at Herdsman Lake. The location of this burial place is unknown, and it has been suggested that it could be "anywhere within a few kilometres of the lake edge" (O'Connor, *et al*, 1989).

Aboriginal Heritage Act 1972

Under the *Aboriginal Heritage Act 1972*, it is an offence to damage, alter or destroy any Aboriginal sites unless written consent has been obtained from the Minister for Indigenous Affairs. This includes sites not yet registered with the Department of Indigenous Affairs.

Sites that have been registered by the Department of Indigenous Affairs within or near Herdsman Lake Regional Park are as follows:

- S02411 - Herdsman Lake;
- S00681 - Herdsman Lake North; and
- S00682 - Herdsman Lake North East.

Native Title Act 1993

The land comprising Herdsman Lake Regional Park is subject to two native title claims. In accordance with the Commonwealth *Native Title Act 1993* future public works constructed on all reserved lands and waters managed by CALM will need to be notified in writing.

Parties that require notification are:

- representative Aboriginal bodies;
- registered native title bodies (corporate) and registered native title claimants for CALM managed land/waters on which the operations are to be carried out.

These parties are to be given the opportunity to comment on the proposed public works. A "public work" includes buildings, structures which are fixtures, roads, bridges, wells, bores and major earthworks. Additionally, notification is required for the preparation of management plans in the same manner as for public works.

NON - ABORIGINAL USE AND ASSOCIATION

White settlers in Western Australia had changed the name of *Ngurgenboro* to Herdsman by 1836 (Thomas *et al.*, 1989). In 1854, a large area of land in the vicinity of the Lake was granted to a group of Benedictine monks and by the 1900s the majority of Herdsman Lake area was owned by the Roman Catholic Church (Blyth and Halse, 1986). At this time, the main land use was grazing of stock.

In 1912, the Osborne Park area was made suitable for market gardening by drainage into Herdsman Lake (Blyth and Halse, 1986). In 1916 the soils of Herdsman Lake were tested for agricultural potential and found to be inferior to those in Osborne Park (MRPA, 1976). Despite this a soldier settlement scheme began in 1920 through purchase of land from the Roman Catholic Church (Blyth and Halse, 1986) which was followed by an ambitious planning scheme to reclaim land from the Lake.

With the introduction of the drainage system for the soldier's settlement scheme, Herdsman Lake became a compensating basin for drainage waters from surrounding areas (Clarke, Davis, Murray, 1990). Drainage work commenced in 1921. An open drain was constructed from Osborne Park to pass through the north western corner of Herdsman Lake and flow, via a three kilometre long tunnel, to the Indian Ocean near Floreat Beach. A system of subsidiary drains, connected to the Osborne Park Main Drain was developed to drain Herdsman Lake itself. Irrigation of the reclaimed Lake was affected by a system of locks on the drains. Drains could be made to overflow into the surrounding lands when irrigation was required (Teakle and Southern, 1937).

The drainage scheme was completed in 1925. The sale of long narrow blocks of land radiating out from the edge of the Lake began in 1928 but the project was never successful (Blyth and Halse, 1986). Unlike adjacent areas, the highly acidic Lake bed peat of Herdsman Lake proved unsuitable for intensive agriculture and the area still flooded in winter (Thomas *et al.*, 1989). This led to a detailed soil survey by Teakle and Southern in 1934 to fully assess the agricultural potential of Herdsman Lake (MRPA, 1976).

Since the 1930s, past uses have included cattle grazing and extensive market gardening. While both of these land uses have been removed from the Park, the pressures of urban development have gradually led to the encroachment of residential and industrial developments upon the Park.

The Stephenson - Hepburn report of 1955 recommended reservation of the Lake area for "Parks and Recreation". This was subsequently implemented in the Perth's1963 MRS (MRPA, 1976).

Following the implementation of the 1976 Concept Plan for Herdsman Lake, several regional roads were developed near the Lake as well as an industrial zone to the north-east and residential developments on the north-west and south-west shores of the Lake. The Concept Plan recognised the value of the natural environment by restricting access to the central wetland area. The concept of creating deep channels with open waters to form a moat around the Lake was initiated to obtain material on which to build new developments as well as to increase the diversity of habitats available to wildlife. Subsequently three deep lakes were formed, known as Floreat Waters, Popeye Lake and Powis Lake, each with shallow extensions to form part of the moat proposed for the whole Lake. To date the moat is still to be completed. Approval was granted by the former State Planning Commission in 1988 for dredging operations to complete the moat surrounding Herdsman Lake (see Section 14).

The main feature of European cultural heritage value in the Park is the Herdsman Lake Settlers Cottage. The cottage which provides an example of an early settlers' cottage and has been acquired and renovated by the National Trust of WA in association with the WAPC (Heritage & Conservation Professionals, 1992). The cottage and the surrounding area (which contains a small vegetable garden and interpretive display) will be vested in the National Trust in accordance with Section 10 – Park Management Zones.

Strategies

1. **Ensure management obligations are fulfilled according to the *Aboriginal Heritage Act 1972* and the *Native Title Act 1993* before any planning or public works take place. (CALM, CS) [Ongoing]**

2. **Research and incorporate information on Aboriginal and non-Aboriginal history of the Park into interpretive material where appropriate (Section 40). (CALM) [High]**

3. **Seek involvement of Aboriginal and historic groups in the management of the Park. (CALM, National Trust) [Ongoing]**

24. Park Aesthetics and Landscape Amenity

The objective is to maintain and enhance the natural and cultural landscape qualities of the Park.

LANDSCAPE DESCRIPTION

The Park lies within the Swan Coastal Plain landscape character type (CALM,1994). The Coastal Plain slopes gently westwards from the Darling Scarp to the Indian Ocean. The Park is located approximately five kilometres from the coast and is part of a chain of wetlands that extends north-south parallel to the coast.

As a series of wetlands, Herdsman Lake, Lake Monger and Jackadder Lake provide strong visual connections to and within surrounding residential suburbs. Herdsman Lake, the predominant landscape feature of the Park, helps define the character of an area formerly known as "The Great Lakes Area" shortly after European settlement (Blyth and Halse 1986).

The Park includes a variety of different landscapes, ranging from "natural" areas to highly modified, developed parkland areas. This variety of landscapes is in contrast to the surrounding urban development and increases the Park's aesthetic value.

Human intervention has had significant impacts upon Herdsman Lake Regional Park and its surrounds. Firstly, the Park is surrounded by urban development which has isolated Herdsman Lake from nearby wetland areas. Secondly, the Park's natural landscapes have been modified by the dredging of open water bodies (Powis Lake, Popeye Lake and Floreat Waters), the construction of reticulated open parkland, the removal of Lake fringing vegetation and the introduction of *Typha orientalis*. Other infrastructure and facility developments include car parks, recreation facilities, board walks, built structures, signs, and drainage infrastructure.

LANDSCAPE QUALITY

The Park landscape encompasses areas which can be described as high, medium or low visual quality. These categories can be mapped using CALM's Visual Management System, 1989. Once mapped, any modifications within and adjacent to the Park can be assessed according to the visual quality rating and the ability of the landscape to incorporate the proposed change.

There are many areas of high scenic quality, most of which occur around the wetlands and open water bodies of Herdsman Lake.

A modified landscape is not always considered to be of low scenic quality. Areas of high scenic quality can include well-maintained parkland, areas fronting on to water elements and areas with extensive views that are enjoyed and appreciated by visitors. Having a natural or parkland foreground with a backdrop of Perth's central business district skyline can also contribute to high visual quality. The Park contains all of these features.

Areas of low visual quality include large cleared areas, highly disturbed areas (with dumped rubbish or weed infestation), built structures such as drainage outlets, views into adjoining houses, power lines and other utilities. These structures detract from the enjoyment of the lakeside environment and require upgrading, replacement, removal or screening to contribute positively to Park amenity. Provision of adequate shade is also an issue that has a major impact on the quality of visitor experience and landscape amenity.

LANDSCAPE CHARACTER

Maintaining or enhancing the natural and cultural landscapes of the Park are integral components of the effective management of the Park. While this means protecting natural areas, in other areas it may involve upgrading modified landscapes. Rehabilitation works should use local plant species grown from locally collected seed or from the nearest viable seed source. The re-created landscape should resemble the character of the original landscape. It is important that the ambience of the wetland is retained even if the area is going to be used intensively. View corridors incorporating the use of low vegetation should be considered in rehabilitation planning (Section 22). In grassed areas, a substantial part of the shoreline should be planted with local riparian vegetation. Local riparian vegetation would not impede the view of the water and would add to the "natural" appearance of the area, as well as provide habitat for birds and trap nutrients.

The strategy of planting only local plants within the Park will not apply to areas surrounding the Herdsman Lake Settlers Cottage. Non-local species that reinforce the historical character of the cottage will be allowed, provided they are not invasive.

Strategies

1. **Classify landscape features in the Park according to CALM's Visual Management System in order to assess the form and location of all facilities and services within the Park. (CALM, CS) [Low]**

2. **Identify and protect important landscapes within the Park. (CALM, CS) [Low]**

3. **Ensure recreation facilities and park furniture are of a high standard and suited to the surrounding landscape. Facility provision should be planned and agreed to by the joint managers of the Park. (CALM, CS) [Ongoing]**

4. **Ensure that new infrastructure and developments within or adjacent to the Park are designed to minimise impacts on visual quality and include a landscape plan demonstrating integration with the surrounding area. Liaise with Western Power, Water Corporation and other infrastructure providers before works are carried out in the Park. (CALM, CS) [Ongoing]**

5. **Identify sites of low visual quality (e.g. drainage outlets, degraded and weed infested areas) and undertake appropriate remedial action. (CALM, CS, Water Corporation) [Low]**

6. **Consider view corridors when undertaking rehabilitation works within the Park. (CALM) [Ongoing]**

25. Greenway Corridors and Links

The objectives are to manage Herdsman Lake Regional Park consistently with Greenway principles and to encourage appropriate management of corridors and links between the Park and other conservation or recreation areas.

Greenways is a generic term that has been applied to a wide range of landscape planning strategies, concepts and plans (Tingay and Associates, 1998). It has been defined as "networks of land containing linear elements that are planned, designed and managed for multiple purposes including ecological, recreational, cultural, aesthetic, or other purposes compatible with the concept of sustainable use" (Ahern, 1995).

Herdsman Lake Regional Park is surrounded by urban and industrial development, which isolates it from other areas of open space. Due to the intensity and close proximity of development, the Park is vulnerable to the pressures of adjacent land uses. It is therefore important that greenway links between the Park and adjoining areas of open space are maintained and further enhanced where necessary.

Major roads limit linkages within the Park and between other wetland areas. For example, Jon Sanders Drive divides Glendalough Open Space and the remainder of the Park.

On a regional scale, there are a number of "green" areas within close proximity to the Park. To the east is Lake Monger, to the north is Lake Gwelup, and to the south-west are the Churchlands campus of Edith Cowan University, Wembley Golf Complex and Bold Park.

A study of Perth's Greenways (1998) has identified a number of proposed corridors including and surrounding Herdsman Lake Regional Park. These are illustrated in Figure 8 and are as follows:

Link Number	Link Name
9	Mitchell Freeway / Railway
18	Herdsman Lake – Bold Park
23	Herdsman Lake – Lake Gwelup
30	Herdsman Lake – Lake Monger – Freeway – Wanneroo Road

(Tingay and Associates, 1998)

Figure 8 - Greenway Corridors and Links

Source: Tingay and Associates, 1998

In addition to the corridors outlined above, it may be possible to extend the Herdsman Lake – Bold Park greenway to include Lake Claremont, Cottesloe Golf Course and Allen Park.

The use of local plants in landscaping road reserves together with purpose-designed animal underpasses and overpasses as well as fauna warning signs can assist to minimise the impact of major roads on the movement of fauna.

The type of interface between the Park and adjoining land uses plays a major role in insulating or exposing (as the case may be) the Park to undesirable impacts. The spread of invasive weed species into the Park can be reduced by providing educational information to local residents about the proliferation of weeds from adjoining properties and by the planting of local species in existing areas. Managing agencies should liaise with the landowners of proposed Greenways near the Park

to develop a coordinated approach to their management.

Strategies

1. **Liaise with the landowners involved with proposed Greenways near the Park to develop a coordinated and complementary approach to the management. (CALM, CS) [Medium]**

2. **Develop a list of Park compatible plants to be provided to Park neighbours and the City of Stirling. Discourage the planting of invasive introduced plants near the Park. (CALM, CS) [Medium]**

3. **Encourage providers of transport and power services to adopt "wildlife friendly" design, management and maintenance practices. (CALM, CS) [Medium]**

D. RECREATION

26. Recreation Goal and Guiding Principles

RECREATION GOAL

Provide for a range of quality recreation and tourism opportunities in a manner that minimises conflict between visitors, and is consistent with other management objectives and Park values.

RECREATION GUIDING PRINCIPLES

1. Preservation of the Values of the Land Itself
Natural systems (including landscapes, natural processes, the ecosystems of particular sites and biota) should be able to sustain the recreation that is occurring or proposed. Recreation should be focused in public use areas of the Park. The intensity of recreational activities may need to be controlled to ensure it does not destroy the value and nature of the activity.

2. Recreation Opportunities
A range of recreation opportunities should be provided for in a local and regional context thereby providing Park visitors with a choice of recreation activities and experiences which enhance the values of the Park. The Recreation Opportunity Spectrum (ROS) is a planning tool that enables managers to provide for the greatest possible range of opportunities in a given area, while limiting unintended incremental development (Stankey and Wood 1982). Principles of the ROS have been utilised in developing the Recreation Masterplan (Figure 9 – page 41).

3. Consistency of Recreation with Reserve Purpose
Recreational activities must be compatible with the assigned purpose and management zoning of reserves within the Park. Reserves within the Park will be assigned an appropriate purpose for the protection and enhancement of Park values under the *Land Administration Act 1997.*

4. Equity
A range of activities consistent with a reserve's purpose should be allowed in the Park. However, uses that impair other forms of acceptable use or jeopardise the safety of other visitors should be specifically managed, directed to more appropriate places or not permitted. Priority will be given to activities that increase awareness, appreciation and understanding of the natural environment.

5. Management
Activities and facilities must comply with the managing agencies' requirements. If effective management of recreational activities or facilities cannot be provided they should be restricted, relocated or removed from the Park.

Strategy

1. **Apply the above principles as required in managing recreation in the Park. (CALM, CS) [Ongoing]**

27. Visitor Use

The objective is to ensure that the level and type of visitor use are sustainable and minimise conflict with other Park visitors and values.

Surveys have been carried out into recreation use of the Park by Barnes (1998) and Colmar Brunton (2001). The information presented in these reports provides a basis for understanding visitor requirements and demand in the Park.

Barnes (1998) identified that most visitors to the Park are local residents who use it for recreational purposes such as walking, exercising the dog, enjoying the scenery, cycling, picnic and playground use. At Maurice Hamer Park, for example, more than 75% of the people surveyed walked to the Park and over 35% visited the Park daily.

Another visitor survey was undertaken by Colmar Brunton in 2001 aimed to quantify the number of visitors to specified Park areas as well as qualify the attitudes and satisfaction of Park visitors. Colmar Brunton (2001) listed a number of recreational activities that are popular at the Park, including:

- walking;
- exercising/fitness;
- birdwatching/observing wildlife;
- riding bikes;
- using the play equipment;
- walking the dog;
- picnicking; and
- fun and relaxation;

Two sites were surveyed by Colmar Brunton:
1. Maurice Hamer Park; and
2. Popeye Lake Park.

An estimated 85,000 visits to Maurice Hamer Park occur annually, and walking is by far the dominant recreational activity. Bike riding, jogging and walking the dog were also popular activities. At Popeye Lake Park, visitor numbers were lower and it was estimated that 22,500 visits occurred per year (Colmar Brunton, 2001).

In relation to visitor use, 71% of visitors to Maurice Hamer Park lived locally with 13% living within the Perth metropolitan area. Only 10% of the visits to the location used vehicles to access the Park, with the majority (67%) either walking or jogging to the Park. In comparison, at Popeye Lake Park, only 45% of visitors to the area lived locally with most people (53%) travelling from other areas of metropolitan Perth to visit the location. The most popular mode of access to Popeye Lake Park was by private vehicle (72%); only 26% of visits accessed the area by foot.

The majority of Park users surveyed by Colmar Brunton (2001) visited the Park daily at Maurice Hamer Park, and weekly at Popeye Lake Park. Averaged over both sites, approximately 80% of users were repeat visitors, and the majority of visits were between 30 minutes to 1 hour in duration.

The estimated total number of visits to the areas managed by CALM within Herdsman Lake Regional Park is over 153,000 per year (Colmar Brunton, 2001). This does not include the visits to recreation areas managed by the City of Stirling such as Perth Horse and Pony Club and the tennis court area near Jon Sanders Drive.

The Herdsman Lake Wildlife Visitor Centre is also a popular destination within the Park. The Gould League in conjunction with the Education Department organises environmental and educational programmes at the Centre which attract large numbers of school groups throughout the year. The Gould League estimates that approximately 8,000 students from 300 schools visit the Centre per annum with an additional 2,000 visitors attending environmental education programmes including bird walks, FrogFest, the Freshwater Festival and other community forums (Harris, R. pers. comm., 2003).

Observation and community input also suggest that the natural features, serenity and abundant wildlife attract visitors to the Park. Additionally, workers from the nearby Herdsman Industrial Area frequent the Park at lunchtime.

Strategy

1. **Prepare and implement a visitor survey programme to gain an understanding of visitor use, numbers and satisfaction within the Park. Use CALM's VISTAT as a basis for the programme. Following the survey take appropriate action where necessary. (CALM) [High]**

Key performance indicators for visitor use
The success of these strategies will be measured by: 1. Changes in visitor numbers and satisfaction levels. 2. Provision of formalised access in the Park (Section 28 – Recreation Masterplan). 3. Completion of a visitor survey programme.
Target: 1. No decline in visitor satisfaction from 2005 levels. 2. Complete access and circulation components of recreation masterplan within ten years of completion of regional park management plan. 3. Visitor survey programme completed within two years of completion of regional park management plan.
Reporting: 1. Every 3 years. 2. Every 5 years. 3. Every 5 years - completed by 2005 and implementation reported by 2009.
Response to target shortfalls: Investigate the cause and report to the Conservation Commission for action.

28. Recreation Masterplan

A Recreation Masterplan will help ensure that a variety of recreation opportunities are offered in the Park and that they will complement those offered in surrounding areas such as Jackadder Lake and Lake Monger.

A Recreation and Interpretation Plan for Herdsman Lake Regional Park was developed by Tooby and Associates (1984). Considering the changes that have occurred to the Park, the increase in surrounding residential development and different management requirements, this plan has since been revised.

The revised Masterplan will coordinate recreation developments within the Park and will allocate appropriate facilities and services to those areas of the Park best able to accommodate them in a sustainable manner.

The Masterplan reflects the management zones and land uses described in Section 10 of this Plan. The four management zones (Conservation, Natural Environment Use, Recreation, Subject to Further Planning) provide a guide to acceptable facilities and uses at a given site. The Recreation Masterplan considers access, internal circulation and the type of facilities to be provided within the Park.

The wetlands areas of Herdsman Lake Regional Park, managed for Conservation and Protection will have access limited to boardwalks on the periphery of the Lake with the emphasis being on the enjoyment of nature. The Natural Environment Use areas will have greater access with the emphasis on passive uses, education and interpretation. Provision of some facilities within these areas is anticipated. The designated Recreation areas will be the most intensively used and modified sections of the Park. The emphasis

will be on providing well-designed recreation areas without detracting from the natural and cultural values of the Park.

Strategies

1. **Implement the Recreation Masterplan that allocates appropriate facilities and services to those areas of the Park best able to accommodate them in a sustainable manner. Priority will be placed on developing appropriate access in the Park. (CALM, CS) [High]**

29. Recreation Sites and Facilities

The objective is to provide and manage a range of quality recreation sites and facilities that allow for a diversity of recreation opportunities without conflicting with other Park values.

Although the Herdsman Lake Regional Park provides for a range of recreation opportunities, of particular significance is the opportunity to recreate in a natural environment within an urban area. Maintaining this experience will be a key consideration in providing for recreation sites and facilities within the Park as it is this experience that attracts many people to the Park.

In the past there has been limited direction for the coordinated development of recreation sites within the Park. This has lead to a proliferation of facilities in the Park some of which are poorly located, while others could be considered inappropriate or surplus to demand. Conversely, there are areas in the Park that could sustain greater public use provided appropriate facilities are developed (refer to the Recreation Masterplan, Figure 9).

Site Plans

Two site plans will be prepared, one for Popeye Lake Parkland and the other for the area surrounding the Herdsman Lake Wildlife Centre providing more detailed direction for the development of each site. The site plans are discussed below.

Popeye Lake Parkland

The site plan for Popeye Lake Parkland will focus on upgrading existing facilities such as the play equipment and pedestrian and cyclist access. The potential for new facilities such as a café or kiosk with associated toilets may exist however, priority will be placed on improving existing passive recreation facilities.

Herdsman Lake Wildlife Centre

The site plan for the area surrounding the Wildlife Centre will concentrate on improving vehicle access, car parking and the prominence of the Wildlife Centre. Currently the site is difficult to access with the configuration of the intersection at Selby Street and Pearson Street and car parking is sub-standard. Improved pedestrian access is also an important consideration for the site.

There is also potential to redevelop the Wildlife Centre with improved visitor interpretive facilities, promoting awareness of the Park for local, regional and international visitors. Capacity also exists to enhance the Centre's current environmental education programmes with the opportunity for the Centre to be further developed for research purposes aimed at attracting primary, secondary and tertiary students, as well as the broader community.

Strategies

1. **Prepare site development plans for Popeye Lake Parkland and the Herdsman Lake Wildlife Centre. The plans will be prepared in consultation with the community and other key stakeholders. (CALM) [Ongoing]**

2. **Ensure all recreation facilities in the Park are safe and constructed in accordance with Australian standards. (CALM, CS) [Ongoing]**

3. **Develop facilities and structures in a manner that is sympathetic to the surrounding landscape. (CALM, CS) [Ongoing]**

4. **Where appropriate make adequate shade provisions at recreation sites and facilities. (CALM, CS) [Ongoing]**

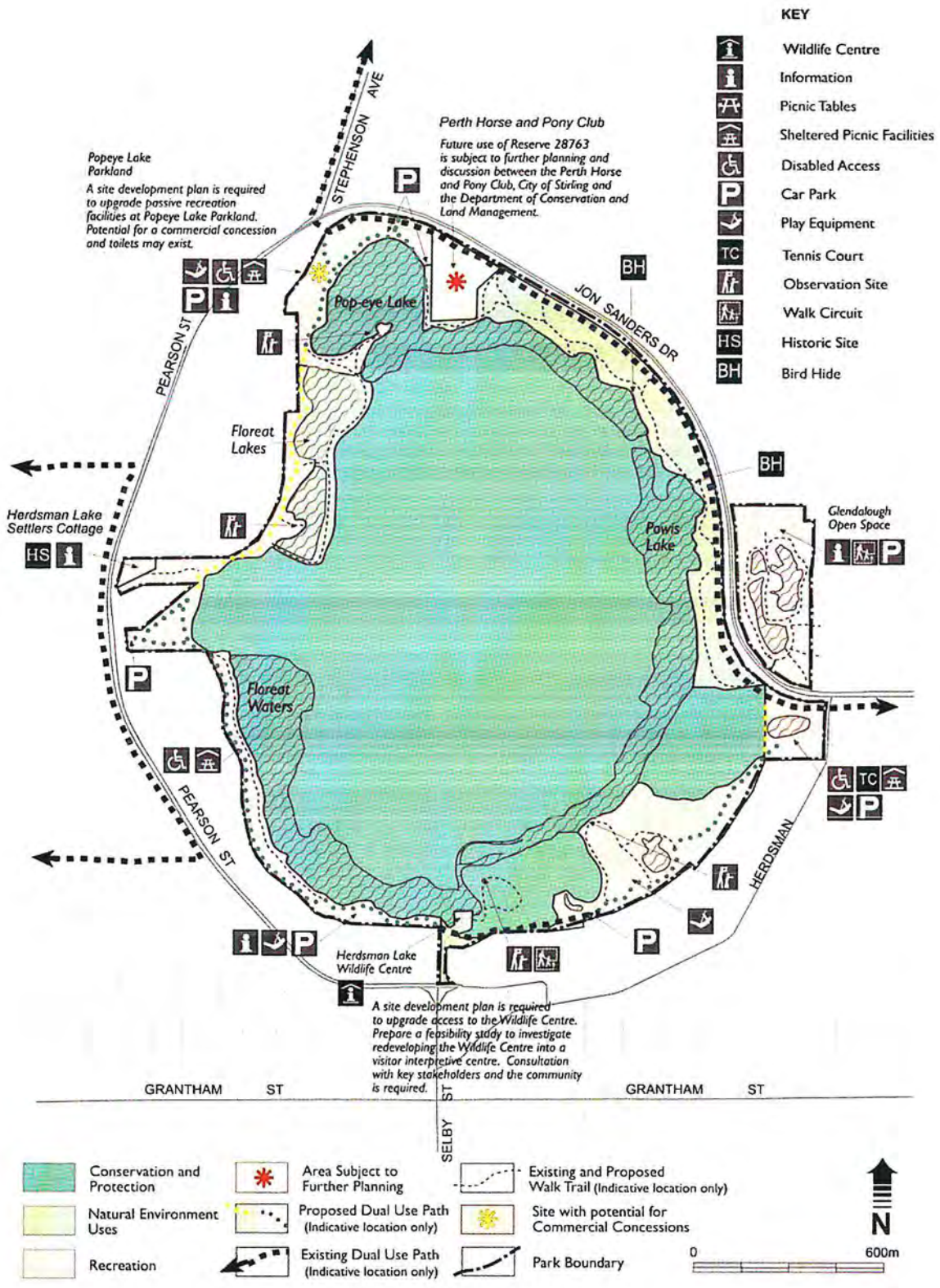

Figure 9 - Recreation Masterplan

30. Park Access and Circulation

The objective is to provide safe, convenient and structured access to and within the Park that is consistent with Park values.

Having a large park surrounded by urban development means that access is a major issue. While access for recreation and education is a legitimate use within the Park, uncontrolled vehicle and pedestrian access has degraded some areas and is a major issue for the managing agencies. Uncontrolled access also enables the dumping of rubbish and garden refuse which is presently a problem.

Park access and circulation are key components of the Recreation Masterplan (see Figure 9 – page 41).

Road Access

The Park is serviced by a comprehensive road network system with a number of major roads passing within close proximity to the Park, including the Mitchell Freeway to the east.

Direct access to the Park is via a number of suburban streets including Jon Sanders Drive, Herdsman Parade, Flynn Street and Pearson Street. Jon Sanders Drive divides the Park in the east separating Glendalough Open Space from Herdsman Lake.

TransPerth operates a number of bus services to areas surrounding the Park. Buses stopping along Pearson Street provide access to the Park.

Car Parking

The provision of adequate car parking will help prevent the undesirable effects of uncontrolled parking and access. Existing car parking is available at the following nine locations: the Wildlife Centre, Moondine Drive Parkland, Herdsman Lake Tennis Courts, Perth Horse and Pony Club, Popeye Lake Park, The Lane, Maurice Hamer Park (north), Maurice Hamer Park (south), and Glendalough Open Space.

A key issue for the managing agencies to address is the appropriateness of car parking in the Park. While it is anticipated that no further car parks will be required in the Park, it should be recognised that a number of car parks may need to be redesigned or access controlled after hours to help reduce vandalism. For example the car parks at the Wildlife Centre and The Lane may be redesigned to meet Australian design standards or to increase their capacity.

It is suggested that the car park in the northern portion of Maurice Hamer Park be removed as it does not conform to appropriate Australian design standards and the majority of visitors to this location are local residents and on-street parking is considered sufficient.

Car parking in the Park will be reviewed during the term of this Plan to ensure it is appropriate. The closure of car parks at night will also be considered in an effort to reduce sporadic vandalism.

Cycle and Pedestrian Access

Local residents access the Park by cycling and walking. Quiet suburban streets surrounding the Park provide good walking and cycling environments. A dual use pathway (DUP) borders the Park to the north and east along Jon Sanders Drive.

Paths provide access throughout the Park with the exception in the northwest where the path system is incomplete as the area is still under private ownership. Paths are generally constructed of crushed limestone with many being less than two metres in width. Although pedestrian access around the Park is adequate during most times of the year, during winter sections of the path system become inundated after heavy rain.

It is planned to upgrade the path system in the Park to improve access for both pedestrians and cyclists. This will be achieved by developing a DUP around the Park. Where possible, separate pathways for pedestrian and cyclists will be provided in order to avoid the dangers of combined use on the DUP (see Figure 9 – Recreation Masterplan).

Access to Herdsman Lake will be restricted to the boardwalks on the periphery of the waterbody, as illustrated in the Recreation Masterplan. All other access to the wetlands and waterbodies in the Park will be prohibited unless it is for monitoring, research, education or managerial purposes.

Access for All

The condition of path surfaces within the Park is poor in sections and inhibits access for people with disabilities. Where required, path surfaces will be upgraded to allow for improved disabled access. Appropriate pathways and ramps will need to be provided to allow those with disabilities to experience the diverse settings within the Park. All paths within the Park will be designed in accordance with Australian standards.

Private Vehicle and Motorbike Access

The illegal driving of vehicles on pathways, grass areas and other recreation areas is a management issue. Private vehicle access will be restricted to designated parking areas and access roads. Access outside these areas may endanger other Park visitors, cause damage to the landscape and adversely affect wildlife.

Model Boat, Boat and Canoe Access

Unauthorised watercraft will be prohibited from accessing the wetlands and water bodies of the Park. The use of motorised and non-motorised recreation and tourism watercraft (such as boats and canoes) is considered inappropriate within the Park given the

potential adverse impacts on native fauna and wetland vegetation.

Watercraft used for educational, research or monitoring purposes may be permitted with the expressed permission of the relevant managing agencies. Additionally, watercraft used for management purposes will be permitted.

A study on model boat activity on Herdsman Lake was undertaken by Birds Australia to determine the impact of this activity on birdlife. The study found that the activity of the WA Model Boat Club was not detrimental to waterbirds (Bamford *et al*, 1988). However, the retrieval of boats had the potential to disturb bird-breeding sites. The use of model boats is therefore prohibited.

Access for Maintenance Vehicles
Boundary access for maintenance vehicles is provided at many points throughout the Park. Vehicle use within the Park must be justified and appropriately controlled. Where possible, maintenance vehicles should use existing pathways.

Horses and other Animals
Riding horses and other animals in the Park could create conflict with the Park's values and its users. Riding of horses will only be considered at the Perth Horse and Pony Club located in the northeast of the Park.

Future use of the Perth Horse and Pony Club site is subject to further discussions between the Perth Horse and Pony Club (Inc.), the City of Stirling as the agency that currently manages the area and owns the improvements (clubhouse and storage sheds) on-site and CALM (see Section 35).

Strategies

1. **Implement the Recreation Masterplan (Figure 9). The Masterplan will:**
   - **coordinate access and circulation allowing visitors to move safely and conveniently throughout the Park. Park access should be integrated with surrounding community and regional path networks;**
   - **provide appropriate recreation facilities and services;**
   - **provide adequate parking facilities at major recreation nodes;**
   - **provide sensitively located and designed shoreline access to the Lake (e.g. boardwalks and viewing platforms);**
   - **help restrict private vehicles to designated car parks and access roads.**

   (CALM, CS) [High]

2. **Prohibit unauthorised watercraft from accessing the wetlands and water bodies of the Park. Watercraft used for educational, research, monitoring or managerial purposes may be permitted for use within the Park. (CALM) [High]**

3. **Consider the needs of disabled people when designing recreation facilities within the Park. (CALM, CS) [Ongoing]**

4. **Provide for emergency response within the Park and ensure the path system allow for emergency vehicle access in appropriate areas (Section 30). (CALM, CS) [Medium]**

5. **Review car parking facilities within the term of this Plan to ensure they are appropriate. (CALM, CS) [Ongoing]**

6. **Consider the closure of car parks at night to reduce vandalism. (CALM, CS) [Ongoing]**

7. **Restrict private vehicles, trail bikes and motorbikes to designated parking areas and access roads. (CALM, CS) [Ongoing]**

8. **Prohibit the riding of horses or other animals outside of the Perth Horse and Pony Club site. Future use of the Perth Horse and Pony Club site is subject to further planning. (CS, Perth Horse and Pony Club, CALM) [Ongoing]**

31. Signs

The objective is to provide a system of signs that communicates the location of the Park features, provides orientation assistance, identifies hazards, leads to appropriate use of the recreation areas and helps communicate information about the Park.

Signs play an important role, both notifying Park visitors about the way in which the Park can be accessed and used, as well as communicating information about the Park's identity and values. Signs need to be designed to provide messages about the Park in a consistent way and without compromising the quality of the area in which they are sited.

Sign System
CALM has developed a sign system for Perth's regional parks to help ensure signs are designed and located appropriately. The regional parks' sign system is a sub-system of CALM corporate sign manual.

The regional parks' sign system includes detailed design specifications for all signs provided in the Park. It aims to introduce a suite of signs that are of a high standard, are robust and have a consistent and contemporary style. The sign system includes directional and

orientation signs, management signs, risk warning signs and interpretive signs. The sign system also includes a brand image or logo for each park. The Herdsman Lake Regional Park brand image will be used on a number of sign types to enhance public recognition of the Park.

The City of Stirling will be encouraged to adopt the regional parks' sign system for signs in areas of the Park under their control.

Sign Plan
The sign system will be implemented at Herdsman Lake Regional Park according to a park-specific plan. The sign plan will direct the placement of signs within the Park to optimise the effectiveness of signs and ensure that an appropriate level of visitor information is provided.

Strategies

1. **Use the regional park sign system as the standard for signs in the Park. (CALM, CS) [High]**

2. **Implement the Park sign plan to direct the placement of directional, management and interpretive signs within the Park. (CALM, CS) [High]**

3. **Liaise with other authorities that have jurisdiction within the Park to ensure consistency of signs within the Park. (CALM, CS) [Ongoing]**

32. Visitor Safety

The objective is to take all reasonable and practicable steps to ensure the safety of visitors in the Park.

There is always an element of risk in outdoor recreation activities. Nevertheless, all reasonable and practicable efforts will be taken to minimise risks to visitors.

Visitor safety will be promoted through information and education about potential problems and dangers. Visitor safety will also be an integral component in undertaking works programmes and capital developments within the Park. Recreation facilities and amenities for visitors will be developed and maintained in accordance with relevant Australian Design Standards. Management actions to reduce safety hazards should, if possible, be consistent with the values of the Park and should not intrude unduly on the experience of visitors.

When managing risk, CALM is guided by *Policy Statement No.53 - Visitor Risk Management.*

Strategies

1. **Implement a Visitor Risk Management Programme to manage and monitor all known risks in the Park. (CALM, CS) [High]**

2. **Ensure visitor safety is an integral component of works programmes and capital developments within the Park. (CALM, CS) [Ongoing]**

3. **Provide information to visitors that highlight potentially hazardous areas and activities, as well as appropriate preventative actions and emergency procedures. (Section 40). (CALM, CS) [Medium]**

33. Utilities and Park Services

The objective is to provide cost effective, efficient and safe services and utilities within the Park in a manner that minimises environmental impact.

SERVICES

Services such as electricity, water, sewer and telephone are available at locations within the Park. Future recreational, commercial, educational or managerial facilities within the Park may require services at additional locations within the Park.

STORM WATER OUTLETS AND DRAINAGE FACILITIES

The Water Corporation manages the main drains and branch drains leading into and located within Herdsman Lake. The City of Stirling manages the local drainage system within and entering the Lake.

There are numerous stormwater outlets and drainage facilities within the Park (see Figure 10 – page 46). The two main issues associated with drainage facilities are:

- ecological impacts (Section 15 - The Lake and Wetlands, Section 16 – Flora and Vegetation, and Section 18 - Weeds); and
- aesthetic and visual impacts (Section 24 - Landscape Amenity).

The ecological impacts associated with stormwater drainage can be reduced and requires co-operation between the land managers, land use planning agencies and drainage infrastructure providers. The management of stormwater entering the Park's wetlands is a catchment wide issue, and controls need to be implemented at that level. No additional outfalls or connection of any newly constructed drain networks to existing outfalls are considered appropriate. Existing stormwater outfalls will be reviewed to assess the viability of improving water quality entering the Park.

Many outlets are unattractive and more attention to detail is necessary so that they blend with their natural surroundings. Consideration should be given to their appearance and function by battering back walls and

planting the sides with local vegetation. This would have the effect of improving existing outlets and may assist in stripping nutrients from storm water before it reaches the lake. Together with modifications to their alignment these treatments should lead to utilities that remain functional and yet merge into their surroundings.

It should be noted, that although the vegetated and unlined drains located throughout the Lake help improve the water quality by stripping nutrients and allowing settlement of silt, the precipitation of inorganic contaminants and degradation of organic contaminants from the runoff water can impede water flow and become stagnant and malodorous. It is therefore important that the Water Corporation and the City of Stirling review and monitor the drains within the Park to for improving (or at least not further degrading) the quality of water in the Park.

It is also important that any infestation of aquatic weeds in drains entering the Park is managed to reduce the threat to the wetland ecosystems.

PARK MAINTENANCE

Regular maintenance is required to provide a safe and pleasant environment for visitors to the Park. Maintenance activities need to be undertaken in a manner that does not impact upon the conservation values of the Park. Maintenance programmes need to be strictly implemented to ensure activities such as mowing do not encroach into conservation areas. In addition, management access points within the Park need to be controlled in order to prevent inappropriate vehicle access.

TOILETS

It is not planned to develop any stand-alone toilet blocks within the Park. Public toilet facilities would only be considered as part of major capital improvements in the Park, for example, at a café or kiosk (see Section 29 – Recreation Sites and Facilities).

Should new toilets be considered as part of major capital improvements, they are to be connected to sewer outlets or other environmentally acceptable disposal systems. The use of septic tanks is to be avoided except in conjunction with alternative treatment units.

RUBBISH COLLECTION

The provision of rubbish bins should be minimised and visitors encouraged to take their rubbish home. Managing agencies will determine the location of bins and collection arrangements.

ROADS

Roads will only be constructed in the Park if they are for recreation or management purposes only. Where possible, facilities should be located close to existing car parks or near the Park boundary to reduce the need to place roads within the Park. Management vehicles should, where possible, use paths to limit the need for additional roads and to minimise the impact on the natural environment.

Future road plans for the area around Herdsman Lake indicate that Stephenson Avenue will be aligned along the north-west boundary of the Park parallel to Pearson Street. This is a part of the State Government's plan for a major arterial roads network in the Perth metropolitan area.

POWER LINES

To minimise the visual impact of power supply within the Park it is advocated that all power lines be placed underground. Mains power lines should be placed so that there is minimal visual impact. Where feasible, power supplies should be from alternative energy sources, for example solar power.

Strategies

1. **Where appropriate, ensure a detailed rehabilitation programme accompanies service works which may impact on Park values (Section 22). (CALM, CS) [Ongoing]**

2. **Review existing drainage facilities to improve water quality in the Park, reduce the risk of weed infestation and to improve the aesthetics of the outlets (Sections 15 and 24). (Water Corporation, CS, CALM) [High]**

3. **Promote "take it home" rubbish education. (CALM, CS) [Medium]**

4. **Construct roads within the Park for approved recreation or management purposes only. (CALM, CS) [Ongoing]**

5. **Place power lines to facilities and amenity lighting underground to improve aesthetics of the Park. (CALM, CS) [Low]**

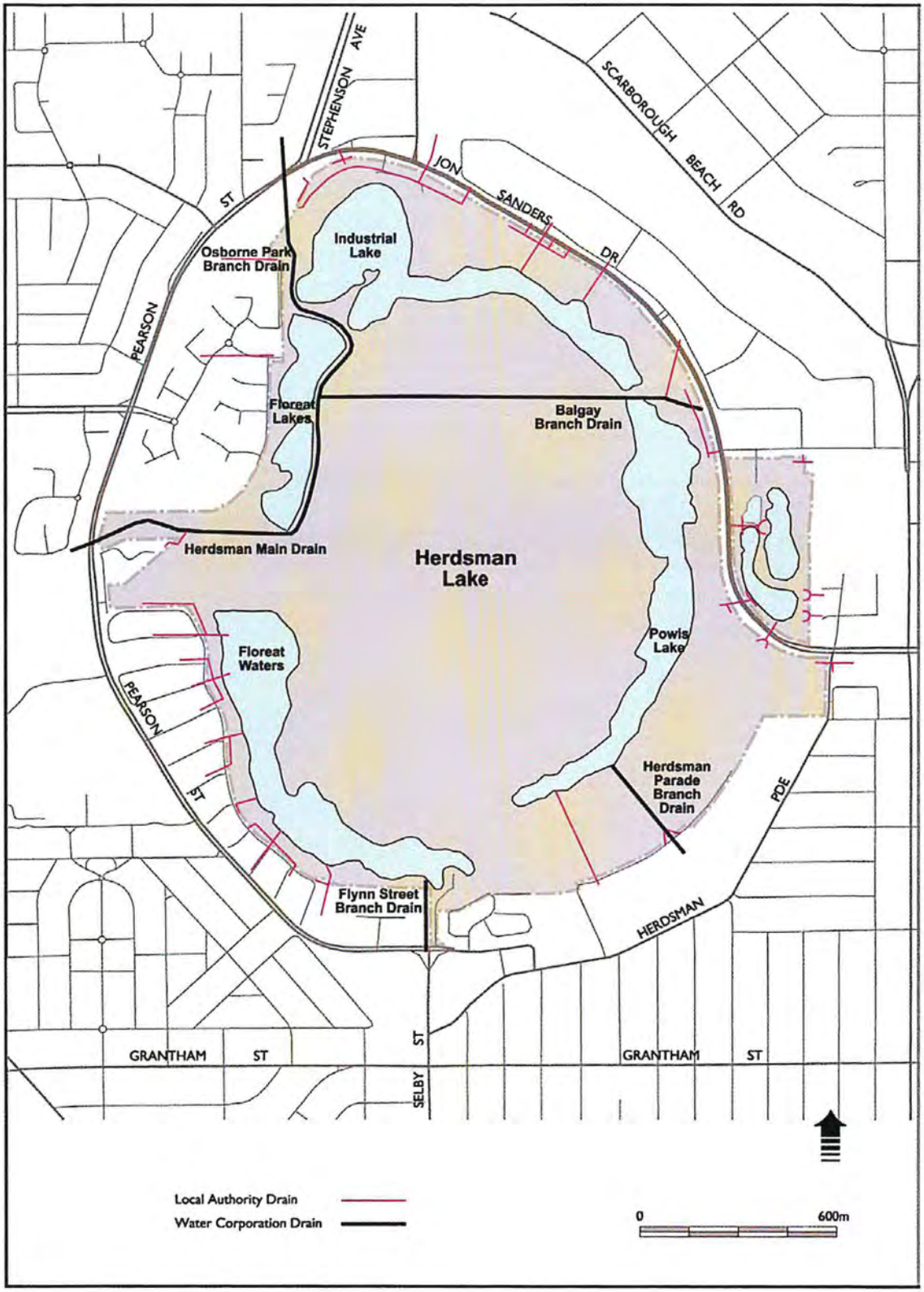

Figure 10 - Existing drainage infrastructure
(Source: Clarke *et al* 1990).

E. COMMERCIAL CONCESSIONS

34. Commercial Goal and Guiding Principles

COMMERCIAL GOAL

Allow for and manage concessions within the Park that service visitor requirements, do not adversely affect other park values and contribute positively to regional park management costs.

COMMERCIAL GUIDING PRINCIPLES

1. Consistency of Commercial Use with Reserve Purpose
Concessions for visitor services must be compatible with the assigned purpose of reserves within the Park. Reserves within the Park will be afforded an appropriate purpose for the protection and enhancement of Park values under the *Land Administration Act 1997*.

2. Preservation of the Values of the Land Itself
Concessions for visitor services should not compromise the natural and cultural values of the Park. Concessions should not be located in areas of the Park zoned for Conservation and Protection. Future developments should be of a character and arrangement that do not detract from the natural settings, landscape amenity and conservation values of the Park. Proponents of significant developments within the Park will be required to undertake a review of the environmental impacts of the proposed development.

3. Equity
Concessions for visitor services within the Park should be of a nature that promotes multiple use by Park visitors. Concessions that impair other forms of acceptable use or jeopardise safety of other visitors should be specifically managed, directed to more appropriate places or not permitted. Priority will be given to commercial uses that incorporate features aimed at increasing the awareness, appreciation and understanding of the natural environment.

4. Leased or Owned by the Managing Agencies
Concessions within the Park should be either through a lease or license arrangement, or where the managing agency owns and operates the facility or development.

5. Financially Viable
Through a tendering process, proponents of significant developments within the Park will be required to document the financial viability of the proposed concession. Revenue generated by concessions on land managed by CALM within the Park will be used to help meet the overall cost of managing regional parks.

6. Management
Activities and facilities must comply with the managing authorities' requirements. If effective management of commercial facilities or activities cannot be provided they should be restricted to appropriate levels, relocated or removed from the Park.

Strategy

1. **Apply the above principles as required in managing commercial concessions in the Park. (CALM, CS) [Ongoing]**

35. Leases and Licences

The objective is to ensure that commercial operations and leases are consistent with this Plan and that any leases and commercial operations help offset Park management costs.

Given its urban location and potential to accommodate commercial activities, the Park will continue to be subject to commercial proposals.

Commercial concessions (leases and licences) may be granted on lands or waters managed by CALM to provide appropriate facilities and services for visitors. A lease allows the lessee to occupy a particular area of land or waters, whereas a licence allows the licensee to enter and use the land.

Leases and licences provide a mechanism to bring private capital and management expertise into visitor services in natural areas. Concessions need to be carefully designed and managed, or they may detract from the conservation and landscape values of the Park. Appropriate concessions can generate income to help offset Park management costs and can significantly enhance public access and enjoyment of the Park.

CALM and the City of Stirling should assess proposed leases and commercial concessions according to the objectives as set out in this Plan. Concessions must be consistent with the purpose of the reserve and the

protection of its values. Commercial concessions on land managed by CALM within the Park will be established and managed in accordance with *Policy Statement No 18 - Recreation Tourism and Visitor Services.* (Note: CALM's Recreation Tourism and Visitor Services Policy was under review at the time of writing this Plan, should there be any inconsistencies between this Plan and the revised policy, future management will be in accordance with the new policy).

According to the *Conservation and Land Management Act 1984*, the Executive Director of CALM may grant a lease on land vested in the Conservation Commission of Western Australia subject to consultation with the Commission and approval of the Minister for the Environment. The Executive Director may apply terms and conditions as appropriate and the term of the lease may not exceed 21 years, but may include an option or options to renew that lease for a further term or terms not exceeding, in the aggregate, 21 years. The lease must be tabled before each House of Parliament within 14 sitting days of its execution by all parties to the grant or renewal.

Under the same Act, the Executive Director of CALM may grant a licence in writing to any person to enter and use certain land.

Leases and licences pertaining to land managed by the City of Stirling require the approval of the Stirling City Council.

All development proposals on land reserved as "Parks and Recreation" in Perth's MRS require approval from the WAPC. The WAPC in association with CALM will use this Plan as a mechanism for guiding development proposals within the Park or which impact upon the Park. Additionally, any commercial development proposed in the Park should be advertised appropriately to allow for consultation with the community.

A tendering process for potential commercial proponents to be involved in the Park will be publicly competitive and consistent with State and local government tendering processes.

Advertising within the Park requires the approval of the relevant managing agency.

EXISTING CONCESSIONS FOR VISITOR SERVICES

Existing concessions for visitor services (including community environmental organisations and recreation clubs) within the Park are as follows:

- the Herdsman Lake Wildlife Centre (Gould League of WA);
- the World Wide Fund for Nature (WWF);
- the Perth Horse and Pony Club;
- tennis courts at the corner of Jon Sanders Drive and Herdsman Parade are available for hire. The City of Stirling's Parks and Reserves section is responsible for their operation.

Wildlife Centre - Gould League of WA

The Gould League of WA provides environmental education programmes at the Herdsman Lake Wildlife Centre on behalf of the Education Department. Lease arrangements for the Centre (at Reserve No. 31906) are currently being negotiated between the Gould League and CALM.

The site currently offers some visitor interpretive facilities, but there is scope to further develop these for the general public. Further scope also exists to promote awareness of the Park through the Centre, for local, regional and international visitors. In addition to its current environmental education role for school students, the opportunity exists for the Centre to act as a resource centre for University and TAFE students, as well as the broader community. Research and education studies could be used in Park monitoring. Information on the values of the Park combined with activities and programmes to further develop and appreciate these values could also be expanded.

As outlined in Section 29 – Recreation Sites and Facilities, a site development plan will be prepared by CALM to upgrade access and parking at the Wildlife Centre. This will include discussions with the Gould League of WA and the World Wide Fund for Nature.

World Wide Fund for Nature (WWF)

The WWF played an important role in establishing the Wildlife Centre at Herdsman Lake in the early 1980s. Currently the WWF is utilising a small cottage next to the Wildlife Centre and is negotiating lease arrangements over the cottage with CALM as well as discussing access requirements to the Wildlife Centre with the Department and the Gould League of WA.

Perth Horse and Pony Club (Inc.)

The Perth Horse and Pony Club (Inc.) is located in the northeast of the Park adjacent to Jon Sanders Drive (at Reserve 28763). The Club currently operates under an agreement with the City of Stirling allowing for equestrian activities within the Club's designated area.

Improvements at the Perth Horse and Pony Club site include a clubhouse and storage sheds. The City constructed the facilities in the late 1980s and arranged a lease for the Club to utilise the site.

The Stirling City Council has resolved that it prefers not to retain future management of Reserve 28763. It has also resolved for the City (through its Recreation Services Business Unit) to consider finding alternate and compatible users of the site in accordance with the objectives of the regional park.

As such, the future use of the site and the appropriateness of equestrian activities requires further discussion between the Perth Horse and Pony Club (Inc.), the City of Stirling (as the owner of improvements on-site and agency that currently manages Reserve 28763) and CALM.

OPPORTUNITIES FOR COMMERCIAL VISITOR SERVICES

Ice Cream Vans, Fast Food Outlets and Bicycle Hire

It may be appropriate for these businesses to operate in the Park, subject to the issuing of an appropriate licence by the managing agencies. Such activities must comply with the managing agency's requirements including not conflicting with other Park visitors or degrading Park

values. Litter control would be considered in any approval for such business to operate in the Park. Operators need to comply with local government health and building requirements.

Cafe or Kiosk
Some investigation regarding the development of a café or kiosk within Herdsman Lake Regional Park has occurred in consultation with key stakeholders.

As indicated in the Recreation Masterplan (Figure 9 – page 41) a potential site for a commercial concession in the Park is Popeye Lake Parkland given it is highly modified, is easily accessible and has expansive views over the Herdsman Lake to the central business district of Perth.

While potential for new commercial concessions such as a cafe or kiosk may exist at Popeye Lake Parkland, priority will be placed on improving existing passive recreation facilities at the site.

As indicated in Section 29 – Recreation Sites and Facilities, the site plan for Popeye Lake Parkland will focus on upgrading existing facilities such as the play equipment and pedestrian and cyclist access. Should resources, however, become available CALM will consider re-initiating planning processes and stakeholder consultation for a commercial concession at the site.

Subject to further planning and discussions between the Perth Horse and Pony Club, the City of Stirling and CALM, Reserve 28763 may present an opportunity for a commercial concession.

For the development of a cafe or kiosk to proceed, expressions of interest would be sought through a publicly competitive tendering process. A comprehensive business plan and an environmental review would be required before any development could proceed.

COMMUNITY OR SPECIAL EVENTS

From time to time there may be demand for use of areas of the Park for community and special events. The appropriateness of community or special events within the Park will be assessed by the managing agency controlling the respective area. Gatherings requiring sole use of a site will require a booking. A concession arrangement may be required between the event-organiser and the managing agency for the right to use a site and to cover the operational and administrative costs incurred by the managing agency.

Managing agencies must use the guiding principles established for recreation and commercial uses as a means of determining the appropriateness of proposed activities. CALM should be consulted in the assessment of community events, as the coordinating agency for the Park. The requirements of the City of Stirling must also be met.

CONCESSIONS FOR PURPOSES OTHER THAN VISITOR SERVICES

Commercial concessions for purposes other than visitor services are generally not considered appropriate within the Park, unless there is a considerable benefit to the Park.

LEASES

Two leases for purposes other than visitor services currently exist within the Park:

- a lease with the Chrysalis Montessori School; and
- a lease with Telstra for a mobile phone telecommunications tower.

Chrysalis Montessori School
Chrysalis Montessori School, located on Parkland Road, currently occupies a small portion of Park (Part lot 1 Parkland Road, Glendalough) adjacent to its school buildings. The owner of the land is the WAPC. The area, which adjoins the school buildings, is fenced and used solely as a playground for the school. Discussions are currently taking place between the Department for Planning and Infrastructure, CALM and the Chrysalis Montessori School for the Park boundary to be amended and the area excised from the Park. This will require an amendment to the MRS.

Telstra mobile phone telecommunications tower
Lot 277 Selby Street, Herdsman that contains the mobile phone tower was transferred to the Conservation Commission of Western Australia as public open space to be managed by CALM under a lease to Telstra. Managing the reserve for telecommunication is consistent with the reserves assigned purpose. When assessing proposals for, or managing telecommunications facilities, CALM is directed by *Policy Statement 49 Radio/Tele Communications Facilities.* (Note: CALM's Radio/Tele Communications Facilities Policy was under review at the time of writing this Plan, should there be any inconsistencies between this Plan and the revised policy, future management will be in accordance with the new policy).

LICENCES

Beekeeping
CALM may grant permits to beekeepers to use Crown land under the *Conservation and Land Management Act 1984.* Permits are granted on the proviso that biodiversity and conservation objectives are not compromised, where the activity is compatible with other land uses. CALM's *Policy Statement No. 41 Beekeeping on Public Land* was under review at the time of writing this Plan, the draft policy indicates that current apiary site permits will be maintained and renewed, but no additional permits will be granted on land reserved or proposed to be reserved primarily for conservation purposes, unless allowed for under a completed management plan.

The introduced honeybee (*Apis mellifera)* can have detrimental effects on native insects, hollow-using animals and vegetation. Competition for flora resources between honeybees and other native pollinators may favour the more aggressive foraging of the introduced bee, which results in a decline of native insects. Other possible effects are inefficient pollination of some local plants, destruction of flowers and hybridisation of some native plant species by cross-pollination of different native species.

Given the high visitation to the Park, its proximity to residential areas and the general exclusion of access to the central conservation area of Herdsman Lake, no permits will be granted for beekeeping in the Park.

Strategies

1. **Establish and manage any commercial operations in accordance with CALM's *Policy Statement No 18 - Recreation Tourism and Visitor Services*. Concessions in the Park may be permitted if they are consistent with the purpose of the relevant reserve. (CALM, CS) [Ongoing]**

2. **Ensure any commercial activities are consistent with the commercial guiding principles. Conditions are fulfilled by concession holders and an appropriate fee is paid that contributes an income to the management of regional parks. (CALM, CS) [Ongoing]**

3. **Ensure proponents of commercial activities complete an appropriate expression of interest. (CALM, CS) [Ongoing]**

4. **Assess community and special events proposed in the park in accordance with objectives of the Plan as well as the guiding principles for commercial and recreation use of the Park. A concession arrangement may be required between the event organiser and the managing agency for the right to use a site and to cover the operational and administrative costs incurred by the managing agency. (CALM, CS) [Ongoing]**

5. **Where appropriate, allow provisions for community organisations and clubs that are consistent with the reserve purpose. (CALM, CS) [Ongoing]**

6. **Develop management guidelines for advertising within the Park. (CALM, CS) [Medium]**

7. **Prepare a feasibility study to investigate redeveloping the Herdsman Lake Wildlife Centre into a visitor interpretive centre in consultation with the Gould League of WA. (CALM) [High]**

8. **Excise the Chrysalis Montessori School lease area from the Park. (DPI) [Medium]**

9. **Exclude beekeeping activities from the Park. (CALM) [Ongoing]**

36. Mining and the Extraction of Basic Raw Materials

The objective is to protect the Park's values from exploration, mining and the extraction of basic raw materials.

The Conservation Commission of Western Australia does not consider mining and the extraction of basic raw materials as an appropriate land use in the Park, hence there is a strong presumption against these activities.

EXTRACTION OF BASIC RAW MATERIALS

Depending on the land tenure involved there are different legislative requirements for extraction or mining of basic raw materials.

On freehold land basic raw materials (including sand, limestone, limesand, clay, gravel and hard rock) are not defined as "minerals" under the *Mining Act 1978* and commercial extraction is subject to extractive industry licences under the *Local Government Act 1995*. Any freehold property in the Park that is subject to an extractive industry licence will be processed under the *Local Government Act 1995*. Given the Park is reserved for Parks and Recreation in the MRS, the extractive industry licence will be determined by the WAPC.

Basic raw materials targeted on reserves vested with the Conservation Commission or other Crown land will be processed under the *Mining Act 1978*.

The mining of basic raw materials from within the Park is unlikely to be environmentally acceptable and such proposals will be referred to the Environmental Protection Authority (EPA) for assessment. The EPA may assess the proposal as "environmentally unacceptable".

MINING

Applications for mining within regional parks will be processed under the *Mining Act 1978*.

The State Government's environment policy includes a prohibition on mineral and petroleum exploration and mining in national parks and nature reserves. State Cabinet has determined that applications lodged prior to 10 February 2001 would not be affected and would be processed in accordance with the policy that applied at that time.

In processing applications, regional parks are recognised by the Department of Industry and Resources (DOIR) under the *"Guidelines for Mineral Exploration and Mining within Conservation Reserves and Other Environmentally Sensitive Lands in Western Australia"* (DME, 1998). Applications affecting the Park will also be subject to *The Mineral Exploration and Development Memorandum of Understanding* (MOU) between the EPA and DOIR (DME, 1995). The MOU clarifies referral arrangements for mineral exploration and mining proposals to the EPA and CALM where these proposals occur within conservation reserves and other environmentally sensitive lands.

Mineral exploration in 'A' Class nature reserves and conservation parks (in the southwest of Western Australia) is subject to the concurrence of the Minister for the Environment and the Minister for State Development. Approval for mining to occur in the Park is subject to EPA assessment. If mining is to occur in 'A' Class nature reserves and conservation parks it would require EPA assessment and Parliamentary consent.

Strategies

1. **Ensure any proposals for mining and extraction of basic raw materials affecting the Park are referred to the EPA. (CALM) [Ongoing]**
2. **Review proposals for mining and extraction of basic raw materials with the view to excluding them from the Park. (CALM) [Ongoing]**
3. **Should proposals for mining or the extraction of basic raw materials be approved, ensure adequate provisions are made to manage impacts and to protect the remaining Park areas. (CALM) [Ongoing]**

F. RESEARCH

37. Research Goal

RESEARCH GOAL

Seek a better understanding of the natural, cultural and social environments, as well as the impacts of visitor use, park management and external influences on the Park.

38. Research

The objective is to further develop and maintain knowledge regarding visitor use, park management, natural processes and the influence of people and other external influences on the Park.

There are many opportunities for research within the Park. Visitor use, management regimes, rehabilitation and weed control, and external influences all need to be evaluated for their impact on the Park.

As discussed in Section 27 – Visitor Use, since accepting management responsibility of the Park, CALM has undertaken two studies into visitor use in areas of the Park – Barnes (1998) and Colmar Brunton (2001). These studies provide information to allow more informed management decisions regarding recreational use of the Park.

Kobryn (2001) studied the properties of stormwater entering Herdsman Lake and the effects of land uses within the catchment area on stormwater as a PhD thesis at Murdoch University. The three main aims of the work were:

1. determine the importance of stormwater drains in the water and pollution balance of the Lake;
2. evaluate pollutant retention rates by the wetland; and
3. identify current land uses in the catchment, determine their impacts on the wetland and identify tolerable levels of urbanisation for a wetland of this type.

A study of the environmental effects of the 1986 Argentine ant treatment programme at Herdsman Lake was carried out by the Wetland Ecology Group at Murdoch University in conjunction with Dr Geoff Ebell of the Chemistry Centre and Dr Stuart Halse of CALM. Funding from the State Planning Commission and Agriculture Western Australia supported the study. The study provided information on the nature of stratification and inputs into the moat, the impact of dredging and possible designs for future monitoring programmes (Davis and Garland, 1986).

The Marine and Freshwater Research Laboratory at Murdoch University also undertook a study of water quality and invertebrate community structure at Herdsman Lake as part of a chemical and biological monitoring programme for ten lakes on the Swan Coastal Plain in 1986/87. This allowed a comparison of Herdsman Lake to be made with nine other local wetlands (Rolls *et al*, 1990).

Between September 1982 and May 1983, ESRI Australia Pty. Ltd. undertook a water quality study of Herdsman Lake for Herdsman Industrial Estate Pty Ltd. This study was undertaken concurrently with the sampling of Floreat Waters by the State Planning Commission.

Details of all of the above studies are contained in the References and Bibliography section of this Plan.

It is desirable that research programmes involve as wide a range of people as possible. The involvement of volunteers, labour market programmes, educational institutions and individual researchers can reduce research costs and assist in providing information to managing agencies and the broader community. The Park is situated close to a number of tertiary, secondary and primary education institutions and further opportunities exist for these institutions to play an important role in research within the Park.

Strategies

1. **Support and where possible seek grant applications to encourage research within the Park. (CALM) [Ongoing]**

2. **Encourage the participation of volunteers, educational institutions and other organisations in research projects within the Park. (CALM) [High]**

G. COMMUNITY RELATIONS

39. Community Relations Goal

COMMUNITY RELATIONS GOAL

Promote informed appreciation of the Park's natural environment, cultural values and recreation opportunities and facilitate liaison with the community about their management.

40. Information, Interpretation and Education

The objectives are to increase the community's awareness, appreciation and understanding of the Park's values and management practices, and to involve a wide range of public participation in the implementation of this Plan.

An effective communication programme is essential to achieve the goals and objectives of the management of the Park. It informs the public of attractions, facilities and recreation opportunities available within the Park and provides an avenue to promote an appreciation, and greater understanding and enjoyment of the natural environment. Additionally, it fosters appropriate behaviour so that adverse impacts on the environment are minimised.

A communication plan and programme for the regional parks in Perth has been completed by CALM. The communication plan has three parts:

1. information – providing an overview of opportunities and details of facilities, activities and regulations;
2. interpretation – exploring natural and cultural features; and
3. education – providing detailed materials and programmes designed to facilitate learning, focusing on target groups (e.g. school groups, community groups).

The communication programme will be implemented by way of signs, displays, publications (such as brochures and Park notes) and guided activities. Close liaison between the managing agencies will be necessary to help ensure the development of a coordinated programme of information, interpretation and education for the Park.

An interpretation plan has also been completed for Herdsman Lake Regional Park providing information specific to the Park to visitors. Interpretive information will assist people plan their visit, enjoy and appreciate the Park and help them recall their experience when they depart. The Park offers many opportunities for developing an enriching body of interpretive material. Key areas for interpretation and education within the Park include:

- the lakes and wetland areas;
- recreational opportunities;
- flora and fauna;
- how local residents can reduce nutrient loads into the wetlands in the Park and therefore participate in the recovery of the wetland system;
- cultural influences (both Aboriginal and non-Aboriginal people);
- Herdsman Lake and its relationship with other wetlands on the Swan Coastal Plain;
- the Regional Park entity, its management and evolution; and
- responsible use of the Park.

The development of interpretive material should be undertaken in a coordinated way to ensure the most effective use of available resources and to present a well-integrated, consistent body of information about the Park.

Involvement of the community in Park management, ongoing liaison with community groups and the provision of interpretive and educational materials will be important for maintaining the values of the Park and to maximise its use as an educational resource. Community involvement in the management of the Park is further discussed in Section 42.

The Gould League has been an extremely important and active group, leading regular interpretative activities for the public, providing considered and invaluable advice and comments about management issues and generating excellent press coverage for issues and activities in the Park. Their efforts have assisted in raising the awareness and understanding in the local community of the Park's identity and values.

There is potential to upgrade the Wildlife Centre into a visitor interpretive centre. The Centre could serve as a focus for educational and research programmes and could offer accessible, timely information about the values of the Park together with activities and programmes to interpret those values.

School groups will continue to place heavy demands for educational activities and talks at the Park. A number of

local schools have been involved with activities such as planting and rehabilitating degraded areas. There is the opportunity to conduct these school activities in conjunction with CALM's existing schools education programme and the Department's Bush Rangers Programme.

The Herdsman Lake Settler's Cottage is also an important interpretation node in the Park presenting the social history of Herdsman Lake and relevant aspects of the natural environment.

Strategies

1. **Implement and periodically update the Regional Park Communication Plan. The plan provides direction on:**
   - **community education;**
   - **community involvement; and**
   - **interpretive strategies and techniques.**

   (CALM) [High]
2. **Implement the interpretation plan for Herdsman Lake Regional Park. (CALM, CS) [High]**
3. **Continue to liaise with all interest groups to ensure a coordinated approach to interpretation and education within, and adjacent to the Park. (CALM, CS) [Ongoing]**
4. **Continue to encourage, promote and support the local volunteers with resources to help them carry out their activities. (CALM, CS) [Ongoing]**
5. **Encourage greater visitor use of the Wildlife Centre in order to increase the dissemination of information relating to wildlife and wetland environmental education, and to increase community understanding of Park environmental and conservation values. (CALM, Dept of Education, Gould League of WA) [High]**
6. **Investigate upgrading the Wildlife Centre into a visitor interpretive centre. (Section 29 and 35) (CALM) [High]**

H. PLAN IMPLEMENTATION

41. Priorities, Funding and Staff

The objective is to manage the Park according to the priorities developed for implementation.

PRIORITIES

The priorities for managing the Park have been established by the managers of the Park and appear in brackets behind each strategy in this Plan. They represent the priorities at the time of writing. CALM, in consultation with the Conservation Commission of Western Australia, will review priorities in reference to changing circumstances during the term of the Plan. There are many strategies outlined in this Plan, while some are guidelines others are prescriptions for specific actions. The City of Stirling and CALM will implement this Plan within the framework of available resources.

Subsidiary plans and implementation programmes

In implementing the priorities of the Plan, more detailed subsidiary plans will be required prior to operations taking place within the Park (see Section 2).

Subsidiary plans to be (or that have been) prepared as part of the Herdsman Lake Regional Park planning process include:

- Overall Water Management Plan (Section 15);
- Fauna Management Programme (Section 17);
- Weed Management Plan (Section 18);
- Fire Response Plan (Section 19);
- Pest Animal Control Plan (Section 20);
- Rehabilitation Plan (Section 22);
- Visitor Survey Programme (Section 27);
- Recreation Masterplan (Section 28);
- Site Development Plans (Section 29);
- Sign System and Sign Plan (Section 31);
- Visitor Risk Management Programme (Section 32);
- Communication Plan for regional parks (Section 40);
- Interpretation Plan (Section 40); and
- Volunteer Information Package (Section 42).

Additionally, an annual projects list will be prepared to guide major works on CALM-managed lands within the Park. The City of Stirling and Herdsman Lake Regional Park Community Advisory Committee will be consulted in the preparation of the annual projects list (Section 11).

STAFFING

The City of Stirling currently manages Council reserves within the Park using staff from their Parks and Reserves Department and contractors as required. CALM services its management obligations with staff from the Department's Regional Parks Unit and contractors.

FUNDING ARRANGEMENTS

The City of Stirling and CALM will finance and manage their respective land areas (Figure 4 – page 10). CALM has been allocated a recurrent budget for the maintenance of regional parks from State Treasury. Additionally, a capital budget has been provided by the WAPC for the future planning and development of facilities within regional parks. Some funding for local governments involved in regional parks is available through Area Assistance Grants Schemes administered by the WAPC.

Responsibility for funding the acquisition of private lands proposed for inclusion in the Park remains with the WAPC.

Strategies

1. **Prepare and implement an annual projects list, taking into account the priorities identified in this plan. Consult with the Herdsman Lake Regional Park Community Advisory Committee when preparing this list. (CALM) [High]**
2. **Seek corporate sponsorship and other funding arrangements for the Park. (CALM, CS) [Ongoing]**

42. Community Involvement

The objective is to facilitate community involvement in the management of the Park.

THE HERDSMAN LAKE REGIONAL PARK COMMUNITY ADVISORY COMMITTEE

The public is formally involved in implementing this Plan through the Herdsman Lake Regional Park Community Advisory Committee.

The Committee provides a forum at which issues affecting the Park are discussed. It consists of community members and representatives from the City of Stirling, Water Corporation and CALM. The Committee commented on the draft management plan prior to its release for public comment and assisted in finalising the management plan. The committee's role is also to provide advice in regard to the ongoing management of the Park.

The existing Community Advisory Committee's role, composition and structure will be reviewed periodically.

INTERACTION WITH THE BROADER COMMUNITY

It is important that the community is actively involved in implementing this Management Plan and preparing and implementing subsidiary plans. This encourages a sense of ownership of the Park by the community and

encourages interested people to become involved in the Park's future planning and management. To facilitate the community involvement in the Park CALM has prepared a Regional Park Volunteer Information Package. When consulting with the community regarding the management of the Park, CALM is guided by *Policy Statement No.15 – Community Involvement (Public Participation and Volunteers)*.

Residents bordering the Park can have a great impact on the Park. It is important to seek the cooperation and involvement of adjacent landowners to protect the values of the Park. This can be done through educational programmes that promote responsible use of the Park and inform the community of management roles and responsibilities. Programmes should outline the effects of inappropriate activities such as dumping rubbish and garden waste in the Park, and disposing fish and pool water into local drains that flow into the Park's wetlands and waterbodies (Section 40).

Edith Cowan University – Churchlands Campus, Churchlands TAFE College and a number of primary and secondary schools provide a strong educational presence in close proximity to the Park. All educational institutions, particularly Edith Cowan University should be encouraged to use the Park for educational and research purposes.

There are a number of different ways members of the community can be involved in assisting with the implementation of this Plan including:

- joining community volunteer groups such as the Gould League of Western Australia and Habitat Herdsman;
- joining CALM's Bush Rangers Programme;
- contacting members of the Herdsman Lake Regional Park Community Advisory Committee to discuss issues in the Park;
- reporting problems and issues to the managing agencies; and
- involvement in clean-up days (e.g. Cleanup Australia Day).

Strategies

1. **Periodically review the role and composition of the Herdsman Lake Regional Park Community Advisory Committee. (CALM) [Ongoing]**

2. **Maintain active liaison with community groups involved in the Park. (CALM, CS) [Ongoing]**

3. **Promote community groups involved in the implementation of this management plan and subsidiary plans. (CALM, CS) [Ongoing]**

4. **Encourage and support the activities of community groups, schools and other groups interested in the Park. (CALM, CS) [High]**

5. **Continue to encourage, promote and support the local volunteers with essential resources to carry out their activities. (CALM, CS) [Ongoing]**

6. **Facilitate community involvement in the Park by implementing the Regional Park Volunteer Information Package. (CALM, CS) [Ongoing]**

7. **Promote responsible use of the Park and keep the community and other organisations informed of management actions, programmes and developments within the Park. (CALM, CS) [Ongoing]**

8. **Monitor the number of volunteer hours contributed to the management of the Park. (CALM) [Ongoing]**

Key performance indicators for community involvement
The success of these strategies will be measured by: 1. Change in volunteer hours contributed to the management of the Park. 2. Existence of an active community advisory committee.
Target: 1. Increase in volunteer hours contributed to the management of the Park from 2005 levels. 2. Maintain an active community advisory committee for the Park.
Reporting: 1. Every 3 years. 2. Every 3 years.
Response to target shortfalls: Investigate the cause and report to the Conservation Commission for action.

43. Term of the Plan

This Plan will help progress the Park towards its long-term vision (Section 5). In doing so it will be subject to reviews to ensure its appropriateness and effectiveness.

The term of this plan will be 10 years. After that time, unless it is revoked, the Plan will remain in force until a new plan is approved. Section 61 of the *Conservation and Land Management Act 1984* provides for the Plan to be amended as required. If major changes to the Plan are proposed, the revised changes will be released for public comment.

44. Performance Assessment

MANAGEMENT PLAN AUDIT

The Conservation Commission of Western Australia has overall responsibility for auditing the implementation of the Plan. Overall management performance and the effectiveness of the plan will be audited assessing the key performance indicators (see Table 2) and may include other parameters.

CALM will report to the Conservation Commission of Western Australia periodically. The Commission will take action as appropriate.

ANNUAL REVIEW

CALM will undertake a review of the management plan in preparing an annual projects list for the Park. The Herdsman Lake Regional Park Community Advisory Committee will be involved in preparing the annual projects list.

Strategies

1. **Audit the overall effectiveness of the Park's management based on the key performance indicators (Table 2). (Conservation Commission of Western Australia) [Ongoing]**
2. **Review the implementation of this Plan annually in preparing an annual projects list. (CALM) [Ongoing]**

Table 2 - Performance Assessment

KEY VALUES	KEY OBJECTIVE	KEY PERFORMANCE INDICATORS		
		Performance Measure	**Target**	**Reporting Requirements**
The Park's conservation, recreation and landscape values.	9. Land Tenure To ensure the values of the Park are protected by security of tenure and reserve purpose.	1. Changes in land tenure.	1. Complete all land tenure changes in accordance with the regional park management plan within ten years.	1. Every 5 years.
The wetland ecosystem of Herdsman Lake.	14. Lakes and Wetlands To manage the Park in a manner that helps protect and enhance the wetland environment of the Park.	1. Changes in abundance, species diversity and structure of naturally occurring aquatic macro-invertebrate populations. 2. Completion of an integrated catchment management plan for the Herdsman Lake catchment area.	1. No decline in the abundance or diversity of naturally occurring aquatic macro-invertebrate populations based on 2005 levels. 2. Integrated catchment management plan finalised within 5 years of the completion of the regional park management plan.	1. Every 3 years. 2. Every 5 years - completed by 2008 and implementation reported by 2012.
The diversity of wildlife and fauna habitats including the flora and vegetation that form the habitats.	15. Flora and Vegetation To protect, conserve and rehabilitate local plant species and communities in the Park.	1. Changes in the abundance of selected local wetland flora species. 2. Existence of a weed and rehabilitation plan.	1. No decline in the abundance of selected local wetland flora species from 2005 levels. 2. Implement the weed and rehabilitation plan.	1. Every 3 years. 2. Every 5 years - completed in 2003, implementation reported by 2007.
Herdsman Lake is a significant bird breeding area and summer refuge for transequatorial migratory waders and has an abundance and diversity of birdlife.	16. Fauna To conserve naturally occurring fauna species in the Park, particularly threatened and priority avian fauna.	1. Changes in species diversity of naturally occurring avian fauna. 2. Changes in the abundance of selected naturally occurring avian species. 3. Changes in high conservation value bird habitat. 4. Completion of a fauna management programme.	1. No decline in species diversity of naturally occurring avian fauna from 2005 levels. 2. No decline in the abundance of selected naturally occurring avian species from 2005 levels. 3. No decline in selected avian fauna habitat from 2005 levels. 4. Fauna management programme completed within 3 years of completion of regional park management plan.	1. Every 3 years (note: seasonal variations). 2. Every 3 years (note: seasonal variations). 3. Every 3 years. 4. Every 5 years - completed by 2006 and implementation reported by 2010.

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Table 2 (continued) - Performance Assessment

KEY VALUES	KEY OBJECTIVE	KEY PERFORMANCE INDICATORS		
		Performance Measure	**Target**	**Reporting Requirements**
The diversity of wildlife and fauna habitats including the flora and vegetation that form the habitats.	17. Weeds To minimise the impact of environmental weeds on the local plant species and communities in the Park.	1. Changes in the abundance and distribution of priority environmental weeds as outlined in the *Herdsman Lake Regional Park Weed Control and Revegetation Plan.*	1. No increase in the abundance and distribution of priority environmental weeds from 2005 levels.	1. Every 3 years.
		2. Changes in populations of high priority weeds as identified in the *Environmental Weeds Strategy for Western Australia.*	2. No new populations of weed species rated high in the *Environmental Weeds Strategy for Western Australia* over the life of the Plan.	2. Every 3 years.
		3. Existence of a weed and rehabilitation plan.	3. Implement the weed and rehabilitation plan.	3. Every 5 years - completed in 2003, implementation reported by 2007.
The Park provides opportunities for a wide range of passive and active recreation. Of particular significance is the opportunity to recreate in natural environments that are relatively undisturbed yet close to urban areas.	26. Visitor Use (and the recreation masterplan) To ensure that the level and type of visitor use are suitable and minimise conflict with other park visitors and values.	1. Changes in visitor numbers and satisfaction levels.	1. No decline in visitor satisfaction from 2005 levels.	1. Every 3 years.
		2. Provision of formalised access in the Park (Section 28 – Recreation Masterplan).	2. Complete access and circulation components of recreation masterplan within ten years of completion of regional park management plan.	2. Every 5 years.
		3. Completion of a visitor survey programme.	3. Visitor survey programme completed within two years of completion of regional park management plan.	3. Every 5 years - completed by 2005 and implementation reported by 2009.
The Park is a community asset.	42. Community Involvement To facilitate community involvement in the management of the Park.	1. Change in volunteer hours contributed to the management of the Park.	1. No decrease in volunteer hours contributed to the management of the Park from 2005 levels.	1. Every 3 years.
		2. Existence of a community advisory committee.	2. Maintain an active community advisory committee for the Park.	2. Every 3 years.

REFERENCES AND BIBLIOGRAPHY

Ahern J., (1995), Greenways as a Planning Strategy, J. Landscape Urban Planning, 33: 131 – 156.

ANZECC (1992) Australian Water quality guidelines for Fresh and Marine Waters, National Water Quality Management Strategy, Australian and New Zealand Environment and Conservation Council, Canberra, Australia.

ANZECC (2000), Best Practice in Protected Area Management Planning, ANZECC Working Group on National Parks and Protected Area Management Benchmarking and Best Practice Programme.

Australian National Committee, International Council on Monuments and Sites (ICOMOS) (1999) Australian ICOMOS Burra Charter, South Australia.

Bamford, M., Davies, S., & Van Delft, R., (1988), Model Boats: Their Effect on Waterbirds at Herdsman Lake, Royal Australasian Ornithologists Union, Perth, Western Australia.

Barnes S. (1998), Visitor Survey of Designated Regional Parks, Department of Conservation and Land Management, Perth, Western Australia.

Beckle, H., (1981), The Wetland "Lost". Drainage of Perth's Lake Systems, Western Geographer Vol 5, No's 1 to 2.

Blyth, J. and Halse, S., (1986), Herdsman Lake: Inner City Sanctuary, Landscope (2), pg 28-34.

Churchill, D., (1956), Pollen Bearing Sediments from South Western Australia, Honours thesis, Botany Dept, UWA Australia.

City of Stirling, (1999), The Keeping and Control of Cats Local Law, Perth, Western Australia.

Clarke, K., Davis, J, & Murray, F., (1990), Herdsman Lake Water Quality Study, Murdoch University, Perth, Western Australia.

Collins, P., (1984), Herdsman Lake Industrial Estate Environmental Monitoring Report, Phase I, September 1982 - June 1983, Prepared for Metropolitan Region Planning Authority, Perth, Western Australia.

Colmar Brunton (2001) CALM Regional Parks Usage Survey 2001, Research Report prepared for the Department of Conservation and Land Management.

Curry, P., (1981), A Survey of the Birds of Herdsman Lake. Department of Conservation and Environment, Bulletin 105, Perth, Western Australia.

David Bennett Consulting (1988), Public Environment Review – Floreat Lakes Residential Development, Prepared for the State Planning Commission and Sherwood Overseas Co. Pty. Ltd. Perth, Western Australia.

Davies, J (1993) Jackadder Lake Nutrient Balance Study – July 1992 to July 1993, Final Report, City of Stirling, Perth, Western Australia.

Davis J. and Christidis F., (1997), A Guide to Wetland Invertebrates of Southwestern Australia, Perth, Western Australian Museum.

Davis, J. and Garland, M., (1986), Herdsman Lake Pesticide Study, School of Environmental and Life Sciences, Murdoch University, Perth, Western Australia.

Davis, J., Rosich, R., Bradley, J., Growns, J., Schmidt, L., Cheal F., (1993) Wetlands of the Swan Coastal Plain, Volume 6, Wetland Classification on the Basis of Water Quality and Invertebrate Community Data, Water Corporation of Western Australia and the Western Australian Environmental Protection Authority, Perth, Western Australia.

Davis, J., Halse, S., Ebell, G., (1987), Herdsman Lake Pesticide Study, unpublished.

Department of Agriculture, (1988) Argentine Ant Control Annual Report 1987/1988, Perth, Western Australia.

Department of Conservation and Environment (1980) Atlas of Natural Resources Darling System Western Australia, Department of Conservation and Environment, Western Australia.

Department of Conservation and Environment (1983), Conservation Reserves for Western Australia as recommended by the Environmental Protection Authority – 1983, Report No. 13, Department of Conservation and Environment, Perth, Western Australia.

Department of Conservation and Environment, (1993), Status Report Conservation Reserves for Western Australia, as recommend by the Environmental Protection Authority (1976 – 1984), report No. 15, Department of Conservation and Environment, Perth, Western Australia.

Department of Conservation and Land Management, (1999), Department of Conservation and Land Management Regional Parks - Community Advisory Committee, Information Package, Perth, Western Australia.

Department of Conservation and Land Management (1986) Rehabilitation of Disturbed Land, Policy Statement No. 10, Department of Conservation and Land Management, WA.

Department of Conservation and Land Management (1986) Weeds on CALM Land, Policy Statement No. 14, Department of Conservation and Land Management, WA.

Department of Conservation and Land Management (1987) Fire Management, Policy Statement No. 19, Department of Conservation and Land Management, WA.

Department of Conservation and Land Management (1991) Community Involvement (Public Participation and Volunteers), Policy Statement No 15, Department of Conservation and Land Management, WA.

Department of Conservation and Land Management (1992) Beekeeping on Public Land, Policy Statement No 41, Department of Conservation and Land Management, WA.

Department of Conservation and Land Management (1996) Visitor Risk Management , Policy Statement No 53, Perth, WA.

Department of Conservation and Land Management (1991) Recreation, Tourism and Visitor Services, Policy Statement No. 18, Perth, WA.

Department of Conservation and Land Management (1989) Visual Landscape Management System, Perth, WA.

Department of Conservation and Land Management (1994) Reading the Remote, Landscape Character Types of Western Australia, Department of Conservation and Land Management, WA.

Department of Conservation and Land Management (1999) Environmental Weed Strategy for Western Australia, Perth, Western Australia.

Department of Conservation and Land Management. Sign Manual, Department of Conservation and Land Management, Western Australia.

Department of Conservation and Land Management (1997), Canning River Regional Park: Management Plan 1997-2007, Management Plan No 36, National Parks and Nature Conservation Authority and City of Canning, Perth, Western Australia.

Department of Conservation and Land Management (1997a), Canning River Regional Park: Analysis of Public Submissions, Management Plan No 36, National Parks and Nature Conservation Authority and City of Canning, Perth, Western Australia.

Department of Conservation and Land Management (2002) Corporate Plan, Perth, Western Australia.

Department of Minerals and Energy (1995) The Mineral Exploration and Development Memorandum of Understanding. Unpublished.

Department of Minerals and Energy (1998) Guidelines for Mineral Exploration and Mining within Conservation Reserves and Other Environmentally Sensitive Lands in Western Australia. DME Information Series No. 11. Perth WA

Department of Transport, (1996), The Perth Bicycle Network Plan, Bikewest.

Dieback Working Group, (2000), Managing Phytophthora Dieback, Guidelines For Local Government, Perth, Western Australia.

Environmental Protection Authority, (1988), Floreat Lakes Residential Development – North West Sector Herdsman Lake, Report and Recommendations of the EPA, Perth, Western Australia.

Environmental Protection Authority, (1989), Statement of Ministerial Conditions for the Floreat Lakes Residential Development – North West Sector Herdsman Lake, Perth, Western Australia.

Environmental Protection Authority, (1990), A Guide to Wetland Management in Perth, Bulletin 374, Environmental Protection Authority, Perth, Western Australia.

Environmental Protection Authority (1992) Environmental Protection (Swan Coastal Plain Lakes) Policy, Perth, Western Australia

Environmental Protection Authority (1993) Red book : status report : on the implementation of Conservation Reserves for Western Australia as recommended by the Environmental Protection Authority (1976-1984), Environmental Protection Authority, Perth.

Environmental Protection Authority and the Department of Minerals and Energy (now Department of Industry and Resources) (1995) Mineral Exploration and Development Memorandum of Understanding, Unpublished.

ESRI, (1981), Herdsman Park Estate, Environmental Review and Management Programme, Cooper Corporation Pty. Ltd., Perth, Western Australia.

ESRI, (1983), Herdsman Industrial Estate Western Australia. Phase 1 Environmental Monitoring Report September 1982 to June 1983, ESRI Australia Pty. Ltd, Perth Western Australia.

Fire and Emergency Services Authority of Western Australia (1998) Western Australian Hazardous Materials Emergency Management Plan, Perth Western Australia.

Government of Western Australia, (1997), Parks for People: Western Australia, Brochure, Western Australian Planning Commission, Perth, Western Australia.

Government of Western Australia (2000), Bush Forever, Perth, Western Australia.

Halse, S., (1985), Herdsman Lake Situation Report, Confidential Report prepared for the Department of Conservation and Land Management, Perth, Western Australia.

Harris, R. (2003) Gould League of Western Australia, Personal Communication.

Heritage & Conservation Professionals, (1992), Conservation Study - Herdsman Lake Settlers Cottage, Western Australia, Prepared for Department of Planning and Urban Development, Perth, Western Australia.

Hill, A. L., Semeniuk, C. A., Semeniuk, V., & Del Marco, A., (1996), Wetlands of the Swan Coastal Plain, Volume 2B - Wetland Mapping, Classification and Evaluation - Wetland Atlas, Perth, Western Australia.

King, S., (1997), Herdsman Lake Settlers Cottage", in: Trust News, Volume 199.

Kobryn H.T (2001) Land use changes and the properties of stormwater entering a wetland on a sandy coastal plain in Western Australia, PHD Thesis, Murdoch University.

Majer, J. and Flugge, R., (1984), The Influence of Spraying on Argentine (Iridomyrmex humilis) and Native Ants (Hynenoptera formicidae). Bulletin 8, School of Biology, WAIT, Perth.

Maunsell & Partners Pty Ltd, (1989), Herdsman Lake Reserve - Draft Management Plan, Prepared for Department of Conservation and Land Management, Perth, Western Australia.

Metropolitan Region Planning Authority, (1976), Herdsman Lake Concept Plan, Perth, Western Australia.

O'Connor, R., Quartermaine, G. and Bodney, C. (1989) Report on an investigation on to Aboriginal significance of wetlands and rivers in the Perth-Bunbury Region, Western Australian Water Resources Council.

Pinder A,. Trayler K.M, Davis J.A, (1991), Chironomid Control in Perth Wetlands: Final Report and Recommendations. Murdoch University, Perth, Western Australia.

Regeneration Technology (2002). Herdsman Lake Regional Park Weed Control and Revegetation Plan, Prepared for the Department of Conservation and Land Management, Perth Western Australia.

Regional Parks Task Force (1990) Task Force Report on the Administration, Planning and Management of Region Open Space and Regional Parks in Perth, Western Australia, Report to Cabinet, Department for Planning and Urban Development and Department of Conservation and Land Management, Perth.

Reiffer , P. (2001), Gould League of Western Australia, Personal Communication.

Royal Australasian Ornithologists Union (RAOU), (1996D), Database of Western Australian Birds Project, (RAOU tracking database).

Rolls, S., Davis, J., Balla, S., Bradley, J., (1990), Biological and Chemical Monitoring of Water Quality into Wetlands on the Swan Coastal Plain, WA. Draft report (School of Biological and Environmental Sciences), Murdoch University, Perth Western Australia.

Schmidt and Rosich, (1993) "Physical and Chemical Changes and Processes", in: Davis, J., Rosich, R., Bradley, J., Growns, J., Schmidt, L., Cheal F., (1993) Wetlands of the Swan Coastal Plain, Volume 6, Wetland Classification on the Basis of Water Quality and Invertebrate Community Data, Water Corporation of Western Australia and the Western Australian Environmental Protection Authority, Perth, Western Australia.

Seddon, G., (1972), Sense of Place, University of WA Press, Perth, Western Australia.

Stankey G and Wood J (1982) The Recreation Opportunity Spectrum: An Introduction - Australian Parks and Recreation.

State Planning Commission (1985), Improvement Plan No. 21 for Herdsman Lake, Perth, Western Australia.

Stephenson, G. Hepburn J (1955) Plan for the Metropolitan Region Perth and Fremantle Western Australia, Government Printer, Perth, Western Australia.

Teakle, L. and Southern, B., 1937, The Peat Soils and Related Soils of Western Australia. II, A soil survey of Herdsman Lake, Journal of Agriculture, Western Australia 1, Pg. 404-424.

Tingay and Associates, 1998, A Strategic Plan for Perth's Greenways, Final Report, Perth, Western Australia.

Thomas, M., Thomas, D., Wannell, H., Wannell, P., Robson, M., Wilkins, O., Muir, D., Muir, E. (1989) Along the Plank Road Through Njookenbooro to Scarborough Beach, Colourtype Press, Perth, Western Australia.

Tooby and Associates (1984), Herdsman Lake Recreation and Interpretation Plan, Prepared for Department of Conservation and Land Management, Perth, Western Australia.

Water and Rivers Commission, (1997), Perth Groundwater Atlas, Water and Rivers Commission, Perth, Western Australia.

Water Corporation, (1997), Herdsman Main Drain Scheme Review, Perth, Western Australia.

White, S.R., (1984), Herdsman Lake Wildlife Series No 1: The Great Fen of Metropolitan Perth, Gould League of Western Australia, Perth, Western Australia.

Wood & Grieve Consulting Engineers & Dr T. Riggert Consulting Ecologist, (Undated), Herdsman Lake - South East Section, Feasibility Report on Proposed Development Plan, Prepared for Metropolitan Region Planning Authority, Perth, Western Australia.

APPENDICES

Appendix A - Abbreviations used in this Plan

BRM	Basic Raw Materials
CAMBA	China Australia Migratory Bird Agreement
CS	City of Stirling
DCE	Department of Conservation and Environment
CALM	Department of Conservation and Land Management
DE	Department of Environment
DLI	Department of Land Information
DOIR	Department of Industry and Resources
DPI	Department for Planning and Infrastructure
DPUD	Department of Planning and Urban Development (now DPI)
DUP	Dual Use Pathway
EPA	Environmental Protection Authority
FESA	Fire Emergency Service Authority
ICOMOS	The International Charter for the Conservation of Monuments and Sites. The Burra Charter was adopted by the Australian ICOMOS in 1981.
JAMBA	Japan Australia Migratory Bird Agreement
LAA	*Land Administration Act (1997)*
MRPA	Metropolitan Regional Planning Authority
MRS	Metropolitan Region Scheme
RAOU	Royal Australasian Ornithologists Union
SPC	State Planning Commission
WAPC	Western Australian Planning Commission
WWF	World Wide Fund for Nature

Appendix B – CALM policies referred to in this Plan

Rehabilitation of disturbed land, Policy Statement No. 10

Weeds on CALM Land, Policy Statement No. 14

Community Involvement (Public Participation and Volunteers), Policy Statement No. 15

Recreation, Tourism and Visitor Services Policy Statement No. 18 [review in preparation]

Fire Management Policy, Policy Statement No. 19 [review in preparation]

Beekeeping on Public Land, Policy Statement No. 41 [review in preparation]

Radio/ Tele Communications Facilities, Policy Statement No. 49 [review in preparation]

Visitor Risk Management, Policy Statement No. 53

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