Thomsons Lake Nature Reserve

Draft Management Plan

2003

Conservation Commission

THOMSONS LAKE NATURE RESERVE

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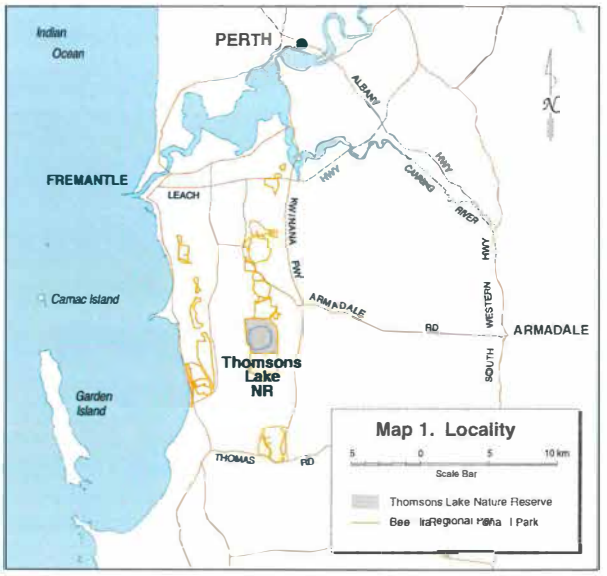
PART A: INTRODUCTION

Thomsons Lake Nature Reserve (Thomsons Lake) is a Class A reserve, of 551 hectares, gazetted for the purpose of 'Fauna Conservation and Research and Drainage'. Part of Beeliar Regional Park, it is located approximately 34 kilometres south-west of Perth in the City of Cockburn (Map 1).

The reserve is an internationally important habitat and refuge for water birds. In 1990, Thomsons Lake, together with Forrestdale Lake, was nominated for inclusion on the List of Wetlands of International Importance, known as the Convention on Wetlands (Ramsar, Iran, 1971). The reserve was also listed on the Register of the National Estate in 1978, and in 1997 the entire Regional Park was placed on the register's Interim List*. Thomsons Lake, Booragoon Lake and the Spectacles are three wetlands within Beeliar Regional Park that have been listed in the Directory of Important Wetlands in Australia.

Map 1 Locality



* If a site is registered on the Interim List of the National Estate, it has been publicly proposed for entry in the Register, and the Australian Heritage Commission may be awaiting any objections or seeking other data before making a decision on whether the place should be entered on the Register proper.

KEY VALUES

The outstanding key values of Thomsons Lake are those that contribute to its Ramsar listing. In its joint listing with Forrestdale Lake, Thomsons Lake satisfies three criteria for nomination to the Ramsar list:

1. internationally significant waterbird habitat which regularly supports more than one per cent of the individuals of the known Australian population of the long-toed stint;
2. it is of special value for maintaining the genetic and ecological diversity of the region because of the qualities and peculiarities of its flora and fauna; and
3. it is a particularly good representative of a natural or near-natural wetland, characteristic of those that were once widespread on the Swan Coastal Plain.

(Environment Australia 2001)

Other key values are:

4. rich Aboriginal heritage;
5. an array of natural and cultural values within close proximity to urban centres that provide significant opportunities for enriching learning experiences;
6. its importance for the protection of threatened and priority flora and fauna species; and
7. vegetation communities representative of those once widespread on the Swan Coastal Plain.

The main aim of this management plan is to protect these key values, by setting objectives and developing strategies to meet such objectives (Table 1).

REGIONAL CONTEXT

Thomsons Lake is one of 19 wetlands in Beeliar Regional Park and is the largest lake in the regional park's eastern chain of wetlands. Collectively the lakes form one of the most important wetland systems in the Perth metropolitan area. The reserve is part of Bush Forever Site 391 'Thomsons Lake Nature Reserve and Adjacent Bushland, Beeliar', which also includes Kogolup Lake to the north (State of Western Australia 2000a). Most areas in Beeliar Regional Park, including Thomsons Lake, are protected under the Metropolitan Region Scheme (MRS) by their Parks and Recreation reservation. The MRS provides the basis for most planning decisions throughout the Perth metropolitan region.

Adjacent land uses at Thomsons Lake include rural living blocks and urban developments to the east and north-west. The reserve, along with remnant vegetation and Conservation Category Wetlands located adjacent to it form part of a regionally significant contiguous bushland/wetland linkage as part of Beeliar Regional Park (State of Western Australia 2000). Bush Forever site 256 'Yangebup and Little Rush Lakes, Yangebup' is to the north, and site 392 'Harry Waring Marsupial

Reserve, Wattleup' is to the south. Both of these are also part of the regional park.

In addition to its nature conservation significance, Thomsons Lake is valued by the community as a place for nature appreciation close to urban areas. It also provides significant landscape and amenity value to the region while providing education and scientific research opportunities.

Beeliar Regional Park

Thomsons Lake is a part of Beeliar Regional Park, which is classed as 'regional open space' comprising land of multiple tenures and reserve purposes, with coordinated management by the Department of Conservation and Land Management (the Department).

Planning for regional parks occurs at a number of levels and while the directions for the management of Thomsons Lake are specified in the *Beeliar Regional Park Draft Management Plan* (2001), its Ramsar listing and conservation values require more specific management planning and direction. Hence the development of this area-specific plan that complements the strategies of the *Beeliar Regional Park Draft Management Plan* (2001) and provides specific details for the management of Thomsons Lake.

PART B: MANAGEMENT DIRECTIONS AND PURPOSE

VISION

The vision for Thomsons Lake Nature Reserve is:

... to be recognised for its international significance as a wetland providing refuge for both migratory waders and local waterbirds, and where natural, cultural (indigenous and other Australian) and aesthetic values are appreciated and protected. Natural systems and processes will be able to function and evolve, and the flora, fauna and habitats will be maintained in the same or better condition as they are today. The reserve will be managed in partnership with the community for its intrinsic values, as a refuge for wildlife and a safe place to be enjoyed by present and future generations.

LEGISLATIVE FRAMEWORK

Legislation

The management and planning for Thomsons Lake Nature Reserve is influenced by the following legislation:

The *Conservation and Land Management Act 1984* (CALM Act), which governs the declaration and management of protected areas, and imposes certain obligations relating to management planning of these areas.

The *Wildlife Conservation Act 1950* (Wildlife Conservation Act), which governs the specific protection of native flora and fauna on all lands and waters within the State.

Nature reserves are declared under the *Land Administration Act 1997*. They are vested in the Conservation Commission of Western Australia, and managed by the Department in accordance with the CALM Act, the Wildlife Conservation Act, and the policies of both the Department and the Conservation Commission. The Department's primary objective in the management of nature reserves, as defined in Section 56 of the CALM Act, is 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."

The Department's decision making, and subsequent management, is further guided by the principles of its *Corporate Plan (2002-2005)*, in particular:

- *"the diversity and health of ecological communities and native species throughout WA will be maintained and restored"; and*
- *"where there are threats of serious or irreversible damage, the lack of full scientific certainty shall not be used as a reason for postponing measures which seek to prevent loss of biodiversity".*

Environment Protection and Biodiversity Conservation Act 1999

The presence of the migratory birds protected under the Japan–Australia Migratory Bird Agreement (JAMBA) and the China–Australia Migratory Bird Agreement (CAMBA) at Thomsons Lake means that the site is given additional protection under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Migratory species are listed as one of six matters of national environmental significance that incite this Act, and so any actions likely to have a significant impact on the migratory species must first be subject to environmental assessment and approval.

Ramsar wetlands are protected under the EPBC Act, which requires environmental assessments and approval regimes for actions that have, or are likely to have, a significant impact on the wetlands. The Act also establishes standards for managing Ramsar wetlands through the Australian Ramsar Management Principles and specifies these standards as regulations (Environment Australia 2001).

OBLIGATIONS AND AGREEMENTS

Australia is a participant of, and signatory to, a number of important conservation agreements and policies. Many of these affect the management of conservation estate.

Convention on Wetlands of International Importance (Ramsar Convention)

Australia became a signatory to the Ramsar Convention in 1974. This Convention obliges contracting parties to formulate and implement management plans to promote the conservation of wetlands included in the List of Wetlands of International Importance.

Japan-Australia Migratory Bird Agreement (JAMBA)/China-Australia Migratory Bird Agreement (CAMBA)

Australia has signed treaties with Japan and China to protect migratory birds. The JAMBA and CAMBA treaties provide for cooperation between the respective governments to protect migratory species and their habitats. Nearly 80 bird species are listed under these Agreements, 21 of which have been recorded at Thomsons Lake (Burbidge 2002).

Wetlands Conservation Policy for Western Australia 1997

The Wetlands Conservation Policy for Western Australia is the result of the Government's recognition of the fundamental importance of conserving and managing wetlands in a sustainable manner. It outlines the Government's commitment to identifying, maintaining and managing the State's wetland resources, as well as the agencies involved and their responsibilities. This policy facilitated the establishment of a Wetlands Coordinating Committee, chaired by the Department of Conservation and Land Management, to coordinate the implementation of the policy.

PERFORMANCE ASSESSMENT

The Conservation Commission will measure the success of this plan by using the Key Performance Indicators (KPIs) that are identified in Table 1. The KPIs will also enable the Commission to gauge the success of this plan in protecting the identified key values and how these values have contributed to meeting the relevant strategies in the Department's *Corporate Plan 2002-2005*, viz.:

1. Recover threatened flora, fauna and ecological communities.
2. Protect biodiversity from threatening processes, agents and activities, including feral animals, weeds, dieback and other exotic diseases, salinity and inappropriate fire regimes.
3. Improve community knowledge of biodiversity conservation issues and awareness, understanding and support for the Department's activities, services and policies.
4. Partner with other agencies and groups with similar interests.

The Department is responsible for providing periodic reports to the Conservation Commission so it can assess the Department's success in meeting the KPIs. The frequency of these reports will depend on the requirements of each KPI, the satisfactory establishment of baseline information against which to audit, and any unforeseen changes to the environmental conditions. If the Commission determines, based on the KPIs, that the values of the planning area are being degraded, they may instruct the Department to:

1. alter its management to better address threats;
2. change the objective in this management plan where it is considered unrealistic; or
3. change the KPI where it is considered unrealistic.

The Department will invite public comment on any proposed amendments to its management of the nature reserve, where it is contrary to this management plan.

PART C: MANAGING THE NATURAL ENVIRONMENT

BIOGEOGRAPHY

The Interim Biogeographic Regionalisation for Australia (IBRA) provides a framework for conservation planning for a comprehensive, adequate and representative system of protected areas to conserve and protect Australia's terrestrial biodiversity. IBRA is a landscape-based approach to classifying the land surface from a range of continental data on environmental attributes. IBRA version 5 was developed by Environment Australia (2000), identifying 85 bioregions, based on lithology, geology, landform and vegetation. Each bioregion reflects a unifying set of major environmental influences, which shape the occurrence of flora and fauna and their interaction with the physical environment. Twenty-six bioregions occur in Western Australia.

Thomsons Lake is in the Swan Coastal Plain bioregion, a low-lying coastal plain, mainly covered with woodlands, which is dominated by *Banksia* or Tuart *(Eucalyptus gomphocephala)* on sandy soils, Swamp Sheoak *(Allocasuarina obesa)* on outwash plains, and paperbark in swampy areas. In the east, the plain rises and is dominated by Jarrah woodland, while the outwash plains, once dominated by *A. obesa* – marri woodlands and *Melaleuca* shrublands, are extensive only in the south (Environment Australia 2000). When this management plan was prepared, some 15.3 per cent of the Swan Coastal Plain bioregion was vested in the Conservation Commission of Western Australia. It is proposed under the draft Forest Management Plan (Conservation Commission of Western Australia 2002) that this will increase to 17 per cent, of which 0.04 percent will be represented in Thomsons Lake.

Thomsons Lake is one of four internationally important, and 29 nationally important wetlands in the Swan Coastal Plain bioregion (Environment Australia 2001).

GEOLOGY, LANDFORM AND SOILS

The geomorphic elements of Thomsons Lake are typical of the Swan Coastal Plain. Thomsons Lake is situated in the Perth Basin, on the Swan Coastal Plain, and occupies a depression between two sand dune systems - the Bassendean system to the east and the younger Spearwood system to the west. The junction of these dune systems is marked by the eastern chain of wetlands of Beeliar Regional Park, of which Thomsons Lake is the largest (Department of Conservation and Land Management 2001).

The two dune systems have occurred as a result of accumulation and subsequent distribution of beach sands of successive shorelines. The major factors influencing their formation are thought to be a series of marine transgressions and prevailing westerly winds.

The soils of Thomsons Lake are considered infertile. The Bassendean sands are highly leached grey quartz sands characterised by excessively drained ridges and very poorly drained interdunal swales, whereas the Spearwood dunes are younger, less leached and with higher, more rolling relief. The soils are yellow to brown and, within Thomsons Lake, correspond with the soils of the Karrakatta soil/landform unit, described as "undulating landscape with deep yellow sands over limestone" (Crook and Evans 1981).

There are no major threats to the soils or landforms of the nature reserve because active recreation is restricted and the presence of a vermin-proof fence, which prohibits access by trail bikes, horses and the like.

CATCHMENT AND WATER PROTECTION

Hydrology

Thomsons Lake is a surface expression of groundwater, with an area of open water covering approximately 151 hectares, or 27 per cent of the total nature reserve, when full. It is one of 12 Ramsar sites in WA and one of only four within the Swan Coastal Plain bioregion. The ability of the lake to support waterbird populations is dependent on the presence and quality of water, both of which are directly affected by surrounding land use practices and groundwater management.

Lake water levels respond to events that cause variations to the quality and quantity of groundwater supply such as rainfall and modified land uses within catchments, including groundwater extraction and urban development. In order to protect the wetland ecosystem and the values that contribute to the reserve's Ramsar listing, the impacts of existing and proposed land uses need to be understood and managed.

The eastern chain of wetlands of Beeliar Regional Park, which includes Thomsons Lake, is located on the western edge of the Jandakot Groundwater Mound (JGM). There is a complex series of groundwater flows into the wetlands, generally in a westerly direction from the mound.

Thomsons Lake, along with Kogolup Lake to the north, is subject to a drainage management plan – the Southern Lakes Drainage Scheme. The drainage scheme was developed with the Environment Protection Authority's (EPA) approval, as an environmental condition of an MRS rezoning of land to the east of Thomsons Lake from rural to urban-deferred. It diverts stormwater from nearby urban areas away from Thomsons and other lakes, in order to minimise changes to their water levels and protect them from nutrient loading. The scheme also controls the maximum water levels of the lake (Department of Conservation and Land Management 2001).

Long-term groundwater levels, and hence lake water regimes, are controlled by long-term climatic conditions, and continually change as the climate does. As Perth's climate has become increasingly drier since the 1970s, groundwater levels

on the Jandakot Mound have progressively decreased, thereby increasing pressure on groundwater supply. Other factors contributing to pressures on the groundwater include water abstractions and the influence of drainage on the wetlands.

Management of water resources on the JGM is the responsibility of the Department of Environment (DoE) which, as WA's primary water resources manager, is responsible for the conservation, protection and management of water resources within and surrounding the reserve. However, as the Department of Conservation and Land Management manages the nature reserve, there are overlapping responsibilities with the DoE for the management of Thomsons Lake. The Water Corporation is responsible for monitoring water levels in the lake as an environmental condition for the development of the Southern Lakes Drainage Scheme.

As part of the *Wetlands Conservation Policy for Western Australia 1997*, a Wetlands Coordinating Committee was established, with representatives from various agencies and community conservation groups. This Committee is chaired by the Department of Conservation and Land Management and will act as a forum for information exchange regarding the management of Thomsons Lake, in particular water level regimes and water quality.

Water levels

Groundwater and, subsequently, wetland levels on the JGM have been under considerable pressure over recent years due to a combination of dry climate, groundwater abstractions reaching management limits, and the influence of drainage on the wetlands (Water and Rivers Commission 2001). Lake water levels respond to events that cause variations to the quantity of groundwater supply, such as rainfall and modified land uses within catchments (including groundwater extraction and urban development). In order to protect the wetland ecosystem and values that contribute to the reserve's Ramsar listing, the impacts of existing and proposed land uses need to be understood and managed. To ensure that waterbird habitats are protected, it is important that the lake's water level continues to be monitored, and that management strategies are implemented to maintain suitable water levels.

Environmental Water Provisions (EWPs), including the preferred minimum water level and an absolute minimum level, have been set for Thomsons Lake to ensure its habitat value for migratory birds is maintained. The EWPs are in place to 'protect the ecological character of the lake and in particular its significance as waterbird habitat'. The statutory preferred minimum water level of Thomsons Lake is 11.3 metres Australian Height Datum (AHD), with an absolute minimum of 10.8 metres AHD.

In 1992, environmental conditions were set for the JGM under Section 46 of the *Environmental Protection Act 1986*. These Ministerial conditions are being reviewed after breaches occurred at a number of sites (although not at Thomsons Lake).

In an attempt to prevent future breaches on the mound, the DoE requested that the Minister for the Environment review the existing conditions. Stage II of that review is currently underway and will include a review of environmental criteria, climate variability, long-term groundwater level behaviour and abstraction management. The review will propose revised environmental conditions for the groundwater mound, which, once set, should be incorporated into this management plan.

Water levels in Thomsons Lake are monitored by the Water Corporation as an environmental condition for the development of the Southern Lakes Drainage Scheme. Maximum and minimum levels have been set, and frequency criteria have been applied at Thomsons Lake to allow for both extreme rainfall fluctuations, and for the wetland to continue a hydrological regime consistent with historical records (Ecoscape 1997).

Water Quality

A number of factors influence the water quality of Thomsons Lake, particularly surrounding land use practices, and the runoff from these into the groundwater. Nutrient levels in the lake should be maintained within a range that will minimise adverse effects on waterbirds, riparian vegetation and invertebrates and macroinvertebrates.

Water quality within the lake is monitored by the Water Corporation as an environmental condition for the development of the Southern Lakes Drainage Scheme.

The appropriate management of adjoining land and vegetation is of major importance for the effective conservation of all wetland types. Threats to wetland values can be mitigated by vegetative or other buffers, which assist in reducing water runoff from surrounding land, provide a physical barrier that slows surface flow rates and traps sediments and nutrients, act as corridors for native fauna and reduce the impact of pest insects. Buffers surrounding wetlands that consist of vegetated areas are vital in maintaining the health of the system and habitat diversity (Bowen *et al.* 2002).

The control of diffuse sources of pollution is one of the major issues of wetland management. The use of buffers or setbacks to prevent pollutants entering systems has been widely researched and is a recommended strategy for wetland management.

NATIVE ANIMALS AND HABITATS

Thomsons Lake is especially significant as a wetland habitat. It regularly supports more than 10,000 waterbirds, including 21 species protected under JAMBA and CAMBA and two terrestrial species that are listed under the Wildlife Conservation Act 1950 – Carnaby's cockatoo *(Calyptorhynchus latirostris)* and the peregrine falcon *(Falco peregrinus)*. Carnaby's cockatoo is listed in Schedule 1 (Fauna which is Rare or likely to become extinct) and the peregrine falcon, which has been recorded in many parts of the metropolitan area and may occur in the

nature reserve, is listed in Schedule 4 (Fauna which is Otherwise Specially Protected) (Threatened and Priority Fauna Database 2003).

In total, 136 bird species have been recorded in the reserve, including 69 species of waterbirds (Burbidge 2002). Three 'habitat specialists with a reduced distribution on the Swan Coastal Plain (birds)' and seven 'wide-ranging bird species that have reduced populations on the Swan Coastal Plain' (State of Western Australia 2000a) have also been recorded within the reserve.

The reserve supports the quenda *(Isoodon obesulus fusciventer)*, a Priority 4 species on the Department's Priority Fauna List, as well as the western grey kangaroo *(Macropus fuliginosus)* and the brush-tailed possum *(Trichosurus vulpecula)*. Seven species of frogs, 12 lizard species, three species of snake and one tortoise, the long-neck tortoise *(Chelodina oblonga)* have also been recorded in Thomsons Lake. Several fauna 'underpasses' have been installed under the vermin-proof fence at Thomsons Lake, to enable the passage of tortoises in and out of the reserve, and between Thomsons and Kogolup Lakes.

Exposed mudflats around the lake are essential habitat and feeding ground for migratory waders. To ensure the continued presence of such birds at Thomsons Lake, it is essential that the amount of *Typha orientalis* and, where appropriate, native emergent rushes and sedges be controlled to prevent encroachment too far onto the lakebed. This will ensure that exposed mudflats remain available for utilisation by wading birds.

Migratory Waders

Thomsons Lake is an internationally important habitat for 21 migratory waders that use the lake on a seasonal basis. The most abundant of these species (with their maximum numbers recorded shown in brackets) are the red-necked stint and the curlew sandpiper (2,500 individuals each), and the sharp-tailed sandpiper (1,000 individuals). The next most abundant species are the wood sandpiper (45 individuals) and the common greenshank (40 individuals) (Burbidge 2002).

Invertebrates and Macroinvertebrates

Thomsons Lake supports a variety of invertebrate fauna including water fleas *(Daphnia)*, midges *(Chironomidae)* and the freshwater shrimp *(Palaemonetes australis)*, which are an important component of the food web and are major sources of food for many species such as waterbirds and tortoises (Department of Conservation and Land Management 2001).

Macroinvertebrates are also an essential component of wetland food webs, comprising much of the diet of waterbirds and waders and may act as indicators for the assessment of wetland health (Davis *et al.*, 1993). A study conducted between 1996 and 2003 identified 37 macroinvertebrate taxa in Thomsons Lake, comprising two annelids, two molluscs, eight crustaceans, five

arachnids and 20 insect taxa (Wild *et al.* 2003).

NATIVE PLANTS AND PLANT COMMUNITIES

Thomsons Lake supports a diverse range of vegetation communities and flora characteristic of the original dune systems and wetlands of the Swan Coastal Plain. Four of the 43 floristic community types and subtypes of the southern Swan Coastal Plain, as identified by Gibson *et al.* (1994), are represented in the reserve: Community Type 11 Wet forests and woodlands; Community Type 12 *Melaleuca teretifolia* and/or *Astartea* aff. *fascicularis* shrublands; Community Type 24 Northern Spearwood shrublands and woodlands; and Community Type 28 Spearwood *Banksia attenuata* or *B. attenuata* – *Eucalyptus* woodlands (State of Western Australia 2000a).

Keighery (1999) surveyed the vascular flora of Thomsons Lake and identified 491 taxa, including 360 native and 131 introduced species. Thomsons Lake contains 89 per cent of the 406 native taxa identified in Beeliar Regional Park by Keighery (1996). No species of Declared Rare Flora (DRF) have been recorded within either Thomsons Lake, or the remainder of the regional park (Department of Conservation and Land Management 2001). The reserve does, however, contain one significant flora species: *Dodonaea hackettiana*, a Priority 4 species (Rare Taxa)*. One other species, *Lysinema elegans*, is a significant population endemic to the Swan Coastal Plain and is considered to be poorly reserved (State of Western Australia, 2000a).

When this management plan was prepared, the reserve had not been assessed for Threatened Ecological Communities. This has been addressed in this management plan.

ENVIRONMENTAL WEEDS

Environmental weeds are plants that establish themselves in natural ecosystems and proceed to modify natural processes, usually adversely, resulting in the decline of the communities they invade. Weeds displace indigenous plants, particularly on disturbed sites, by competing with them for light, nutrients and water. Some of their other impacts include the prevention of seedling recruitment, changes to soil nutrients, and changes to the abundance of indigenous fauna. They can also have a significant adverse impact on other conservation values by altering animal habitats, harboring pests and diseases, and increasing fire hazard or changing fire regimes.

An integrated approach to environmental weed management was developed in the *Environmental Weed Strategy for Western Australia* (Department of Conservation and Land Management

* Priority 4 species (Rare Taxa) are those which are considered to have been adequately surveyed and which, while being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every five to 10 years.

1999), and further supported by the Department's *Policy Statement 14 – Weeds on CALM Land*. As the inter-relationship between soil disturbance, weed invasion and native plants is complex, weed control should be undertaken in a strategic and integrated manner with guidance from the *Environmental Weed Strategy for WA*, and the weed management plan proposed for Beeliar Regional Park (Department of Conservation and Land Management 2001). Rehabilitation of areas following weed removal is important to prevent re-invasion of weed species.

Keighery (1999) identified 131 exotic plant species within Thomsons Lake Nature Reserve. As rated in the *Environmental Weed Strategy for WA*, there are 15 High impact species, 57 Moderate, 14 Mild, 35 Low, and 10 species that are either unlisted or not rated. Introduced bulrush *(Typha orientalis)* and pampas grass *(Cortaderia selloana)* (both rated High) pose the greatest threat to native vegetation in the reserve. To date, a control program has been implemented to remove pampas grass, arum lily *(Zantedeschia aethiopica)*, cape tulip *(Homeria flaccida)* (all rated High), fig *(Ficus carica)* (Moderate) and castor oil plant *(Ricinus communis)* and thistle *(Silybum marianum)* (Low).

Priorities for weed control within the reserve are determined based on the principles and rankings of the statewide weed strategy, as well as their potential impacts on biodiversity at a local level. Also taken into consideration are other local concerns such as ongoing maintenance to limit the return of species previously removed, and pressures from neighbouring landowners to remove particular species.

The *Beeliar Regional Park Draft Management Plan* (2001) identifies the presence of weeds as a major problem and a threat to conservation values. Couch *(Cynodon dactylon)*, buffalo grass *(Stenotaphrum secundatum)* and kikuyu *(Pennisetum clandestinum)* (all rated Moderate) are impacting on the local wetland fringe vegetation at Thomsons Lake and introduced bulrush is invading the emergent native vegetation.

Introduced bulrush, an aggressive colonizer in disturbed environments, has the potential to further significantly reduce the area of open water and is a major management issue. Furthermore, as the lake dries in summer, the bulrush dries off presenting a significant fire hazard. The colonisation and spread of *Typha orientalis* around Thomsons Lake has the potential to significantly displace and change fringing vegetation and hence alter waterbird habitat. It does however, provide shelter and nesting sites for birds and other wildlife so its complete removal needs to be carefully considered.

It is important that soil being imported into the reserve (e.g. for landscaping and rehabilitation) is free of both weed seeds and *Phytophthora cinnamomi*.

A proposed Weed and Rehabilitation Plan for Beeliar Regional Park will provide further direction for weed control within Thomsons Lake Nature Reserve.

INTRODUCED AND OTHER PROBLEM ANIMALS

Problem animals are those species, both native and introduced that have become established as wild or naturalised populations and could potentially have a serious impact on natural systems through direct effects such as predation on native animals, habitat destruction, competition for food and territory, introduction of disease, and through environmental degradation by selective grazing. One of the Department's primary operational objectives is to achieve the systematic and safe control or eradication of introduced and problem animals according to agreed priorities that depend on:

1. the impact of the animals;
2. the efficiency and effectiveness of control measures;
3. participation of other stakeholders; and
4. the capacity for long term monitoring of the population.

Predation by foxes has, in the past, been identified as a threatening process for the breeding waterbirds and other native fauna within the reserve (Mawson 2002). In 1993 a vermin-proof fence was constructed around Thomsons Lake, to enable a fox eradication program to be implemented within the nature reserve. Since its construction, foxes have been subjected to an ongoing baiting program within the boundary of the fence, and as a result, are presumed to be present only in very small numbers, if at all. Feral cats, however, are still present in the reserve, and the extent of their impact is currently unknown. The potential of such animals to prey on waterbirds, particularly hatchlings, is a significant concern.

The Beeliar Regional Park Draft Management Plan (2001) recommends that management agencies determine the extent and impact of introduced animals within the park and implement control options where appropriate.

In some instances native fauna can also have negative impacts on their environment. Thomsons Lake Nature Reserve has a population of western grey kangaroos *(Macropus fuliginosus)* confined within the vermin-proof fence. Before the fence was constructed in 1993, it was estimated that the kangaroo population was approximately 20 – 30 animals. A survey in April 2002 by Mawson (2002) counted 141 animals, comprising 67 adult males, 10 juveniles and 64 adult females and sub-adults. This is far in excess of the reserve's natural carrying capacity that is estimated to be no more than 25 animals. Consequently, vegetation within the reserve is being overgrazed and flora values degraded.

The Department, together with the Conservation Commission, are considering a number of management options for the purposes of reducing the impact of kangaroos at Thomsons Lake and for the welfare of the animals:

1. Reduce the kangaroo population to a sustainable level by either translocation or culling.

2. Remove the entire population of western grey kangaroos, with the possibility of reintroducing an alternative macropod species of higher conservation significance that once inhabited the area, such as the western brush wallaby *(Macropus irma)* and/or the quokka *(Setonix brachyurus)*.

Reducing the population by translocating kangaroos to another site is a costly method of population reduction and control, and can cause significant stress on the animals, usually resulting in a high mortality rate (approximately 10 per cent in adult males) from capture myopothy. Translocating kangaroos to new locations can also cause increased competition for resources with local populations, and can also result in the relocated kangaroos dispersing into areas that may offer lower security and/or result in them being involved in traffic accidents.

Reducing the population by culling (using a licensed professional shooter) is a humane method of population control, whereby animals are not subjected to any stresses from capture and handling, and there are no adverse impacts from releasing them into a new environment.

DISEASES

Disease caused by *Phytophthora*

The most significant disease threat to plants within the reserve is *Phytophthora* dieback, caused by the microscopic pathogen *Phytophthora cinnamomi*. It is thought that this pathogen was introduced during European settlement of Western Australia through the soil around roots of plants that were imported for cultivation. There are now known to be eight species of *Phytophthora* occurring within the native plant communities of Western Australia, of which, *P. cinnamomi* is recognised as the most damaging. Once infected, susceptible plants are killed and, in many cases, species are eliminated from the site. This could lead to dramatic and permanent changes to native plant communities and their dependent fauna.

The disease is considered to be a significant threat to the entire Beeliar Regional Park, given that the existing upland plant communities contain a number of susceptible species, namely jarrah, banksias and grasstrees. Limited sampling was undertaken at Thomsons Lake in 1998 as part of the construction of the Southern Lakes Drainage Scheme. The findings show that part of the north-east section of the reserve is affected by dieback (Hart, Simpson and Associates 1998).

The risk of impact from the disease can be reduced by modifying activities that spread the pathogen, and by controlling access to highly susceptible areas. It is equally important to ensure that soil imported into the reserve is free of *Phytophthora*.

The prevention of further spread of *P. cinnamomi* into uninfected areas, as well as the minimisation of spread within and from existing infections, are key management issues. Maher Brampton Associates (2001) identify horseriding as a potential contributing factor to the introduction and spread of *P. cinnamomi* in Thomsons Lake. However horseriding is restricted to one designated bridle trail outside of the fence that surrounds the majority of the nature reserve, which in effect, limits the possibility of horses spreading the pathogen within the reserve. Other measures such as appropriate hygiene controls and practices should also be undertaken to prevent any human induced spread of *P. cinnamomi*.

It is recommended that surveys for *P. cinnamomi* be conducted in any given area every three years (P. Collins, *pers. comm.*). The last survey at Thomsons Lake was conducted in 1998, and it is recommended that a survey of the entire nature reserve be undertaken as per the recommendations of this management plan.

FIRE

Wildfire is a significant threat to both adjoining properties and to the natural and cultural values of the reserve. Large infestations of introduced bulrush *(Typha orientalis)* are fire hazards because fires in bulrush are difficult to control and can cause damage to fringing vegetation. Frequent wildfire in wetland areas will also prevent the establishment of paperbark vegetation and will lead to an even greater domination of the introduced bulrush. Fire activity also encourages the invasion of *T. orientalis* in wetland areas because it regenerates more rapidly than local rush species (Department of Conservation and Land Management 2001).

The Department, in conjunction with the City of Cockburn, is the Hazard Management Authority for fire suppression in Thomsons Lake. In the instance of fire, initial dispatch of fire fighting resources will be coordinated by the Fire and Emergency Services Communications Centre, which notifies the Department and local brigades. Pre and post-suppression works is the Department's responsibility.

The Department, in conjunction with the City of Cockburn and Fire and Emergency Services Authority (FESA), has prepared a *Fire Working Arrangements and Suppression Response Plan* for Beeliar Regional Park (2002), to ensure unplanned fires are responded to by the responsible agency. The plan includes a Response Plan specific to Thomsons Lake that contains information about the area such as values at risk by fire, hazards for firefighters, access points, dispatch requirements, emergency contacts and six major strategies for fire suppression.

Selective prescribed burning will be used where appropriate for the protection of reserve values, to enhance biodiversity, or for the protection of adjoining properties, provided there is no significant impact from fire on the reserve's flora and fauna.

PART D: MANAGING OUR CULTURAL HERITAGE

INDIGENOUS HERITAGE

Research indicates that at the time of colonisation, three Aboriginal clans occupied Perth, one of which was the Beeliar clan (Seddon 1972). The wetlands of the eastern and western chain of what is now Beeliar Regional Park, including Thomsons Lake, were part of the Beeliar District, which extended south of the Swan River.

Beeliar Regional Park is significant to the local Aboriginal people, as parts of it were important camping and food source areas (Polglaze 1986). The eastern chain, and hence Thomsons Lake, is said to have been part of a major trade route between Aboriginal people in the Swan and Murray River areas. The lakes of Beeliar Regional Park also hold importance as spiritual and mythological locations, and according to Polglaze (1986), the wetlands "provide an important link to the natural context, cultural traditions, spiritual life and history of the Aboriginal people of the Swan Coastal Plain".

According to Nyungar tradition, wetlands, waterways and lakes, including Thomsons Lake, are said to be the home of the powerful water serpent figure, the Waugal. The Waugal is spiritually and mythologically important to Aboriginal people who believe that it created rivers and lakes, and maintains the flow of waters that feed its resting places. According to Nyungar beliefs, these places are described as *winnatch*, (a place of great religious significance) and consequently require the highest respect and reverence in the way they are considered used and valued.

It is critical to note that in relation to Nyungar cultural values, this respect and reverence goes beyond the spiritual, and is linked inextricably with environmental integrity. According to Nyungar tradition, the respect and reverence required by a place such as Thomsons Lake requires a level of awareness and acknowledgement of responsibility from visitors and other users that ensures the ongoing protection and good health of the system (G. Kelly, *pers. comm.*).

The conservation of indigenous heritage is important in maintaining the identity, health and well being of indigenous people (Australian Heritage Commission 2002). In Western Australia, the *Aboriginal Heritage Act 1972* (Aboriginal Heritage Act) protects places and objects customarily used by, or traditional to, the original inhabitants of Australia. A register of such places and objects is maintained under the Act, however, all sites are protected under the Act whether they have been entered on the register or not.

Three sites within the nature reserve are listed on the Department of Indigenous Affairs' Register of Aboriginal Sites, all of which are protected under the Aboriginal Heritage Act.

A key management issue is to ensure that Aboriginal sites are protected from damage, and that obligations are fulfilled according to the Aboriginal Heritage Act and the Commonwealth *Native Title Act 1993*, before any planning or public works occurs.

NON-INDIGENOUS HERITAGE

The first colonial settlement of the Cockburn district was in 1830. Initial settlement had little influence on the wetland areas south of the Swan River. However in the late 1800's when the state's population trebled as a result of the goldrushes, market gardens were established on the land surrounding the wetlands. This resulted in vast areas of land being cleared and a once complex network of wetlands drained extensively for agriculture (Drake and Kennealy 1995).

At Thomsons Lake, a proposed grazing lease was rejected in 1954 based on the area's value as habitat for native fauna, and in 1955 the reserve's purpose was changed from 'Drainage' to 'Drainage and Conservation of Fauna'. During this time, and into the 1960s, the as yet unvested reserve was being used by adjoining landholders for cattle grazing and the vegetation was being cut for firewood, with both practices having an impact on the reserve's vegetation.

Land was excised from the reserve in 1962 for a prison site and again in 1969 for The University of Western Australia's Marsupial Breeding Station. The development of land around the reserve mainly occurred during the 1960's, and by 1968, most of the private land to the east and south-west had been subdivided (Crook and Evans 1981).

The managing agency at the time, the Department of Fisheries and Fauna, sought vesting of the reserve. This was agreed to on the proviso that the lake could still be used as required for drainage purposes. So in 1969 the reserve was vested in the then WA Wildlife Authority for its current purpose of Fauna Conservation and Research and Drainage (Crook and Evans 1981).

Since then, Thomsons Lake has become increasingly popular with the local community as a place for nature appreciation, in particular birdwatching and bushwalking, two of the main activities within the reserve. The area is also popular for horseriding, which occurs only outside of the vermin-proof fence.

PART E: MANAGING VISITORS

VISITOR OPPORTUNITIES

Management plans for nature reserves provide for the conservation and restoration of the natural environment, the protection, care and study of indigenous flora and fauna, and the preservation of any feature of archaeological, historic or scientific interest. The Department's draft *Policy Statement 18 – Recreation, Tourism and Visitor Services* outlines the Department's principles, operational guidelines, procedures and administrative controls in relation to facilitating recreation and tourism on Departmental managed lands and waters. This management plan follows the policies outlined in draft Policy Statement 18 where applicable.

The location of Thomsons Lake in a developing urban area makes it a valuable place for the local community to undertake passive recreation in a natural environment. The natural values of the reserve provide opportunities for nature appreciation, bird watching, bushwalking and environmental education.

A Development Concept Plan was prepared for Thomsons Lake Nature Reserve and Harry Waring Marsupial Reserve in 1991 that advocated a number of viewing platforms and boardwalks be erected around the lake. However, this management plan recommends that facilities are kept to a minimum, and that one, possibly two, viewing platforms should be sufficient to meet visitor demand over the life of the plan.

The Beeliar Regional Park Recreation Masterplan, as shown in the *Beeliar Regional Park Draft Management Plan* (2001) proposes a designated bridle path around the entire external perimeter of the vermin-proof fence that surrounds Thomsons Lake Nature Reserve. The proposed trail is essentially an upgrade of the existing informal trail. The Masterplan also proposes a dual-use path on the eastern, northern and part of the western perimeter of the reserve (Map 2).

The *Beeliar Regional Park Draft Management Plan* (2001) states that any recreational activities and/or commercial uses within the park should be compatible with the assigned purpose of the different reserves. It also states that commercial activities should not be located in areas of the park designated as Conservation and Protection, such as Thomsons Lake. As such, commercial uses are not permitted at Thomsons Lake, because it is not consistent with either the purpose of the nature reserve or the management zones designated in the draft management plan for Beeliar Regional Park.

VISITOR ACCESS

Access within Thomsons Lake is provided for a limited number of recreational uses, as well as for management and emergency vehicles. It is largely restricted by the existence of the vermin-proof fence around the reserve.

While the firebreaks and management access tracks form an informal network of walk trails within the reserve, they currently have little or no directional signs for visitors. Installation of such signs would be valuable to assist visitors with navigation and provide visitor safety, particularly in the event of fire. Directional signs should be installed in accordance with the Sign System for Regional Parks.

Most visitors arrive at the reserve by private vehicles or by walking. The main visitor access to Thomsons Lake is on Russell Road (Map 2). This entrance is currently informal and undeveloped and could be upgraded by incorporating information, direction and interpretation signs, which in turn may assist in management of the reserve. The construction of a deceleration lane on Russell Road to create a safer entrance into the reserve could also be considered.

VISITOR USE

Although Thomsons Lake is primarily reserved for nature conservation, passive recreation that does not impact on natural values or ecosystems of the reserve is permitted. Birdwatching, bushwalking and horseriding are the main visitor activities at Thomsons Lake.

Birdwatching

Considering the importance of Thomsons Lake as waterbird and shorebird habitat, it is not surprising that it is a popular destination for birdwatchers, and that birdwatching represents one of the main visitor activities at the site. Bushbirds within the nature reserve are also valued by birdwatchers. To date, no facilities have been provided within the reserve to facilitate this use, which has been addressed through this planning process.

Bushwalking

Bushwalking is a popular pursuit on the trails within Thomsons Lake Nature Reserve. There is a well-established network of walking trails that utilise firebreaks and management access tracks. These would benefit from improved marking and some interpretation signs.

Horse Riding

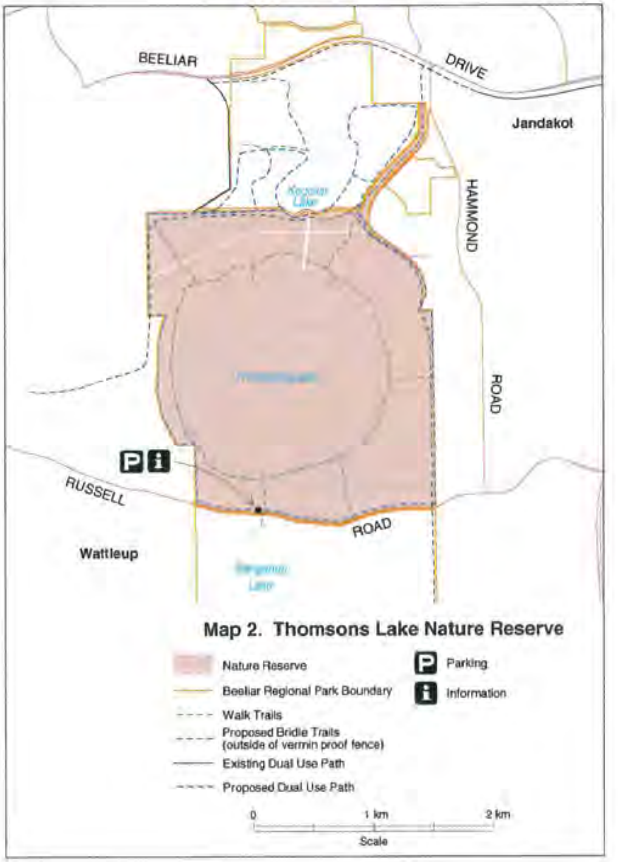
Horseriding is an historical use in the Thomsons Lake area, having being a popular recreation pursuit for at least 40 years. The Department of Conservation and Land Management's draft *Policy Statement 18 - Recreation, Tourism and Visitor Services* (2002) states that horseriding will generally not be permitted in nature reserves (section 2.7.2). However, section 2.7.4 states that an activity may be permitted where it has been previously allowed and the impacts of the activity can be minimised and controlled. This applies to horseriding at Thomsons Lake, where it is only permitted on a narrow trail on the outside perimeter of the vermin-proof fence. The activity will therefore be allowed to continue because the impacts can be controlled.

Most horses that are ridden in the nature reserve come from two nearby horse hire operators. These operators are currently accessing areas of Beeliar Regional Park without licenses, however, the *Beeliar Regional Park Draft Management Plan* (2001) proposes that their activities will soon be regulated and their area of use restricted. License conditions will enable riding trails to be closed if erosion, disease or degradation of vegetation occurs. Such conditions will apply to the current and proposed trails around Thomsons Lake. Riding outside of the designated trails is considered to be incompatible with the area's values and will not be permitted. The *Beeliar Regional Park Draft Management Plan* (2001) identifies a proposed dual use path on the outside perimeter of the reserve, which connects Thomsons Lake to Kogolup Lake in the north and The Spectacles to the south. Adjacent to this proposed path is a proposed bridle trail that links Thomsons Lake to Kogolup Lake.

Education

Thomsons Lake Nature Reserve provides an array of opportunities for education, and is popular with school and community groups, particularly with relation to learning about wetland ecology, as well as flora and fauna and Indigenous heritage. As per the *Beeliar Regional Park Draft Management Plan* (2001), a communication program will be developed for the regional park, which will include an education component. The Cockburn Wetlands Education Centre also plays an important role in environmental education within the regional park, which includes Thomsons Lake.

Map 2: Thomsons Lake Nature Reserve - Access



PART F: MANAGING SUSTAINABLE RESOURCE USE

SCIENTIFIC RESEARCH AND USE

Research is included in the purpose for Thomsons Lake Nature Reserve. There are many opportunities for research within the reserve, for which it is an important and valuable site. This includes studies of the lake's water quality and levels, groundwater interaction, invertebrates, waterbirds, and of terrestrial flora and fauna. Murdoch University has undertaken research at Thomsons Lake into the macroinvertebrate community structure, which can be used as an indicator of wetland health. Ongoing research by universities and other groups should continue to be encouraged and supported by the Department.

Ideally, it would be appropriate for research and monitoring programs to involve a wide range of people and groups. The involvement of volunteers, educational institutions and individual researchers can reduce the costs of such programs and assist in providing information to both management and the broader community. It is important that all research undertaken in the reserve is coordinated by the Department, to ensure an integrated approach that avoids duplication and enables prioritising of projects.

REHABILITATION

The requirement for rehabilitation of lands managed by the Department derives from either an inherited situation in which disturbance occurred in the absence of any commitment to rehabilitate, or as part of a planned management program. Rehabilitation may be required following addition of lands to the parks, gravel pit working, road works, recreation site closure or redevelopment, or activities associated with fire suppression.

The Department's *Policy Statement No. 10 - Rehabilitation of Disturbed Land* provides guidelines for the rehabilitation of lands managed by the Department based on the following principles:

1. Land should be managed as far as possible to avoid disturbance.
2. Rehabilitation should be the last option in a series of management decisions designed to protect environmental values.
3. Rehabilitation should aim to restore original values and help to enhance all potential uses provided the priority uses are not adversely affected.

Only local native species, which are free of *P. cinnamomi* should be used for rehabilitation purposes. Rehabilitation of areas fringing the lake will be given high priority, as required by the *Beeliar Regional Park Draft Management Plan* (2001).

PART G: INVOLVING THE COMMUNITY

INFORMATION, EDUCATION AND INTERPRETATION

Thomsons Lake provides a valuable opportunity to improve community awareness about wetland ecosystems and the values of Ramsar listed wetlands. An effective information, education and interpretation program is vital to achieve the vision and objectives of maintaining, enhancing and communicating reserve values. The program will concentrate on raising awareness about the reserve's conservation values, the Ramsar Convention, potential human impacts, and the positive action visitors can take to support management of the reserve and other wetlands.

A Communication Strategy has been prepared for Perth's eight regional parks, including Beeliar Regional Park. The aim of the strategy is to promote the conservation and enjoyment of regional park values. It outlines interpretive themes (messages) for the regional park network, including park specific themes and management messages.

Following this, an Interpretation Plan for Beeliar Regional Park will be prepared to guide the development and implementation of interpretation facilities for specific areas within the park, including Thomsons Lake. The plan will identify opportunities for interpretation signs and facilities, and locations for these within the nature reserve.

Existing interpretation facilities within Thomsons Lake are limited, which will be addressed in the above-mentioned Interpretation Plan for Beeliar Regional Park. Given the importance of the site as waterbird habitat and its international recognition, high priority could be given to upgrading reserve signs for the purpose of public interpretation and education, thus assisting in achieving management objectives.

WORKING WITH THE COMMUNITY

Community involvement is an integral component of the Department's operations. Community groups and individuals are encouraged to be involved in the planning, management and communication of many of the Department's activities.

The community has been involved in preparing this Draft Management Plan by providing written comments on issues within the parks. In particular, the Beeliar Regional Park Community Advisory Committee has advised the planning team throughout the preparation of this plan.

Community members and organisations are able to comment on this Draft Management Plan either by written submission or by making a submission on the Department's webpage (http://www.naturebase.net/cgi-bin/participate/plancomment.pl).

Ongoing community support is essential for the successful implementation of the final management plan. Community groups are encouraged to take part in volunteer activities at the reserve such as waterbird surveys, water monitoring, rehabilitation and interpretation and education.

PART H: MONITORING AND IMPLEMENTING THE PLAN

The effectiveness of this management plan will be reviewed periodically through a formal auditing process. These audits will include reports on the status of the reserve's key values using KPIs (see Performance Assessment) and an assessment of the effectiveness of current management strategies, as well as providing feedback to the Department's District Manager, Swan Coastal District. The KPIs for the Thomsons Lake Nature Reserve Management Plan are listed in Table 1.

TERM OF THE PLAN

In accordance with the CALM Act, the term of this plan is for a period of 10 years from the date the plan is approved by the Minister for the Environment. At the end of the 10-year period, the plan may be reviewed with full public consultation and then re-submitted to the Minister for approval. The CALM Act also specifies that in the event of such a revision not occurring by the end of the plan's specified life span, the plan will remain in force in its original form, unless it is either revoked by the Minister or a new plan is approved.

The Conservation Commission may initiate a review of the management plan before the 10-year term expires. Should significant changes to this plan be required, public comment on the proposed amendments will be sought.

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KEY POINTS and OBJECTIVES

CATCHMENT AND WATER PROTECTION

Water levels

- Thomsons Lake is a surface expression of groundwater that has formed where the water table intersects with the ground surface. Therefore, management of the lake's water levels involves management of the regional groundwater system
- Water entering the lake comes mainly from rainfall, and in periods of little rainfall the lake's water level decreases significantly.
- The Southern Lakes Drainage Scheme controls the maximum water levels of the lake by diverting stormwater from nearby urban areas away from Thomsons Lake.

Objective

To maintain a water level regime that supports the lake's water-dependent ecosystems and meets the needs of the range of waterbirds that use the lake.

Water Quality

- Water quality within the lake is monitored by the Water Corporation as an environmental condition for the development of the Southern Lakes Drainage Scheme.
- The ability of Thomsons Lake to support waterbird populations is dependant on the presence and quality of water, both of which are directly affected by manipulation of groundwater and surrounding land use practices.
- One of the Department's roles in managing Thomsons Lake is to support the development and implementation of policies and strategies of other agencies, where such strategies benefit the natural values of the reserve.
- Levels of total phosphorous greater than 150mgm/L indicate nutrient enrichment of the wetland.

Objective

To maintain a healthy aquatic ecosystem, thereby ensuring the provision of a feeding ground and refuge for waterbirds and protection of the reserve's ecological values.

STRATEGIES and KEY PERFORMANCE INDICATORS

Strategies:

1. Liaise with the Department of Environment and the Water Corporation regarding the monitoring and maintenance of appropriate water levels.
2. Exchange information relating to water management issues at Thomsons Lake with the Department of Environment and the Water Corporation, via the Wetlands Coordinating Committee.
3. Support the Department of Environment in implementing the Jandakot Groundwater Scheme Environmental Management Plan, and ensure that any changes to groundwater extractions are consistent with its recommendations.
4. Work cooperatively with the water authorities to ensure that the management of the lake's water levels considers waterbird and other fauna habitats.
5. Incorporate criteria from the Department of Environment's Section 46 Review of the Jandikot Groundwater Mound (JGM) into this management plan once they have been developed.

Key Performance Indicator

The development of new Environmental Water Provisions for Thomsons Lake, and adherence to these over the life of the plan.

Strategies

1. Support the Water Corporation in continuing to monitor the water quality of the lake, as required by the conditions of the Southern Lakes Drainage Scheme.
2. Continue to liaise with the Department of Environment and the Water Corporation to ensure the management of water quality takes waterbird and other fauna habitats into consideration.
3. Work cooperatively with state and local government authorities regarding the management of surface and subsurface drainage.
4. Maintain the Department's role on the Jandakot Water Resources Community Consultative Committee.
5. Continue to liaise with the water authorities to ensure that the conditions of the Jandakot Groundwater Scheme Environmental Management Plan are adhered to.

Key Performance Indicators

1. No decline in water quality of the lake over the life of the plan, as determined by the Department of Environment.
2. The annual maximum level of total phosphorous does not exceed 150mgm/L.

TABLE 1: THOMSONS LAKE NATURE RESERVE: MANAGEMENT SUMMARY

KEY POINTS and OBJECTIVES	STRATEGIES and KEY PERFORMANCE INDICATORS
NATIVE PLANTS AND PLANT COMMUNITIES • The reserve supports 360 native plant species, comprising four regional floristic groups of the Swan Coastal Plain and one Priority flora species. • Vegetation communities in the reserve are representative of those once widespread on the Swan Coastal Plain that have now been significantly cleared. • The main threats to the vegetation are environmental weeds, fire, and a kangaroo population in excess of the reserve's carrying capacity. **Objective** To conserve indigenous plant species and communities, particularly threatened or priority species.	**Strategies** 1. Identify and conserve vegetation and flora that is rare, threatened or in need of special consideration. 2. Undertake a survey to assess the reserve for Threatened Ecological Communities. 3. Develop and implement a targeted and integrated monitoring program of vegetation condition, changes to vegetation communities and weed proliferation, as required by the *Beeliar Regional Park Draft Management Plan 2001*. 4. Maintain vegetation biodiversity by reducing threatening processes, and by using fire as appropriate. 5. Monitor the impacts of the kangaroo population on flora values every five years. **Key Performance Indicators** 1. No loss of Priority species over the life of the plan. 2. Density of understorey vegetation is improved from 2003 levels.
NATIVE ANIMALS AND HABITATS • The reserve is listed under the Ramsar Convention as a wetland of international significance. It is an important breeding ground for local birds, and supports 21 species protected under the Japan–Australia Migratory Birds Agreement (JAMBA) and/or the China–Australia Migratory Birds Agreement (CAMBA) and is a summer refuge for 16 migratory bird species. • The reserve provides habitat for 62 species of bush birds and 70 species of native waterbirds, and supports two priority-listed species. • The main threats to the native fauna and fauna habitats are inappropriate water levels and water quality, predation by foxes and cats, environmental weeds and unplanned fire. **Objectives** 1. To conserve indigenous fauna, with an emphasis on threatened and priority species and those protected by international agreements. 2. To conserve and enhance the reserve for waterbirds as per the management requirements for Ramsar-listed wetlands.	**Strategies** 1. Develop and implement a targeted and integrated monitoring program of the fauna within the reserve, as per the *Beeliar Regional Park Draft Management Plan 2001*, including waterbirds and migratory waders. 2. Protect native fauna from introduced predators through appropriate control regimes if/as required. 3. Encourage and support groups (e.g. Birds Australia, tertiary institutions etc.) to undertake specific research and/or monitoring projects within the reserve. 4. Support the preparation and implementation of recovery plans for any threatened fauna species that are identified in the reserve. **Key Performance Indicators** 1. Viable populations of native fauna are maintained over the life of the plan. 2. No loss of species diversity or change in species composition of migratory waders in the reserve, over the life of the plan. 3. The total area of *Typha orientalis* is at least 10 per cent less than 2003 levels.

KEY POINTS and OBJECTIVES	STRATEGIES and KEY PERFORMANCE INDICATORS
ENVIRONMENTAL WEEDS • 130 weed species have been identified within the reserve. As rated in the *Environmental Weed Strategy for Western Australia*, according to their impacts on biodiversity, there are 15 High, 57 Moderate, 14 Mild, 35 Low, and 10 species that are either not listed or rated. • *Typha orientalis* is one of the most serious weed species threatening reserve values. Others include arum lily, pampas grass and cape tulip. **Objective** To minimise the impact of environmental weeds on the values of the reserve, using methods compatible with the conservation of the natural environment.	**Strategies** 1. Implement the weed control strategy, as required by the *Beeliar Regional Park Draft Management Plan 2001*, in conjunction with a rehabilitation plan and in accordance with the *Environmental Weed Strategy for Western Australia*. 2. Map annual distribution of *T. orientalis* and immediately control new satellite clumps. 3. Trial different cost effective methods to control *T. orientalis* as they become available, to determine the best method for Thomsons Lake. **Key Performance Indicators** 1. No increase in the number and cover of species rated High in the *Environmental Weed Strategy for Western Australia*, over the life of the plan. 2. The total area of *Typha orientalis* is at least 10 per cent less than 2003 levels.
INTRODUCED AND OTHER PROBLEM ANIMALS • Problem animals recorded within the reserve include feral cats and rabbits. Foxes have all but been eradicated since the construction of a vermin-proof fence around the reserve in 1993. • The reserve has a population of western grey kangaroos within the vermin-proof fence, which currently exceeds the recommended carrying capacity of maximum 25 animals. **Objective** To prevent, and where possible, negate the impact of introduced and other problem animals on the reserve's values.	**Strategies** 1. Prepare a control program for problem animals based on the following criteria: • existing and potential impact of the species; • the efficiency and effectiveness of control measures; • availability of resources; and • the capacity for long-term monitoring of the population. 2. Ensure adequate vegetation buffers are maintained, both around the lake and around urban developments within close proximity of the reserve, to minimise potential problems with midges. 3. Monitor the kangaroo population every five years, and implement measures to maintain numbers of kangaroos at a sustainable level. **Key Performance Indicators** 1. No increase in the number and distribution of problem animal species from 2003 levels. 2. The kangaroo population within the reserve is maintained at a level that does not impact on biodiversity values of the reserve.

KEY POINTS and OBJECTIVES	STRATEGIES and KEY PERFORMANCE INDICATORS
DISEASES • Part of the north-eastern section of Thomsons Lake is affected by *Phytophthora cinnamomi*. This is the most significant disease threat to flora within the reserve. • The disease could have an impact on revegetation programs in the reserve if the species that are planted are vulnerable to the disease. **Objective** To negate the impact, and prevent further spread, of *Phytophthora cinnamomi*.	**Strategies** 1. Re-survey the entire reserve for *P. cinnamomi* infection at least every five years, and quarantine affected areas. 2. Reduce the risk of introducing and spreading the disease to uninfected areas by limiting access to affected areas, and ensuring appropriate hygiene standards to machinery and vehicles when undertaking works within the reserve. 3. Treat unaffected vegetation around localised *P. cinnamomi* infections to limit further spread. 4. Ensure soils and other materials brought into the reserve are free of *P. cinnamomi*. **Key Performance Indicator** No new human-assisted infections or further spread of *P. cinnamomi* in the reserve, over the life of the plan.
FIRE • In the past, frequent fires in the reserve have contributed substantially to degradation of vegetation and invasion of environmental weeds. • Fire suppression is the responsibility of both the Department and the City of Cockburn. **Objective** To protect the biodiversity of the reserve, as well as people and property, by minimising the impact of wildfire.	**Strategies** 1. Implement the relevant sections of the *Beeliar Regional Park Fire Working Arrangements and Suppression Response Plan (2002)*, in conjunction with the City of Cockburn and the Fire and Emergency Services Authority (FESA). 2. Isolate stands of *T. orientalis* for fire protection purposes by cutting into blocks, and slashing, burning or removing blocks where appropriate. 3. Initiate measures in pre and post suppression works to minimise the spread of plant diseases and weeds in the reserve, as per the *Beeliar Regional Park Fire Working Arrangements and Suppression Response Plan (2002)*. 4. Consider selective prescribed burning for the protection of Reserve values and to enhance biodiversity, as per the *Beeliar Regional Park Draft Management Plan 2001*. **Key Performance Indicator** No loss of Priority species as a result of fire.
ACCESS • Access within the reserve is currently provided for a limited number of recreational pursuits as well as management and emergency vehicles. • Pedestrian access occurs on management tracks and firebreaks throughout the reserve. • The main visitor access node at Thomsons Lake, on Russell Road, is currently informal and undeveloped. Vehicle access off Russell Road may need to be upgraded as a safety measure. • Boat access on the lake is necessary in some instances for scientific research purposes. **Objective** To provide safe and convenient access within the reserve, for visitors and management, that is consistent with reserve values.	**Strategies** 1. Implement the relevant strategies of the proposed Recreation Masterplan, outlined in the *Beeliar Regional Park Draft Management Plan 2001*. 2. Allow for emergency response within the reserve and ensure all paths enable access by emergency vehicles. 3. Install a network of directional signs on the trails, consistent with the Sign System for Regional Parks. 4. Consider upgrading vehicle access off Russell Road, including site enhancement and visitor risk management measures. 5. Prohibit the use of recreational watercraft (including model boats) in the lake, and allow use of watercraft only for education, research and managerial purposes by approved users. **Key Performance Indicator** No disturbance to waterbirds from public access routes around the reserve.

KEY POINTS and OBJECTIVES	STRATEGIES and KEY PERFORMANCE INDICATORS
VISITOR USE AND OPPORTUNITIES • The most popular visitor uses are birdwatching, walking and horseriding. • Horseriders use an informal trail on the nature reserve that runs around the outside of the vermin-proof fence. • A draft Recreation Masterplan has been developed for Beeliar Regional Park, components of which are relevant to Thomsons Lake Nature Reserve. **Objective** To provide for passive, low-impact visitor uses in a manner that is consistent with the reserve's purpose, and which minimises conflict between users.	**Strategies** 1. Promote visitor use that is consistent with the protection and promotion of the reserve's values. 2. Restrict horseriding activities to designated bridle trails, consistent with the strategies outlined in the Beeliar *Regional Park Draft Management Plan 2001*, and as outlined in Map 2 of this plan. 3. Implement the relevant components of the Recreation Masterplan for Beeliar Regional Park.
SCIENTIFIC RESEARCH AND USE • Research is included in the purpose for Thomsons Lake Nature Reserve. • Comprehensive studies of Thomsons Lake should assess water quality and levels of the lake, ground water interaction, waterbirds, invertebrates and terrestrial flora and fauna. **Objectives** 1. To focus research on issues that assist in the delivery of Departmental strategies as per the Corporate Plan, and the business plans of the Nature Conservation and Parks and Visitor Services Outputs. 2. To support and promote external research that will assist in the implementation of the management plan.	**Strategies** 1. As per the *Beeliar Regional Park Draft Management Plan 2001*, encourage the particiapation of volunteers, educational institutions and other organisations to take part in research projects within the reserve, and promote research programs that address the Key Performance Indicators (KPIs). 2. Support, and where possible, seek grant applications to encourage scientific research and monitoring within the reserve, as per the *Beeliar Regional Park Draft Management Plan 2001*.
REHABILITATION • Degradation and loss of natural vegetation has occurred as a result of frequent unplanned fire, pest plants and animals, rubbish dumping, uncontrolled access and horseriding. • Only local native species should be used for rehabilitation purposes. **Objective** To restore degraded areas of the reserve to a condition resembling the natural environment.	**Strategies** 1. Implement the rehabilitation plan for the reserve, as proposed in the *Beeliar Regional Park Draft Management Plan 2001*. 2. Use only plants that have been propagated from seeds and cuttings collected either from within the reserve or from provenance from the Swan Coastal Plain. 3. Coordinate rehabilitation works with weed control and fire protection. 4. Encourage members of the local community and schools to participate in rehabilitation works, and to seek external funding for such works. 5. Ensure mulch and soil used in rehabilitation works does not contain unwanted seeds or plant diseases. 6. Encourage natural regeneration as much as possible by managing grazing pressure from kangaroos and rabbits. **Key Performance Indicator** Density of understorey vegetation is improved from 2003 levels.

KEY POINTS and OBJECTIVES	STRATEGIES and KEY PERFORMANCE INDICATORS
INFORMATION, EDUCATION AND INTERPRETATION • Information, education and interpretation provide targeted communication with the public. • It is important for the effective implementation of the Management Plan that community understanding and support is fostered for the reserve. • A communication strategy has been developed for Beeliar Regional Park, aspects of which are relevant to Thomsons Lake. • There is very little information available about Thomsons Lake's Ramsar listing, and the significance of Ramsar listed wetlands. This will be addressed in the development of an interpretation strategy for Beeliar Regional Park. **Objectives** 1. To increase community awareness, appreciation and understanding of the reserve's values, and to gain support for management practices. 2. To increase community awareness, appreciation and understanding of Thomsons Lake's listing as a Ramsar site, and the significance of Ramsar listed wetlands.	**Strategies** 1. Implement relevant aspects of the *Beeliar Regional Park Communicatio Strategy*. 2. Continue to encourage, promote and support volunteers with essenti resources to help them carry out their activities. 3. Provide information to visitors on reserve values and issues such as Rams listing, visitor safety, permitted activities and regulations.
WORKING WITH THE COMMUNITY • Community involvement is an integral component of the Department's operations. • Community groups and individuals are encouraged to be involved in both the planning and management of Thomsons Lake. • Community support is essential for the successful implementation of this management plan. **Objective** To facilitate effective community involvement in the management of the reserve.	**Strategy** 1. Involve the community in the implementation of this management plan. **Key Performance Indicator** The number of volunteer hours contributed is maintained or increased over t life of the plan.