A strategic plan for

PERTH'S GREENWAYS

FINAL REPORT

Prepared for

Environment Australia

Ministry for Planning

Department of Conservation and Land Management

WA Municipal Association

Department of Environmental Protection

Water and Rivers Commission

Main Roads WA

Swan Catchment Centre

Conservation Council

Greening WA

Australian Trust for Conservation Volunteers

by

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Cover Photographs:

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SUMMARY

Aims and Objectives

The Strategic Plan for Perth's Greenways was commissioned by the Ministry for Planning in association with the Commonwealth Department of Transport and Regional Development. The preparation of the strategic plan was funded through the Commonwealth Government's Urban Forest Program.

The study had the following objectives:

- to undertake a regional assessment of potential and existing corridors along rivers, drainage lines, land use zonings and transportation links within the Perth Metropolitan Region,
- to achieve broad community and government support for the Strategic Plan through widespread consultation,
- to incorporate the principles of Integrated Local Area Planning to provide a framework for regional revegetation management,
- to work with local governments, State agencies, non government groups such as Greening Western Australia and individuals to overview the priorities for revegetation in the Perth Metropolitan Region,
- to provide recommendations and priorities for local revegetation and Greenways creation.

Guiding principles for Greenways in the Perth Metropolitan Region are that corridors supporting compatible multiple uses and linking recreation, conservation and culturally important areas will be encouraged; privately owned land will only be considered in special circumstances; and only local native species will be considered for planting programs.

Consultation

The preparation of this Strategic Plan for Perth's Greenways has been guided by a Steering Committee with representation from the State Agencies, Local Government and community groups. Membership of the Steering Committee was drawn from the Ministry for Planning, CALM, WA Municipal Association, Department of Environmental Protection, Water & Rivers Commission, Main Roads WA, Swan Catchment Centre, Conservation Council, Greening WA and the Australian Trust for Conservation Volunteers.

Comments, inputs and ideas were sought during the preparation of this Strategic Plan from a wide range of community groups, organisations, agencies and interested individuals in meetings, submissions, a community workshop and comments on the draft report. Much of the direction of the Strategic Plan is based on the views expressed by the many people and organisations consulted.

Defining Greenways

Greenways is a generic term that has been applied to a wide range of landscape planning strategies, concepts and plans. 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 land use", (Ahern, 1995).

Other terminology used in the literature with a similar meaning to Greenways include ecological networks, habitat networks, ecological infrastructure, wildlife corridors, riparian buffers, ecological corridors, environmental corridors, greenbelts and landscape linkages.

Existing Environmental Planning Framework Relating to Greenways in the Perth Metropolitan Region

There have been a number of Government and non-Government initiatives relating to the protection of bushland and establishment of a green network that are relevant to Greenways.

The concept of green linkages was first incorporated into the Perth Metropolitan Region Scheme in 1963. The Conservation Through Reserves System 6 Report (1983) discussed the concept of 'green belts', a concept also articulated in Metroplan (1990). The Urban Bushland Strategy (1995) outlined the Government policy on bushland in the Perth Metropolitan Region. Perth's Bushplan, a whole of Government report due for release in 1998, will identify areas of land worthy of protection to conserve the biodiversity of the Swan Coastal Plain portion of the Perth Metropolitan Region.

There is increasing awareness among Local Government Authorities of the need to manage bushland within their boundaries and to create green linkages between bushland areas both within and outside their boundaries. Local Government Authorities have taken varying approaches ranging from the preparation of Green Plans to specific projects for incorporation within their Town Planning Schemes.

Community groups have also been active in the protection of urban bushland and the promotion of Greenways.

Values of Greenways

Greenways have been identified as having conservation, recreation, heritage and educational values. Several studies have addressed the impact of fragmentation of ecosystems and the need for corridors or linkages between areas of vegetation (Bennett, 1990; Saunders & Hobbs, 1991; Bailey and Marcheson, 1992; Merriam & Saunders 1993; Hobbs & Saunders, 1993; Soule, 1996).

Vegetated riparian corridors of adequate width prevent soil erosion and maintain water quality (Collinge, 1996). Best planning practices in water sensitive urban design include the incorporation of stormwater management in a network of public open space (Evangelisti et al., 1997; Landvision et al., 1997). Greenways can also provide recreational opportunities and can help define urban form.

Tree planting has been identified as a cost effective method of absorbing greenhouse gas emissions (Omerod et al., 1993). While large scale plantings of vegetation are able to contribute to the absorption of greenhouse gases, significant reductions in greenhouse gases require initiatives that lead to a reduction in fossil fuel consumption. Vegetated Greenways within the Perth Metropolitan, while having conservation, recreation, urban form and water quality benefits, are likely to provide a minimal contribution to the sequestering of carbon dioxide.

A Strategic Plan for Perth's Greenways

The Strategic Plan for Perth's Greenways builds on and connects areas of remnant vegetation, wetlands and walking trails within the Metropolitan Region.

The Strategic Plan for Perth's Greenways is intended to complement Perth Bushplan and the System 6 update currently being undertaken. It is also intended to act as a catalyst for the development of plans identifying Greenways at a more local level.

Priority has been given to identifying strategic Greenways that provide:

- East-west corridors which link the coast to freshwater and bushland habitats,
- Linkages along foreshore areas,
- Linkages between wetlands,
- Linkages between large areas of bushland.

Management Issues Associated with Greenways

The management of Greenways requires a clear understanding of the primary objectives of the greenway, the most appropriate management techniques for the area, and sufficient resources for effective management.

Management goals for Greenways also should be integrated with land use planning for particular areas. The incorporation of Greenways into structure planning and Town and Regional Planning Schemes will clarify the status and future of Greenways and minimise potential conflict.

The Strategic Plan for Perth Greenways is intended to act as a catalyst for the development of plans identifying Greenways at a more local level. This may be achieved through Local Greening Plans, District Conservation Strategies or Local Environment Plans. A management plan should be developed for each Greenway.

Implementation of the Strategic Plan for Perth's Greenways will be undertaken by a range of agencies and groups. In general, primary responsibility for the management of greenways will reside with the vesting agency. In many cases, effective implementation will require the development of partnerships between some or all of these groups. These partnerships should be developed at both a local and regional level. The implementation of the Strategic Plan for Perth's Greenways should complement the implementation of local level Greenways.

RECOMMENDATIONS

The following recommendations were made regarding the promotion, protection and management of greenways:

Establishment of a Greenways Committee to Promote and Implement Perth's Greenways

1. An interagency committee should be established to review the implementation of the Strategic Plan, to promote the planning and implementation of Greenways at all levels within the Perth Metropolitan Region and to facilitate the exchange of information and research about corridor design and management in urban areas.

2. The Greenways committee should have representation from Ministry for Planning, CALM, Department of Environmental Protection, Water & Rivers Commission, the Water Corporation, Swan River Trust, Main Roads WA, Westrail, WA Municipal Association, Conservation Council, Swan Catchment Centre and other community groups such as Urban Bushland Council, Greening WA and ATCV.

3. The Greenways Committee should complement and liaise closely with the Working Group for Perth's Bushplan.

Protection of Greenways

It is recognised that current government policy and programs support the establishment and maintenance for Greenways.

4. It is recommended that the Ministry for Planning include Greenways as a principle in the Regional Open Space Concept Plan and that Greenways be identified in structure planning. Wherever possible Greenways should be protected by appropriate zoning in the Metropolitan Region Scheme (MRS). This is currently achieved through Parks and Recreation reservation in the MRS.

5. Local Government Authorities should identify potential and existing corridors in their Structure Plans and where possible, in their Town Planning Scheme, and these should be protected through zoning provisions. The provisions of the Model Scheme Text will provide opportunities to include greenways and other areas with conservation value within the Town Planning Scheme. Local Government Authorities should also give consideration to the development of a Local Planning Policy dealing with the planning and implementation of greenways.

Management of Greenways

6. Management of the Greenways identified in the Strategic Plan will be undertaken by a range of agencies and groups including Main Roads WA, Westrail, Western Power, Swan River Trust, CALM, Water Corporation, Local Government Authorities and community groups, depending on the vesting of the area. Primary responsibility for management will reside with the vesting agency.

7. The Greenways dataset should be made available to Government Departments and Local Government Authorities and be publically accessible to facilitate the planning and management of greenways.

8. Agencies (including but not limited to Main Roads WA, Westrail, Western Power and CALM) should devise strategies to enhance values of strategic Greenways including minimising disturbance in the corridors due to the provision of services, and the use of appropriate local species in revegetation programs.

9. The Swan River Trust should establish and maintain Greenways along the areas under its control.

10. The Water & Rivers Commission using its powers under the Arterial Drainage Provisions of its Acts and its commitment to implement better catchment management, improve the conservation and management of vegetated and regionally significant watercourses and drains to protect their values including their functioning as greenways.

    Further, that the Water & Rivers Commission consult and collaborate with Councils, the Water Corporation and other Agencies to facilitate the improved coordination of the environmental protection, planning and management needed to implement waterway and drainage planning and maintenance that are consistent with waterways continuing to have values as wildlife corridors and greenways.

11. Local Government Authorities should identify, manage and protect Greenways. The development of a local Greening Plan or District Conservation Strategy in association with the community will assist Local Government Authorities in prioritising the management of vegetation, including local and regional Greenways.

12. The establishment of Greenways will require the protection and management of existing vegetation as well as revegetation. These activities should be guided by a management plan which should address issues such as the presence of threatened species, weed control, fire management, replanting, genetic source of seeds or seedlings used in revegetation programs, access and public participation.

13. The use of local native species in Greenways should be encouraged. Revegetation projects should ensure that species and structural diversity is maintained.

14. The management of vegetation on private lands that contribute to greenways should be protected and encouraged through options including voluntary management agreements, caveats, covenants, memorials on titles, lease-back agreements, land swaps, performance standards, and rate relief.

Development of Partnerships

15. Partnerships should be formed between Government Agencies, Local Government and community groups at a local and regional level to ensure the implementation of the Strategic Plan for Perth's Greenways. The partnerships can be viewed as

a network with the aim of supporting and encouraging the establishment and ongoing maintenance of Greenways.

16. The four Local Government Authority zones within the Perth Metropolitan Region (Central Metropolitan Zone, Northern Metropolitan, Southern Metropolitan Zone and South-East Metropolitan Zone) may provide a suitable grouping for the planning and management of Greenways that traverse Local Government Authority boundaries.

Greenways Beyond the Perth Metropolitan Region

17. There is a need for Greenways to link areas of remnant vegetation outside the Perth Metropolitan Region with remnant vegetation within that Region. Consideration should therefore be given to the extension of the Strategic Plan beyond the Perth Metropolitan boundary.

18. The concept of Greenways is also equally appropriate to other urban centres such as Bunbury, Albany and Geraldton.

1. INTRODUCTION

1.1 Structure of Report

A Strategic Plan for Perth's Greenways is divided into seven parts as follows.

- **Introduction**
  The Introduction outlines the aims and scope of the study, describes the methodology that was used, details the background to the study and defines Greenways.

- **Existing Framework relating to Greenways**
  This section outlines the legislative framework, policies and plans and non-government initiatives that are relevant to the establishment of Greenways.

- **Values of Greenways**
  The contribution of Greenways to biodiversity, maintenance of water quality, recreation, heritage, urban form and greenhouse gas sequestering are discussed in this section.

- **A Strategic Plan for Perth's Greenways**
  This section presents existing and potential Greenways within the Perth Metropolitan Region.

- **Management Issues associated with Greenways**
  This section discusses some of the management issues associated with Greenways and includes a discussion of resources available for Greenways projects.

- **Recommendations**
  This section makes recommendations regarding implementation of the Strategic Plan for Greenways within the Perth Metropolitan Region.

- **References and Appendices**
  The final section of the report includes references used in the preparation of this report as well as appendices detailing resources available for vegetation projects and comments on the concept of Greenways and the draft report.

The report contains two maps showing the location of strategic Greenways within the Perth Metropolitan Region. Figure 1 shows existing remnant vegetation, conservation category wetlands and proposed Greenways within the Perth Metropolitan Region while Figure 2 shows the location of Greenways and land within areas of secure tenure which includes areas in the Department of Conservation & Land Management (CALM) conservation estate, areas reserved for Parks and Recreation under the Metropolitan Region Scheme (MRS) and Regional Parks.

1.2 Background

The preparation of this Strategic Plan for Perth's Greenways was funded through the Commonwealth Government's Urban Forests Program.

The Urban Forests Program is a component of the expansion of the One Billion Trees Program under the Commonwealth Governments "Greenhouse 21C Statement - A Plan for Action for a Sustainable Future". The program was announced in March 1995. The Urban Forests Program has recently been incorporated into the BushCare component of the Natural Heritage Trust.

The objectives of the Urban Forests Program are to control greenhouse gas emissions through vegetated carbon sinks and to increase the environmental sustainability of urban areas.

The Urban Forests Program in Western Australia has two components: the development of a Strategic Plan for Perth's Greenways and funding for on-ground revegetation projects.

1.3 Aims and Objectives

This report presents a Strategic Plan for Greenways within the Perth Metropolitan Region, as defined in the Metropolitan Region Town Planning Act (1959). It is intended that the Strategic Plan will provide a basis for the development of Greenways at a local and regional scale.

The report was commissioned jointly by the Ministry for Planning in conjunction with the Commonwealth Department of Transport and Regional Development.

The study had the following objectives:

- to undertake a regional assessment of potential and existing corridors along corridors, rivers, drainage lines, land use zonings and transportation links within the Perth Metropolitan Region,
- to achieve broad community and government support for the Strategic Plan through widespread consultation,
- to incorporate the principles of Integrated Local Area Planning to provide a framework for regional revegetation management,
- to work with local governments, State agencies, non government groups such as Greening Western Australia and individuals to overview the priorities for revegetation in the Perth Metropolitan Region,
- to provide recommendations and priorities for local revegetation and Greenways creation.

Corridors supporting compatible multiple uses and linking recreation conservation and culturally important areas will be encouraged. Privately owned land should only be considered in special circumstances. Only local native species will be considered for planting programs.

1.4 Methodology

The preparation of this Strategic Plan for Perth's Greenways has been guided by a Steering Committee with representation from the State Agencies, Local Government and community groups. Membership of the Steering Committee was drawn from:

- Ministry for Planning (Melanie Price; Marie Ward)
- Department of Conservation and Land Management (Rob Towers)
- WA Municipal Association (Adrian Vlok, Lillias Bovell, Clare Walsh)
- Department of Environmental Protection (Margo O'Byrne, Jon Elder, Bridget Hyder-Griffiths)
- Water and Rivers Commission (Alan Hill)
- Main Roads WA (Anna Napier)
- Swan Catchment Centre (Peter Nash)
- Conservation Council (David Wake)
- Greening Western Australia, (Colma Keating, Jill Seymour, Sarah de Bueger)
- Australian Trust for Conservation Volunteers (Dan Huxtable)

The Steering Committee provided guidance to the consultants, reviewed progress on the preparation of the Strategic Plan and assessed projects for grants for on-ground works.

Comments, inputs and ideas were sought during the preparation of this Strategic Plan from a wide range of community groups, organisations, agencies and interested individuals in meetings and a Community workshop. Much of the direction of the Strategic Plan is based on the views expressed by the many people and organisations consulted.

The half day Community workshop was held at the City of Stirling and was attended by over 50 people representing 9 Local Government Authorities, 28 community groups and 7 government agencies. Following a brief presentation outlining the concept of Greenways, the Urban Forests Program and its relationship with Perth Bush Plan, participants at the workshop identified the location of green linkages.

A draft report was released for public comment. Comment was received from a range of community groups, individuals, Local Government Authorities and state agencies. During the public comment period the report was highlighted in the conservation newsletter "Greener Times" with a request for comments. Presentations on the draft report were made to the Urban Bushland Council, the Environmental Officers of the WA Municipal Association, Friends of Bold Park, the Chairman of the Natural Heritage Trust Regional Assessment Committee (NHT) for the Metropolitan Region and the statutory, strategic and environmental planning sections of the Ministry for Planning.

Comments made on the draft report were incorporated in the final report of "A Strategic Plan for Perth's Greenways".
A list of workshop participants and organisations that commented on the Greenways concept and draft report is attached as Appendix 1 to this report.

1.5 Defining Greenways

Greenways is a generic term that has been applied to a wide range of landscape planning strategies, concepts and plans. 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 land use", (Ahern, 1995).

Other terminology used in the literature with a similar meaning to Greenways include ecological networks, habitat networks, ecological infrastructure, wildlife corridors, riparian buffers, ecological corridors, environmental corridors, greenbelts and landscape linkages (Ahern, 1995). For example Hussey et al. (1991) defined a corridor as "a linear feature of vegetation which differs from the surrounding vegetation and connecting at least two patches [of vegetation] which were connected in historical time". The dominant characteristics of corridors (or Greenways) are therefore determined by their relationship with the surrounding area (Loney & Hobbs, 1991).

Fabos (1995) describes three main categories of Greenways, which may overlap in comprehensive Greenways systems:-

- Greenways of ecologically significant corridors and natural systems. These mostly occur along rivers, coastal areas and ridgelines; and serve to maintain biodiversity and provide wildlife migration and appropriate nature studies;

- Recreational Greenways where networks of trails and water link land and water-based recreational sites and areas. These include trails and routes which often have scenic quality as they pass through diverse and visually different landscapes. The recreation focus may be on urban or rural areas and the scale may be local, regional, national or international;

- Greenways with historical, heritage and cultural values. These have attracted tourist interest and provide recreational, educational, scenic and economic benefits. They may accommodate water resources and flood prevention and sensitively located alternative infrastructure for commuting (eg bike paths) recycling of waste and storm water. High quality housing environments may also be provided at greenway edges for permanent and seasonal housing.

One of the key features of the definitions of a greenway is its linkage function, which often occurs at multiple scales (Ahern, 1995). Greenways may range from local links between pockets of bushland, to more extensive linear reserves and wildlife corridors, connecting and encompassing conservation areas and landscape features including waterways and wetland chains. At a regional scale Greenways may connect bushland remnants and open space in the urban setting with larger remnants on the fringe of the city, providing corridors for

wildlife migration and strong lines in the landscape (Wake, pers comm; Greening Australia, 1995). Greenways also have been proposed as a means of defining and revitalising urban areas, providing green spaces to break up urban sprawl and to manage the pattern of development (Walmsley,1995).

For the purpose of this report, Greenways are defined as a linkage connecting and encompassing conservation areas and landscape features and having conservation, recreation, urban planning and/or aesthetic values.

2. THE EXISTING ENVIRONMENTAL PLANNING FRAMEWORK RELATING TO GREENWAYS IN THE PERTH METROPOLITAN REGION

There have been a number of government and non-government initiatives relating to the protection of bushland and the establishment of a green network within the Perth Metropolitan Region. These initiatives are described briefly below.

2.1 State Government Initiatives

The State Government has undertaken several policies and programs that promote green linkages. In "Parks for People" (WAPC & CALM, 1997) the Government promotes Greenways as in the following terms:

> "Imagine being able to walk or cycle in complete safety in bushland and parkland from Central Perth to several outer metropolitan destinations or go along the coast from Mandurah to Yanchep and beyond.
>
> The Greenways concept provides natural corridors linking declared public open spaces such as local, regional or national parks, stream reserves, wetlands and beaches. Eight regional parks are the hubs of the Greenways system and provide large areas of urban bushland, extensive wetlands and important landscapes to refresh the soul."

The concept of a network of regional open space was first introduced in Western Australia in 1955 by Stephenson and Hepburn, and was incorporated into the Metropolitan Region Scheme in 1963. The intention was to protect open space of regional significance for recreation, landscape and conservation.

The Conservation Through Reserves System 6 Report (1983) identified areas of land with conservation, landscape and recreational value, to be managed as regional space. The report discussed the concept of "green belts" and the need for linkages between areas of regional open space. The report proposed a network of parks and reserves to represent and protect flora and fauna. The Conservation through Reserves System 6 Report is currently being updated by the Department of Environmental Protection. The System 6 Update, which involves extensive community consultation and botanical surveys, commenced in 1995. The update is being undertaken in two stages; the Swan Coastal Plain portion of the Perth Metropolitan Region (as part of Perth's Bushplan) and a second stage comprising the Darling Scarp and Plateau, the remainder of System 6 and System 1 areas on the Swan Coastal Plain.

The principles of regional open space, including the interlinking of regional parks by public and private open space as well as by footpaths, bridlepaths and water courses, to provide for public access and passive recreation was further articulated in Metroplan (DPUD, 1990).

The Urban Bushland Strategy identifies sixteen regional parks within Perth and Mandurah Region that are either established or have had commitments for their establishment. These include the Canning River, Darling Range, Gnangara, Yellagonga, Kings Park, Rottnest, Whiteman Park, Rockingham Lakes, Port Kennedy, Beeliar, Serpentine, Bold Park, Peel,

Herdsman Lake and Woodman Point Regional Parks and the Jandakot Botanic Park.

There also are seven National Parks within the Perth Metropolitan Region including Avon Valley National Park, John Forrest National Park, Neerabup National Park, Kalamunda National Park, Walyunga National Park, Serpentine National Park and Yanchep National Park.

Areas of remnant bushland have also been set aside as reserves vested in various authorities for the purposes of conservation and/or recreation.

The Perth Environment Project was established in 1992 by the (then) Department of Planning and Urban Development as a result of increasing community conflict over the need to protect urban bushland from development. The objective of the Perth Environment Project was to provide a comprehensive database of the environmental resources of the Metropolitan Region and to determine priorities for conservation through agreed measures.

The State Government released its policy on bushland in the Perth Metropolitan Region in 1995. The Urban Bushland Strategy established the Urban Bushland Advisory Group (UBAG) which advises the WA Planning Commission on the protection of bushland of regional significance within the Perth Metropolitan Region. The Strategy promotes the concept of categorising bushland according to its local or regional significance.

Locally significant bushland is seen to be the responsibility of Local Government and the community, with Local Authorities encouraged to produce local Bushland or District Conservation Strategies. The State Government has responsibility for bushland identified as regionally significant. Regional planning and the acquisition of land for regional parks within the metropolitan region is the responsibility of the Ministry for Planning and the WA Planning Commission.

Importantly, the Urban Bushland Strategy recognised the need for Greenways between river foreshore reserves, parks, bushland reserves and regional parks throughout the metropolitan region.

The 1996 State Planning Strategy also recognised the importance of urban bushland, identifying the need for greater emphasis on retaining and managing urban bushland in the planning process, the need for a representative reserve system in Strategic Planning as well as the need to formalise the establishment and management of regional parks. The State Planning Strategy identified the need for District or Local Conservation Strategies, also called "Green Plans", to be prepared by local government. Local Conservation Strategies may include local and regional Greenways. The development of 'Local Bushland Strategies' (or Green Plans) by Local Government Authorities is also encouraged in the State Government's Urban Bushland Strategy, which states that data gathered through the Perth Environment Project will be made available to Local Government Authorities.

More recently, Perth's Bushplan is a "whole of government" report that builds on the System 6 Update and the findings of the Perth Environment Project. Prepared jointly by Ministry for Planning (MFP), the Departments of Environmental Protection (DEP) and Conservation and Land Management (CALM), and the Water and Rivers Commission, it identifies areas of land worthy of protection to conserve the biodiversity of the Swan Coastal Plain portion

of the Perth Metropolitan Region. Perth's Bushplan will contribute to the Government's commitment to identify regionally significant bushland and to the National Strategy for Biodiversity. Perth's Bushplan is due to be released for public comment in 1998.

Another recent initiative is the preparation of a statewide, government foreshore policy for the protection and management of creek, stream, river and estuary foreshores (i.e. waterside land and vegetation). The policy is being prepared by the Water & Rivers Commission, Ministry for Planning, Department of Conservation & Land Management, Swan River Trust, Department of Environmental Protection, Agriculture WA and the WA Municipal Association (Water & Rivers, 1998). This initiative complements legislative and policy initiatives taken to protect wetland and groundwater resources within the Perth Metropolitan Region.

The Environmental Protection (Swan Coastal Plain Lakes) Policy 1992 affords protection to lakes on the Swan Coastal Plain, while all types of wetlands on the Swan Coastal Plain have been mapped and classified by the (then) Water Authority of Western Australia. Groundwater resources within the metropolitan region are protected through the Environmental Protection (Gnangara Mound) Policy 1992 and the draft Statement of Planning Policy No 6 – Jandakot Groundwater Protection Policy. The draft Environmental (Swan and Canning River) Policy 1995 provides a legislative framework for the rehabilitation of the Swan and Canning Rivers, one of the major Greenways within the Perth Metropolitan Region.

Best Management Practices in the management of urban water quality can also contribute to the establishment of Greenways. Practices such as Water Sensitive Urban Design, Integrated Catchment Management and the incorporation of stormwater management within a network of Public Open Space are strongly supported by State government agencies and have the potential to contribute to green linkages within the Perth Metropolitan Region.

The Roadside Conservation Committee, an inter-governmental committee also has a role in coordinating the establishment and maintenance of Greenways, particularly those along transportation routes outside the Perth Metropolitan Region.

2.2 Local Government *Initiatives*

There is increasing awareness among Local Government Authorities of the need to manage bushland within their boundaries and to create green linkages between bushland areas both within and outside their boundaries.

The Local Government Urban Bushland Working Group is currently developing a discussion paper on the protection, rehabilitation and management of locally significant urban bushland. The discussion paper will include an analysis of the tools currently available to Local Government Authorities and will be relevant to protection and management of Greenways.

Local Government Authorities have taken varying approaches ranging from the preparation of Green Plans to specific projects for incorporation within their Town Planning Schemes. Several Councils within the Perth Metropolitan region (eg Stirling, Kalamunda, Mundaring, Wanneroo) have developed an integrated Green Plan for their municipality detailing specific

Greenways, while others are at various stages of preparation. Several Councils also have prepared or are preparing management plans for potential Greenways. The City of Melville, for example, has prepared a Foreshore Rehabilitation strategy for part of the Swan River – a regionally significant greenway, while the Cities of Fremantle and Nedlands and the Towns of Mosman Park, Cottesloe and Floreat are preparing a joint approach to coastal rehabilitation.

The City of Armadale and the Shire of Serpentine Jarrahdale have incorporated green corridors into structure planning within their municipalities and the Shire of Serpentine-Jarrahdale has also incorporated conservation zones within its Town Planning Scheme.

The Cities of Gosnells and Canning are planning, designing and implementing Greenways along numerous wetlands and creeks as part of a regional urban water management project funded by the Federal Government through the Local Government Development Program (Landvision et al., 1997).

2.3 Other Initiatives

Community groups have also been active in the protection of urban bushland and the promotion of Greenways.

Community involvement in and understanding of System 6 areas was encouraged through the development of Ecoplan in 1991. Now in its sixth year, Ecoplan provides training and support to over 250 groups and volunteers working in bushland management including existing and potential Greenways.

Greening Australia has promoted the concept of Greenways in urban and rural areas through its Corridors of Green Program linking local and regional vegetation projects to create a "web of life" (Greening Australia, 1995) and through the publication of Local Greening Plans - A Guide for Vegetation and Biodiversity Management (Greening Australia, 1995b). In Western Australia, Greening Western Australia initiated the Ribbons of Green roadside vegetation program in 1989 and continues to support community groups which are establishing corridors.

A community perspective on the need to manage and conserve remnant urban bushland was promulgated with the release of the National Trust of Australia (WA)'s Urban Bushland Policy in 1993 (National Trust, 1993). This policy, prepared jointly with the Wildflower Society and the Tree Society, called for the protection of urban bushland.

The high level of community concern about bushland in the Perth Metropolitan Region was evident in the formation in 1993 of the Urban Bushland Council, a coalition of community groups active in urban bushland retention and management. The Council aims to support local community groups by encouraging local action and networking, and to increase awareness and debate about urban bushland issues (Urban Bushland Council, 1994).

Other initiatives recognise outstanding endeavours in the establishment and maintenance of Greenways. The Living Streams Award is aimed at encouraging the rehabilitation of drains, creeks, rivers or estuary foreshores and promotes the concept of habitat corridors.

Now in its fourth year, the Living Stream Award is sponsored by Water and Rivers Commission and is incorporated in the National Landcare Australia Awards.

The John Tonkin Greening Awards, managed by Greening Western Australia, recognise outstanding conservation and revegetation projects throughout Western Australia, including corridor projects.

3. VALUES OF GREENWAYS

The objectives of the Urban Forests Program are "carbon dioxide sequestration and the enhancement of environmental sustainability, amenity and livability of a number of major Australian urban centres through tree planting and the establishment of other forms of vegetation" (Ministry for Planning, 1996).

Greenways have been identified as having conservation, recreation, heritage and educational values (Government of WA, 1995). The compatibility of these values with the objectives of the Urban Forests Program is discussed below.

3.1 Conservation

Several studies have addressed the impact of fragmentation on ecosystems and the need for corridors or linkages between areas of vegetation (Bennett, 1990; Saunders & Hobbs, 1991; Bailey and Marcheson, 1992, Merriam and Saunders 1993; Hobbs and Saunders 1993; Soule, 1996).

The need for connectivity to "re-integrate fragmented landscapes" is widely recognised (see for example, Bridgewater, 1987). Clearing of native vegetation results in habitat loss and isolation of habitats, a process that is often called habitat fragmentation. Habitat fragmentation has been described as the "most serious threat to biodiversity and the primary cause of the present extinction crisis" (Wilcox & Murphy1985, cited in Collinge, 1996).

Bushland within the Perth Metropolitan Region is highly fragmented, with a mean distance of 1.2km between bushland areas (as indicated in the preliminary mapping for the Urban Bushland Strategy, 1995) and low connectivity between areas. Major and Recher (1994) state that this is a considerable distance for many species of birds and insects and is thought to be an insurmountable barrier for most non flying animals such as reptiles, amphibians and small mammals.

Perth's wetlands and waterways network also provides a valuable but little recognised role in the linkage of bushland areas.

The value of a corridor to wildlife is largely dependent on the quality of habitat it provides, and the abundance of animals in a corridor is linked to the availability of certain habitat components such as food, nesting sites (Recher et al, 1987; Bennett, 1990) as well as the spatial distribution of strips of vegetation (Major & Recher, 1994,; Lynch et al, 1996).

Corridors may function as isolated linear habitats for certain species (Forman & Godron,1986; Bennett, 1990). However, one of the main contributions of corridors to wildlife conservation is facilitating the movement of species through unfavourable environments (Simberloff & Cox 1987; Bennett, 1990; Ahern, 1995). This may be in the form of direct movement by single individuals along the entire length of the corridor, by single individuals punctuated by pauses (for example to feed) within the corridor (Greening Western Australia, 1997), or in the form of gene flow through a population that is resident within the corridor (Bennett, 1990).

Corridors also may have a role in facilitating the movement of fauna as a response to climate change. However Hobbs & Hopkins (1991) concluded that at best, corridors have only a minor role in this context and that other conservation measures (such as a representative reserve system, captive breeding programs and control of land degradation processes) are more important for the protection of natural ecosystems.

Despite the largely beneficial aspects of linkages between areas of remnant vegetation, corridors may also have a negative impact on conservation. Corridor design can encourage movement of fauna into areas where there is a greater risk of mortality (eg roads) and can facilitate the movement of predators into habitat areas. The large edge to area ratio of linear corridors increases their susceptibility to impacts from the surrounding landscape (eg temperature, wind, spread of weeds, spray drift, increased nutrients and water etc.) (Hussey, 1991; Ahern, 1995; Collinge, 1996).

Edge effects may also reduce the effective width of the corridor. For example the original corridor width may be modified to a weedy buffer with a reduced internal habitat area (Friend, 1991). In some narrow Greenways the entire width of a corridor may be subject to edge influences.

The potential conservation implications of such influences is apparent when it is recognised that in Perth, where most of the bushland is in the form of small patches with only 3% of the bushland patches greater than 50ha in size, much of the avifauna comprises edge frequenting species (Major & Recher, 1994).

3.2 Protection of Water Quality

Rivers and their floodplains are natural corridors through often dramatically different terrestrial landscapes (Cross et al, 1991). Although non-linear, many of the wetlands and foreshores in the Perth Metropolitan Region also function as corridors (Thorburn, 1992 and Water & Rivers Commission, 1997). In Western Australia, natural wetlands and creeks tend to be characterised by heavy shaded, low nutrient status and darkly tannin stained water, supporting little algae or aquatic plant growth. Most of the wetland ecosystem is fuelled by the slow rotting of fallen leaves and twigs from the fringing vegetation.

A significant proportion of Perth's channel, basin and flat wetlands have high biodiversity values associated with natural wetland vegetation. In 1991 approximately 20% of Perth's creeks remained totally vegetated while 33% of creeks supported more than half their original vegetation (Hill et al., 1996). Conservation category wetlands, waterways that are regionally recognised and waterways that are 75% vegetated are valuable greenways (Water & Rivers Commission, 1997).

Riparian corridors of adequate width that are vegetated prevent soil erosion and maintain water quality. Vegetation in riparian zones provides bank stability, controls water flow, regulates the light and temperature of adjacent water bodies and provides habitat for aquatic life in vegetative debris (Collinge, 1996).

Vegetated streams also have been shown to provide a biofiltering or nutrient stripping function (Whelans et al., 1993; Pen & Majer, 1994; Bourne & Sheather Reid, 1994; Chambers &

Hale, 1997). Similarly, vegetated buffers around artificial wetlands and drains can influence nutrient removal and flow rates (Chamber et al, 1993; Braid & Lavery, 1996; Evangelisti & Associates et al, 1997).

Other functions of vegetated buffers around wetlands include providing a separation distance between nuisance insect populations and residential areas, preventing invasion of exotic plants, and providing a transition between upland and lowland habitats (Davies & Lane, 1995).

Wetlands, foreshores and their associated vegetation are often of particular significance as wildlife habitat for aquatic life, insects, reptiles and birds (Cross et al., 1991; Pen and Majer, 1994; Hill et al., 1996; Water & Rivers Commission, 1997).

Water Sensitive Urban Design and catchment planning recognises the multiple benefits of vegetated corridors around water bodies (Hill and Nicholson, 1989; Whelans et al., 1993; Klemm & Switzer,1994; Evangelisti & Associates et al, 1996). Best planning practices in Water Sensitive Urban Design include the incorporation of stormwater management in a network of public open space (Evangelisti & Associates et al., 1997; Landvision, 1997), thus linking the water quality and recreational objectives of Greenways.

Management of catchments also requires the protection and rehabilitation of riparian buffers to reduce sediment and nutrient loss, with the establishment of fringing vegetation along drainage lines, also known as 'streamlining' (Heady & Guise, 1994).

3.3 Urban Form

Greenways, whether urban riversides, recreational trails, ecologically significant corridors, scenic and historical routes, or a network comprising elements of each of these, can help to define the form of an urban centre. Greenways at both local and regional scales have been used to "stitch together fragmenting cities and urban areas", and to link urban centres with their hinterlands (Walmsley, 1995).

At a local scale, Greenways lining streets, linking pocket parks with playgrounds, squares and community gardens, should be established to allow new neighbourhoods to coalesce. At a regional scale:-

> "formless 'edge cities' should be given form through boulevards and parkways for intra-neighbourhood, non-commercial travel of all types (be they walkers, joggers, bikers, horse riders, skateboarders, rollerbladers and short trip, low speed transit and vehicle operators); linear parks and campgrounds must be linked up into continuous trail systems incorporating stream valleys, hillsides, ridge-lines, historic and public properties of all kinds having high scenic or cultural interest; and working landscapes, aquifer recharge areas, regional reservations, "rails to trails" networks, recreational rivers and canals. Historic towns and landscapes and scenic byways must be maintained for the larger public good" (Walmsley, 1995).

In addition, a locality can be enhanced by the use of Greenways in urban design, particularly when indigenous plant species are used, providing a "local sense of place" (Powell, 1994).

Flora roads and scenic routes which often support the last vestiges of native vegetation, have an important aesthetic function as well as serving as Greenways.

3.4 Recreation

The provision of recreational facilities such as walk trails, cycle routes and picnic facilities within or adjacent to Greenways will enable the bushland to be appreciated by a wide range of people. The inclusion of appropriate educational signage will inform the community about the ecological significance of the vegetation and the green linkages and will provide an extra recreational opportunity.

In addition to physical recreation, a city's green spaces can also provide a spiritual refuge and place of renewal for residents. The sense of wonder and awe expressed at nature in public open spaces is of increasing value in a highly urbanised and technological society (de Gryse, 1994). The Ministry for Planning and CALM also acknowledge the spiritual component of green places, describing Greenways as "important landscapes to refresh the soul," (Ministry for Planning and CALM,1997).

3.5 Sequestering of Greenhouse Gases

Tree planting has been identified as a cost effective method of absorbing greenhouse gas emissions (Omerod et al., 1993) and the Commonwealth Government's "Greenhouse 21C" program includes a package of measures aimed at reducing greenhouse gas emissions, including an expansion of tree planting programs to provide greenhouse sinks.

Through photosynthesis, actively growing trees absorb carbon dioxide, storing carbon in the form of wood and releasing oxygen into the atmosphere. Carbon dioxide is the most significant of the greenhouse gases, which also include methane, chloro-fluoro-carbons, nitrous oxide and ozone (BTCE, 1995).

The Bureau of Transport & Communications Economics estimates that to fully absorb the carbon emissions from an average car in Australia, seven trees similar to Pinus radiata will have to be planted every year the car is used. To ensure the carbon dioxide is permanently removed from the atmosphere, each tree would need to be replaced after harvesting. These estimates account for carbon stored as wood, leaves and roots in living trees and for the differing rates of decay in diverse forms of carbon such as paper and furniture and assume a carbon absorption rate of 7.5t/ha/pa (BTCE, 1996).

The growth rate of trees and their ability to sequester carbon varies according to the species, the quality of the growing site and the climatic conditions of growth (Gribble, 1992), this and the above rate of carbon sequestering is only likely to be achieved in productive forests in the wetter parts of the Australian mainland.

Limited information is available on the ability of plant species native to the Perth Metropolitan Region to sequester carbon. It is likely there will be significant variation between species due to their differing growth rates and amount of woody material produced. Rapidly growing woody tree species are likely to sequester a greater quantity of carbon than slow growing or herbaceous understorey species.

While large scale plantings of vegetation are able to contribute to the adsorption of greenhouse gases, significant reductions in greenhouse gases requires initiatives that lead to a reduction in fossil fuel consumption through changes to urban transport patterns, changes to building design and improvements in energy conservation. The contribution of vegetated Greenways within the Perth Metropolitan Region to the sequestering of carbon dioxide, while important for conservation, water quality, urban form and recreation, is likely to be minimal compared to the potential of these other possible measures.

4. A STRATEGIC PLAN FOR PERTH'S GREENWAYS

Information used to identify strategic Greenways within the Perth Metropolitan Region included plans showing:

- Areas of remnant vegetation within the Perth Metropolitan Region, provided by the Ministry for Planning,
- Vegetation associations within the Metropolitan region provided by the Ministry for Planning,
- Location and management category of wetlands on the Swan Coastal Plain, prepared by the (then) Water Authority of Western Australia,
- Multiple use corridors identified in the Middle Canning Catchment study.
- System 6 areas located within the Perth Metropolitan Region,
- Regional parks within the Perth Metropolitan Region,
- Walking trails within the Perth Metropolitan Region.

The Strategic Plan for Perth's Greenways is intended to complement Perth's Bushplan and the System 6 update currently being undertaken. It is also intended to act as a catalyst for the development of plans identifying Greenways at a more local level. The development of Local Greening Plans is discussed in more detail in Section 5.

Community input into the draft Strategic Plan of Greenways within the Perth Metropolitan Region was sought through a workshop attended by Community groups, Local Government Authorities and State Government agencies. The draft report was circulated for public comment as described in Section 1.4. This report incorporates the comments made by the range of organisations that had input into the strategic plan at various stages.

The Strategic Plan for Perth's Greenways builds on and connects areas of remnant vegetation, wetlands and walking trails within the metropolitan region. A list of strategic Greenways is provided in Table 1 and the Greenways are illustrated in Figures 1 and 2. Figure 1 shows existing remnant vegetation, conservation category wetlands and proposed Greenways within the Perth Metropolitan Region while Figure 2 shows the location of Greenways and land within secure tenure which includes areas in the CALM conservation estate, Parks and Recreation Reserves under the MRS and Regional Parks.

In identifying Greenways, priority was given to strategic Greenways that provide:

- East west linkages which link the coast to freshwater and bushland habitats,
- Linkages along foreshore areas
- Linkages between wetlands,

- Linkages between large areas of bushland.

Examples of significant east-west linkages in the Strategic Plan include:

- Mundijong Rd which provides an east west linkage between the eastern coastal plain and the coast,
- Whiteman Park to the Swan River,
- Linking the coast with Woodman Point, Mt Brown, Thomsons Lake and Forrestdale Lake and Armadale Settlers Common,
- The linkage between the coast, Port Kennedy Scientific Park and Rockingham Lakes Regional Park.

Strategic linkages within and between wetlands and along foreshore areas include:

- Coastal areas.
- Wetland chains including Yanchep suite to the Goollelal, Herdsman and Pinjar Suites.
- The Swan River through Beeliar Regional Park to Rockingham Lakes Regional Park and Serpentine Regional Park.
- Along the Canning and Swan Rivers.
- Forrestdale Lake to Southern River.
- Canning River with Brixton Street wetland, Roe Highway and Perth Airport bushland.
- Yule Brook to Helena River: from Brixton Street Wetland via Yule Brook along Roe Highway to Helena River.
- The length of Ellen Brook.

Examples of strategic linkages between larger areas of remnant vegetation within the Perth Metropolitan Region include:

- Kings Park to Bold Park and Shenton Park.
- Trigg Bushland with Star Swamp, Gwelup, Carine.
- Whiteman Park, with the old Airbase, Bennett Brook and Wandoo Creek.
- John Forrest National Park and the Swan River, across Caversham Airfield to Whiteman Park along lower Jane Brook.
- John Forrest and Walyunga National Parks.

TABLE 1

STRATEGIC GREENWAYS IN THE PERTH METROPOLITAN REGION

No.	Sector	Linkage
1	NW,SW	Coastal Strip
2	NW	North-West Wetland greenway linking Yellagonga Regional Park, Neerabup National Park and Yanchep National Park
3	NW	Marmion Ave
4	NW	Burns Beach Road
5	NW	Ocean Reef Rd - Marmion Ave - Badgerup Lake - Gnangara Lake
6	NW	Star Swamp - Trigg Bushland *(also see 8)*
7	NW	Trigg Bushland - Lake Gwelup along Karrinyup Road
8	NW	Star Swamp - Trigg Bushland *(also see 6)*
9	NW	Mitchell Freeway / Northern Railway
10	NW	Hepburn Ave - Alexander Drive - Coast
11	NW	Wanneroo Road
12	NW	Marangaroo Road
13	NW	Alexander Drive - Gnangara Lake
14	NW	Badgerup Rd & Ocean Reef Rd (Lake Jandabup - Lake Badgerup)
15	NW	Lakeview Street (Lake Pinjar - Lake Mariginup - Lake Jandabup)
16	NW	Pinjar Road (Lake Pinjar - Lake Mariginup - Lake Jandabup)
17	NW	Lake Mariginup - Yellagonga Regional Park
18	NW	Herdsman Lake - Bold Park
19	NW	Bold Park - Kings Park
20	NW	Bold Park to Lake Claremont and Allen Park
21	NW	Whiteman Park - Bennett Brook
22	NW	Gnangara Road - Whiteman Park - Lake Goollelal
23	NW	Herdsman Lake - Lake Gwellup
24	NW	Swan River
25	NE	Helena River
26	NE	Tonkin Highway - Swan River – Perth Airport

27	SW	Perth-Fremantle Railway
28	NW	Perth-Midland Railway
29	NW	Alexander Drive linking golf course
30	NW	Herdsman Lake - Lake Monger - Freeway - Wanneroo Road
31	NW	Old Yanchep Road Linking Lake Pinjar - Yanchep National Park
32	NW	Whiteman Park - Swan River - Wandoo Creek
33	NW	Star Swamp - Lake Karrinyup
34	NW	Burns Beach – Neerabup National Park
35	NW	Neerabup National Park - Coast
36	NW	Coastal Plain Walktrail (Coast - Walyunga National Park)
37	NW	Gnangara Regional Open Space - Wetland
38	NW	Star Swamp - Whiteman Park
39	NW	Whiteman Park - Swan River - Bennett Brook
40	NW	Whiteman Park - Melaleuca Park
41	NW	Yellagonga Regional Park - Melaleuca Park
42	NW	Creekline to Ellen Brook
43	NW	Neaves Road Creekline to Ellen Brook
44	NE	Ellen Brook - entire length
45	NE	Lower Jane Brook - Whiteman Park (links John Forest National Park – Caversham Airfield - Whiteman Park)
46	NE	Susannah Brook
47	NE	Walking Trail (John Forest National Park - Lake Leschenaulta)
48	NE	Walyunga National Park - Avon Valley National Park
49	NE	Kadina Brook
50	NE	Roe Highway
51	NE	Walk trail (State Forest - Greenmount National Park)
52	NE	Poison Gully
53	NE	Walk trail John Forest National Park
54	NE	Hardy Road - Railway Reserve - Helena Valley
55	NE	Bibbulum track

56	NE	Toodyay Road
57	NE	Chittering Valley Road
58	NE	Walyunga National Park - John Forest National Park (Roland Road, O' Brian Road)
59	NE	Sawpit Gully to Ellenbrook
60	NE	Old Railway line - Rahne Road – Utah Road - Avon Valley National Park
61	S	Cardup Brook
62	S	Beenyup Brook
63	S	Manjedal Brook, linking Darling Scarp with Oakford Main Drain
64	S	Mendulla Brook, linking Serpentine National Park with Serpentine River
65	S	Serpentine River
66	S	Mundijong Road linking eastern coastal plain with the coast
67	S	Old Tramway - Serpentine Road links with 78, 90 and 79 to Swan River
68	S	Brixton Street - Roe Highway - Perth Airport - Scarp - Canning Highway
69	S	Armadale Townsite - Armadale Settler' s Common - Forrestdale Lake - Thomsons Lake
70	S	Southern River - Canning River - Darling Range Regional Park
71	S	Canning River - Swan River - Darling Range Regional Park
72	S	Canning River - Golf Course
73	S	North Lake - Bibra Lake - Roe Highway Extension
74	S	Stock Road
75	S	Stock Road to Bibra Lake
76	S	Russell Road - Thomsons Lake - Woodman Point Regional Park
77	S	South-west Highway Linking Mundijong Road - Southern River – Darling Range Regional Park
78	S	Thomsons Lake – Forrestdale Lake
79	S	Swan River - Canning River
80	S	Kwinana Freeway
81	S	Forrestdale Lake – Thomsons Lake
82	S	Piney Lakes - Wireless Hill - Swan River
83	S	Port Kennedy Scientific Park - Rockingham Lakes Regional Park

84	S	Port Kennedy Scientific Park – Serpentine River
85	S	Links chains of wetlands parallel to and east of Mandurah Road, including Stakehill suite of wetlands
86	S	Lake Richmond - Lake Cooloongup
87	S	Leda Ridgelines - Rockingham Road
88	S	Main Drain Birrega - Oakford
89	S	Paganoni Swamp - Lake Walyungup - Port Kennedy Scientific Park
90	S	Blue Gum, Booragoon, Pine, Bibra and North Lakes, Little Rush, Yangebup and Thompsons Lake
91	S	Southern River - Jandakot Botanic Park
92	S	Jandakot Botanic Park - North Lake
93	S	Connection to Coastal Area - Point Peron
94	S	Leach Highway linking Bullcreek wetland with Piney and Booragoon Lakes
95	S	Bullcreek wetland along Karel Ave to connect with 73
96	S	Stock Road - Coast (Woodman Point)
97	S	Southern River - Forrestdale Lake - Thomas Road - Spectacles - Coast
98	S	Perth Airport - Hartfield Park – Yule Brook
99	S	Forrestfield Marshalling Yards
100	S	Tonkin Highway linking Hartfield Park and M53
101	S	Woodlupine Brook (joins Yule Brook)
102	S	Yule Brook
103	S	Crumpet Creek
104	S	Walking Trail near Railway Road
105	S	Coast – Buckland Hill – Swan River
106	S	Perth – Armadale Railway Line
107	NE	Brockman River
108	NE	Creekline linking Walyunga National Park and Ellenbrook
109	S	Extensions to Forrestfield Railway
110	S	Kalamunda Road
111	S	Kadina Brook

112	S	Adelaide Street, Kalamunda
113	S	Ridge Hill Road
114	S	Oaklands Drain
115	S	Bickley Brook
116	S	Ellis Brook
117	S	Drain linking Canning River and Southern River
118	S	Drain linking Forrestfield Lake with the Oakfield - Birrega Drain
119	S	Wungong Brook
120	S	Extension to Greenway 76
121	S	Peel Main Drain
122	S	Tamworth Swamp
123	S	Links Paganoni Swamp with Serpentine River
124	S	Drain between Serpentine River and South-West Highway
125	S	Drain between Serpentine River and South-West Highway
126	S	Forrestfield Main Drain
127	S	Helm Street
128	S	Brickwork Drain
129	S	Linking remnant vegetation and wetlands in Shire of Serpentine-Jarrahdale

NW = North-west sector of Perth Metropolitan Region
NE = North-east sector of Perth Metropolitan Region
S = Southern sector of Perth Metropolitan Region

5. MANAGEMENT ISSUES ASSOCIATED WITH GREENWAYS

The management of Greenways requires a clear understanding of the primary objectives of management, the most appropriate management techniques for the area, and sufficient resources for effective management. It also requires the development of partnerships between community groups, local government authorities and State Agencies.

As discussed in Section 3, Greenways in an urban environment have several functions including their roles as habitats for wildlife, as conduits for movement of wildlife, to delineate areas of development, in recreation, environmental education, aesthetics and in stormwater management. The management of Greenways therefore needs to be aimed at each corridor's primary objective but at the same time, at achieving multi-purpose uses wherever possible.

Management goals for Greenways also should be integrated with land use planning for particular areas. The incorporation of Greenways into structure planning and Town and Regional Planning Schemes will clarify the status and future of Greenways and minimise potential conflict. The planning and management of Greenways will also require development of partnerships within and between municipalities, community groups, State Government Agencies and the corporate sector.

5.1 Planning for Greenways – Local Greening Plans

The Strategic Plan for Perth Greenways is intended to act as a catalyst for the development of plans identifying Greenways at a more local level. This may be achieved through Local Greening Plans, District Conservation Strategies or Local Environment Plans.

A Greening Plan is a publicly endorsed, structured and systemic approach to the management, protection, and enhancement of existing vegetation and to the development of linkages between green spaces. Such a Plan may include an inventory of open space areas, identify additional green space requirements and prioritise actions for particular sites or corridors.

Typically a Greening Plan is developed in two stages. The first stage includes an inventory of the natural resources within the municipality including topography, soils and geology, vegetation associations, vegetation condition and wetlands. The second stage includes the development of a map of intended future vegetation and natural resources, and for each area, the values of the vegetation, the issues and pressures that have to be handled, the objectives for each area and recommended management guidelines and conservation measures. Conservation measures can generally be grouped into three implementation categories: securing vegetation assets, managing changes in land use and rehabilitation (Greening Australia, 1995b). The successful development and implementation of a Greening Plan is dependent on community and Local Government Authority input and support.

Local Environment Plans and District Conservation Strategies are similar to Green Plans but may include a broader range of environmental issues. Greening Plans plans do not need to be stand alone documents and may be developed as part of a scheme review or in the

context of other projects undertaken by Local Government Authorities.

The Model Scheme Text, which is currently in draft form, provides opportunities for the protection of Greenways through a Local Planning Strategy and Special Control Areas. A Local Planning Strategy may define areas for conservation as well as indicating special priorities and programs of action. Special Control Areas allow for the provision of particular planning issues including areas identified as having landscape values and environmental significance. When approved, all future Town Planning Schemes will be required to be prepared in accordance with the Model Scheme Text (WAPC, 1997). Alternatively the development of greenways or a local greening plan may be the subject of a Local Planning Policy.

Several Local Government Authorities within the Perth metropolitan region have prepared Green Plans or their equivalent, while other local government authorities are in the process of developing such plans. The City of Stirling's Green Plan identifies potential linkages between areas of bushland as well as areas of vegetation needing management within the City of Stirling. The approach taken by the Shire of Kalamunda in its District Conservation Strategy was to map the natural resources and to identify the strategies required to manage environmental issues within the Shire. This included the identification of potential wildlife corridors.

Local Government Authorities in rural areas are also developing Green Plans. The Shire of Chittering's Rural Strategy identifies wildlife corridors and areas with conservation values (Taylor & Burrell, 1995). The Shire of Tambellup has assessed the health of remnant vegetation within the Shire and made recommendations on management, which include the establishment of a network of corridors linking reserves (Mercer, 1996). These rural models can be adapted to an urban context.

Some Local Government Authorities have identified the need for information about Green Plans to assist them to establish Greenways. Local Government Authorities with Green Plans in place (for example City of Stirling, City of Wanneroo, and Shire of Kalamunda) can provide a mentoring role to those councils considering the development of Green Plans (or District Conservation Strategies or Local Environment Plans).

The book, "Local Greening Plans: A Guide for Vegetation and Biodiversity Management" is aimed at helping local government authorities develop management strategies for vegetation (Greening Australia, 1995b). A Resource Directory containing information on where to get resources relevant to Greening Plans also is currently being prepared by Greening Western Australia and is scheduled for release by the end of 1997.

Information on the natural resources within an area that may assist in the preparation of a Local Greening Plan also is available from a number of government agencies, including those represented on the Steering Committee.

PRINCIPLES OF PLANNING GREENWAYS

- *The first step in planning a greenway is to identify what patches of bush, wetlands or areas you want to link. (Information on native vegetation remaining within the Perth Metropolitan Region is available from Ministry for Planning). The development of a Green Plan for a local government authority will also identify areas of ecological significance.*
- *Next identify the objectives of the greenway, for example:*
  - *to facilitate movement of fauna;*
  - *for recreation;*
  - *to act as a buffer along a creek;*
  - *to define urban nodes.*

  This will help to set the design parameters for the greenway. Of course many greenways have more than one objective.
- *Greenways aimed at facilitating the movement of native fauna also need to provide habitats and food, particularly for smaller animals and insects. It is important that the corridor contain a varied microhabitat such as fallen logs, rocks and piles of debris. A corridor aimed at wildlife should mimic as far as possible the patches of bush it is connecting. Greenways should incorporate habitat nodes wherever possible.*
- *The width of a corridor that is useful for the movements of fauna varies with each corridor and with the species that may use it. In general, the wider the better, as narrow corridors suffer more from edge effects such as weed invasion. However, narrow corridors can resist edge effects if the vegetation is in good condition with an intact understorey.*
- *Greenways that are buffers to streams should take into account the width of the floodway, soil types, landform and remnant vegetation when determining the appropriate width of the buffer.*
- *Greenways aimed at promoting recreational opportunities should take into account the need for a sense of personal safety to facilitate enjoyment and use of the greenway. This can be achieved by attention to the placement of paths, and the proximity of large dense shrubs.*
- *Planning a network of greenways (or alternatively a Green Plan) should involve the community, the Local Government Authority and State Agencies and should be based on ecological principles.*
- *The management of greenways should be guided by a Management Plan. In the absence of a Management Plan, the interim guidelines for the management of bushland developed by the Department of Environmental Protection should be used.*
- *Greenways may follow a landform such as a creek or chain of wetlands and consist largely of one vegetation association e.g. wetland vegetation, or may cut across the landscape and therefore incorporate a number of vegetation associations. The two types of greenways will require different management strategies.*

5.2 Management of Greenways

Despite their (generally) narrow width, Greenways should be managed as a natural system and to promote nature conservation while at the same time recognising the other values such as recreation, that a greenway may have. Species and structural diversity should be maintained or restored with a preference for the use of local native species wherever possible.

A management plan should be developed for each Greenway and should address such issues as land tenure and vesting, the presence of threatened species, weed control, fire management, replanting, and the genetic source of seeds or seedlings used in any revegetation programs. Other issues of equal importance include the management of people: issues of access, the development of a corridor stewardship, and the encouragement of public participation (Low, 1991).

Draft guidelines developed by the Department of Environmental Protection for the management of bushland can serve as an interim guide to the management of Greenways while a management plan is being developed. Managing Perth's Bushlands (Scheltema and Harris, 1995) contains useful information on the management of bushland including the control of weed species within the Perth Metropolitan region.

5.3 Implementation

Implementation of the Strategic Plan for Perth's Greenways will be undertaken by a range of agencies and groups including Main Roads WA, Westrail, Swan River Trust, CALM, Water Corporation, Western Power, Local Government Authorities and community groups. The agency with which the land is vested will generally have primary responsibility for management of that component of the greenway. In many cases, effective implementation will require the development of partnerships between some or all of the groups listed above. These partnerships should be developed at both a local and regional level. The implementation of the Strategic Plan for Perth's Greenways should complement the planning and implementation of local level Greenways.

An inter-agency committee also will support, encourage, promote and review the implementation of the Strategic Plan for Greenways within the Perth Metropolitan Region. The committee will have representation from Ministry for Planning, Department of Environmental Protection, CALM, Main Roads WA, Westrail, Swan River Trust, WA Municipal Association, Water & Rivers Commission, Water Corporation, Swan Catchment Centre, Conservation Council and other community groups such as Urban Bushland Council, Greening Western Australia and ATCV. The committee will complement and liaise closely with the Working Group for Perth's Bushplan.

This report focussed on the use of public land as greenways due to the report's Terms of Reference. However, it is acknowledged that land in private ownership can also contribute to a network of regional and local greenways within the Perth Metropolitan Region and should be considered in planning greenways at a local level.

Greenways should be afforded protection wherever possible by appropriate zoning under the Metropolitan Region Scheme (MRS). This is currently achieved through reservation in the MRS for Parks and Recreation, which does not distinguish between conservation and

recreation. Potential and existing corridors should be identified by Local Government Authorities in structure plans and where possible, in their Town Planning Schemes.

Alternatives to reservation can also ensure the protection and management of greenways. Examples include:

- voluntary management agreements;
- caveats;
- covenants;
- memorials on titles;
- lease-back arrangements;
- land swaps;
- performance standards;
- subvesting of reserves to incorporated management groups acting as custodians.

5.4 Resources for Greenways Projects

Resources for Greenways projects will depend in part on the ownership or vesting of the land involved. For Local Governments, the development of a Green Plan by a Local Government Authority in partnership with the community can assist in prioritising limited resources for vegetation projects, and strengthen funding applications.

Funds for Greenways projects in the Perth Metropolitan Region are available through Commonwealth and State Government Programs such as the Natural Heritage Trust, Gordon Reid Foundation for Conservation and the Community Conservation Grants Program. Corporate sponsored programs such as the Alcoa Landcare Project provide support for projects located in the southern part of the metropolitan region. Assistance for Greenways projects is also available through labour market programs and the Australian Trust for Conservation Volunteers. Further information on these programs is provided in Appendix 2.

The corporate sector can also be approached for sponsorship of specific projects.

The WA Municipal Association has recently prepared a draft paper highlighting funding opportunities for Landcare activities (WAMA, 1997). Some of these opportunities which include voluntary and compulsory rate levies, are also relevant to Greenways within the Perth Metropolitan Region.

6. RECOMMENDATIONS

6.1 Establishment of a Greenways Committee to Promote and Implement Perth's Greenways

1. An interagency committee should be established to review the implementation of the Strategic Plan, to promote the planning and implementation of Greenways at all levels within the Perth Metropolitan Region and to facilitate the exchange of information and research about corridor design and management in urban areas.

2. The Greenways committee should have representation from the Ministry for Planning, CALM, Department of Environmental Protection, Water & Rivers Commission, the Water Corporation, Swan River Trust, Main Roads WA, Westrail, WA Municipal Association, Conservation Council, Swan Catchment Centre and other community groups such as Urban Bushland Council, Greening WA and ATCV.

3. The Greenways Committee should complement and liaise closely with the Working Group for Perth's Bushplan.

6.2 Protection of Greenways

Current government policy and programs support the establishment and maintenance for Greenways.

4. It is recommended that the Ministry for Planning include Greenways as a principle in the Regional Open Space Concept Plan and that Greenways be identified in structure planning. Wherever possible Greenways should be protected by appropriate zoning in the MRS. This is currently achieved through Parks and Recreation reservation in the MRS.

5. Local Government Authorities should identify potential and existing corridors in their Structure Plans and where possible, in their Town Planning Scheme, and these should be protected through zoning provisions. The provisions of the Model Scheme Text will provide opportunities to include greenways and other areas with conservation value within the Town Planning Scheme. Local Government Authorities should also give consideration to the development of a Local Planning Policy dealing with the planning and implementation of greenways.

6.3 Management of Greenways

6. Management of the Greenways identified in the Strategic Plan will be undertaken by a range of agencies and groups including Main Roads WA, Westrail, Western Power, Swan River Trust, CALM, Water Corporation, Local Government Authorities and community groups, depending on the vesting of the area. Primary responsibility for management will reside with the vesting agency.

7. The Greenways dataset should be made available to Government Departments and Local Government Authorities and be publically accessible to facilitate the planning and management of greenways.

8. Agencies (including but not limited to Main Roads WA, Westrail, Western Power and CALM) should devise strategies to enhance values of strategic Greenways including minimising disturbance in the corridors due to the provision of services, and the use of appropriate local species in revegetation programs.

9. The Swan River Trust should establish and maintain Greenways along the areas under its control.

10. The Water & Rivers Commission using its powers under the Arterial Drainage Provisions of its Acts and its commitment to implement better catchment management, improve the conservation and management of vegetated and regionally significant watercourses and drains to protect their values including their functioning as greenways.

    Further, that the Water & Rivers Commission consult and collaborate with Councils, the Water Corporation and other Agencies to facilitate the improved coordination of the environmental protection, planning and management needed to implement waterway and drainage planning and maintenance that are consistent with waterways continuing to have values as wildlife corridors and greenways.

11. Local Government Authorities should identify, manage and protect Greenways. The development of a local Greening Plan or District Conservation Strategy in association with the community will assist Local Government Authorities in prioritising the management of vegetation, including local and regional Greenways.

12. The establishment of Greenways will require the protection and management of existing vegetation as well as revegetation. These activities should be guided by a management plan which should address issues such as the presence of threatened species, weed control, fire management, replanting, genetic source of seeds or seedlings used in revegetation programs, access and public participation.

13. The use of local native species in Greenways should be encouraged. Revegetation projects should ensure species and structural diversity is maintained.

14. The management of vegetation on private lands that contribute to greenways should be encouraged through options including voluntary management agreements, caveats, covenants, memorials on titles, lease-back agreements, land swaps, performance standards, and rate relief.

6.4 Development of Partnerships

15. Partnerships between Government Agencies, Local Government and community groups at a local and regional level should be facilitated to ensure the implementation of the Strategic Plan for Perth's Greenways. The partnerships can be viewed as a network with the aim of supporting and encouraging the establishment and ongoing maintenance of Greenways.

16. The four Local Government Authority zones within the Perth Metropolitan Region (Central Metropolitan Zone, Northern Metropolitan, Southern Metropolitan Zone and South-East Metropolitan Zone) may provide a suitable grouping for the planning and management of Greenways across Local Government Authority boundaries.

6.5 Greenways Beyond the Perth Metropolitan Region

17. There is a need for Greenways to link areas of remnant vegetation outside the Perth Metropolitan Region with remnant vegetation within that Region. Consideration should therefore be given to the extension of the Strategic Plan beyond the Perth Metropolitan boundary.

18. The concept of Greenways is also equally appropriate to other urban centres such as Bunbury, Albany and Geraldton.

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APPENDICES

APPENDIX I

PUBLIC COMMENTS ON THE GREENWAYS CONCEPT AND DRAFT REPORT

a) Workshop Participants

Name	Name of Group/Council/Agency
Marie Ward	Ministry for Planning
Rosalind Murray	City of Wanneroo
Phylis Robertson	Friends of Star Swamp
Rae Kolb	Friends of Star Swamp
Daniel Rajah	City of Stirling
Peter Pearson	Bennett Brook Catchment Group
Graham Milward	Town of Bassendean
Jill Seymour	Greening Western Australia
Gary Fraser	Greening Western Australia
Peter Nash	Swan Catchment Centre
Alan Hill	Water & Rivers Commission
Robyn Murphy	Friends of Trigg Bushland
Jennifer Hawkes	Wetlands Action Group
Challis Tilbrook	Friends of Trigg Bushland
Rosemary Glass	Bayswater ICM Committee
Kristen Tullis	Men of the Trees Bayswater Greenhouse Urban Bushland Council
Bevan Carter	Bassendean Preservation Group
Norma Calcutt	Friends of Bold Park
Jenny Johnson	Hovea Ratepayers
Fiona Houston	Friends of Blue Gum Lake Res.
Michael Parker	WA Municipal Association
Wayne van Lieven	City of Gosnells
Pat Julien	Friends of River Canning Environment
Jenny Drummond	Friends of River Canning Environment
Jack Geneff	Stirling Greens
Mark Street	City of Melville
James Robinson	City of Armadale
Clive Robertson	The Tree Society
Mark Armstrong	Town of Victoria
Paul Lanternier	City of Armadale
Clive Robertson	The Tree Society
Mark Armstrong	Town of Victoria Park/Wetlands Society
Peter Bothwell	Westrail
Lesley Thomas	National Trust (WA)
Lesley Thomas	Ecoscape Australia
Monica Hunt	City of Stirling
Max Hipkins	Swan-Swan ICM Co-Ord Group
Jeff Anderton	Port Kennedy
J Paul Orsini	Friends of Allen Park
S. De la Hunty	Foreshores & Waterways Protection Council

Angela Carr	City of South Perth Environmental Associations
Dan Huxtable	A.T.C.V
Geoff Rawley	APACE
John R Stone	Armadale Settler Common
Ann Stone	Armadale Settler Common
Anna Napier	Main Roads WA
Jeni Alford	CALM - Perth District
Tim Lawrence	Men of the Trees
Judy Fisher	City Beach Primary
Ray Wills	Kings Park & Botanic Garden
Nathan Mc Quoid	Kings Park & Botanic Garden

b) Input into Draft Report:

Karl Karu
Quinns Rocks Environmental Group
David Wake
Maureen Campbell

c) Groups that completed the Greenways Survey Form on current activities related to Greenways, proposed future activities related to Greenways and assistance required.

Nature Reserves Preservation Group, Kalamunda Creek Subgroup
Friends of Blue Gum Lake
Men of the Trees
Bayswater Green Work
Greening WA
Friends of River Canning Environs
Foreshore & Waterways Protection Council
Friends of Bold Park (inc)
City Beach Primary
Kings Park & Botanic Gardens
Friends of Koondoola Regional Bushland
Friends of Trigg Bushland Inc
Bassendean Preservation Group Inc
Bennett Brook Catchment Group
Hovea Rate Payers
Armadale Settlers Common Management Committee
CALM
City of Stirling/Friends of Star Swamp & Trigg Bushland Advisor Committee
Swan River ICMCG
Stirling Greens
Friends of Allen Park

National Trust
Ecoscape (Aust) Pty Ltd
City of Wanneroo
Bayswater ICM Committee
City of Stirling
Town of Bassendean
Wetland Action Group, Stirling
City of Melville
City of Gosnells
City of Armadale
Community Environmental Advisory Committee to the Shire of Kalamunda
Town of Victoria Park
Water & Rivers Commission
Main Roads WA

d) Organisations that commented on the Draft Report:

Community Groups and Individuals

Urban Bushland Council WA Inc
Quenda Creek Subgroup of NRPG, Kalamunda
Friends of Bold Park Bushland Inc
Kwinana/Rockingham/Mandurah Branch, WA Naturalists' Club (Inc)
Rockingham Regional Environment Centre (Inc)
Friends of Lake Richmond
Friends of Perth Airport Bushland
Port Kennedy – Land Conservation Committee
Robert Powell

Local Government

City of Rockingham
City of Armadale
City of Perth
Town of Vincent
City of Bayswater
Shire of Serpentine-Jarrahdale
Town of Kwinana
City of South Perth
City of Melville

State Agencies

Department of Environmental Protection
Westrail
Water & Rivers Commission

APPENDIX 2

RESOURCES FOR VEGETATION PROJECTS

Appendix 2

RESOURCES FOR VEGETATION PROJECTS

There is a range of government and non government programs that provide assistance for vegetation projects in Western Australia. Some of these programs will provide resources for Greenways projects in urban areas. This section describes existing government and non government vegetation programs and whether they provide assistance for the establishment of Greenways within the Perth Metropolitan region.

1. Natural Heritage Trust

The Commonwealth Government's Natural Heritage Trust will provide $1.25 billion over 5 years in the pursuit of better environmental and natural resource outcomes. It therefore will be a significant source of funding for environmental projects, including Greenways projects. The Natural Heritage Trust includes the National Vegetation Initiative (which incorporates the programs previously known as One Billion Trees Community Grants, Save the Bush Community Grants and the National Corridors of Green Program) and the National Rivercare Initiative, (incorporating Fishcare, Waterwatch and National Wetlands Programs). Community groups and local government, in association with one or more community groups, are eligible for community grants through the Natural Heritage Trust.

Natural Heritage Trust funding (through the National Vegetation Initiative) can be used to protect and manage remnant native vegetation, to regenerate degraded native vegetation and to revegetate cleared land and through the National Rivercare Initiative, enhance, protect and restore waterways and wetlands. Revegetation projects should involve the establishment of local species of trees and shrubs. Funds can not be used for activities in National Parks or Nature Reserves.

More information on the National Vegetation Initiative is available from Ken Atkins, Department of Conservation and Land Management (telephone 9334 0425). More information on the National Rivercare Initiative is available from Naomi Arrowsmith, Water and Rivers Commission (telephone 9278 0461).

2. The Gordon Reid Foundation for Conservation

The Gordon Reid Foundation for Conservation provides grants of up to $5,000 through its small grants program for environmental projects undertaken by voluntary conservation groups. Major grants of amounts significantly greater than $5,000 are also available for strategic projects. The Lotteries Commission, through the Gordon Reid Foundation for Conservation, distributed approximately $1.2 million for environmental projects in 1996-97.

Priorities for funding established by the Gordon Reid Foundation that are relevant to the establishment and maintenance of Greenways include planting of local tree and understorey species, establishing corridors to link areas of remnant vegetation and controlling weeds.

Preference given to projects undertaken by voluntary conservation groups. While not ineligible, Local Government Authorities will only be funded where there is no suitably constituted local organisation to manage the project.

More information on the Gordon Reid Foundation for Conservation funding is available from Michael Crouch (tel 9322 1850).

3. State Remnant Vegetation and Revegetation Programs

The State Government, through the Soil and Land Conservation Council provides funding for the protection of remnant vegetation and large scale revegetation protects. Both of these programs target the agricultural area, with the State Revegetation Scheme specifically targeting agricultural areas receiving less than 600mm rainfall pa.

These schemes therefore have little relevance to the establishment and maintenance of Greenways in the Perth Metropolitan Region.

4. Community Conservation Grants

The Environment Minister's Community Conservation Grants provides a total of $165,000 for community groups and individuals to undertake conservation projects. Funding is provided to implement environmental management plans including on ground works, as well as for other conservation projects. More information on the Community Conservation Grants is available from the Environment Minister's office.

5. Aloca Region Landcare Project

The Alcoa Region Landcare project provides support for landcare activities with the local government areas of Cockburn, Armadale, Kwinana, Serpentine - Jarrahdale, Rockingham, Mandurah, Murray, Waroona and Harvey.

Landcare is defined in a broad sense to include actions to make lasting improvements on the local environment and that halt and reverse degradation. Vegetated corridors and protection of wetlands are included in the types of projects funded through this scheme. Community groups, or commercial and government bodies with substantial community support within the local government areas outlined above are eligible to apply for sponsorships, which generally range between $5,000 and $15,000.

6. Trees & Seeds for Biodiversity

Managed by Greening Western Australia, Trees and Seeds for Diversity provides more than 150,000 seedlings and seed for revegetation projects undertaken by community groups in rural areas. The establishment of vegetated corridors using local native species is supported under this program. Preference is given to projects that will serve as a demonstration of best practice in rural revegetation. This program therfore has limited relevance to the establishmnet of Greenways within the Perth Metropolitan region.

More information about Trees and Seeds for Diversity is available from Dorothy Redreau, Greening Western Australia (telephone 9481 2144).

7. Labour Market Programs

There have been significant changes to Commonwealth Government funded labour market programs over the past six months. Training in environmental management was provided in the past through a range of labour market programs known collectively as New Work Opportunities. In 1996 the Commonwealth Government introduced the Green Corps which replaced the New Work Opportunities. Green Corp and other labour market programs which may provide assistance for Greenways projects are discussed below.

7.1 Green Corps and ATCV

The Green Corp is a Commonwealth Government funded Labour Market Program aimed at 17 - 20 year olds that is managed by the Australian Trust for Conservation Volunteers. The twenty six week program includes 6 weeks accredited training, 2 weeks of community service, 4 weeks of ancillary projects and 14 weeks on a core project. The ancillary and core projects are environmental projects which may include the establishment and maintenance of Greenways. Projects are generally located in regional and remote centres but may also be located in the Perth Metropolitan Region. Green Corps thus has the potential to provide labour for Greenways projects in the Perth Metropolitan Region.

The Australian Trust for Conservation Volunteers (ATCV), through its volunteer program, can assist with supplying labour for conservation, rehabilitation and revegetation projects. In contrast to Green Corps projects, projects staffed by ATCV typically range from 1 day to several weeks.

More information about Green Corps and the Australian Trust for Conservation Volunteers is available from Penny Everingham (telephone 9339 3902).

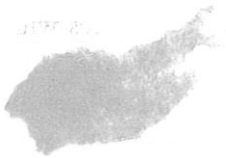
7.2 Environmental Traineeship Scheme

The Environmental Traineeship Scheme is a year long environmental traineeship scheme for16 - 24 year olds that provides trainees with a mix of on-the-job and formal training within environmental disciplines. Within the Perth Metropolitan Region two types of traineeships are offered: one is in land conservation and restoration and the other is in waste management. Trainees spend 39 weeks in on-the-job training and the year of the year in formal training. The Commonwealth Government provides a wage subsidy to the trainees and a training grant to employers. Employers receive a larger grant if the trainee was previously unemployed. More detailed information on the Environmental Traineeship Program is available from APACE Greenskills (telephone 336 1033).

The Environmental Traineeship Scheme has limited potential to provide skilled labour for Greenways projects. Unlike the New Work Opportunities such as LEAP and REEP and the more recent Green Corps which provides a team of people to work on environmental projects, the Environmental Traineeship Scheme is a placement program.

8. Other Opportunties

Funding opportunities for Local Government Authorities for Landcare activities are discussed in a recent paper by the WA Municipal Association (WAMA, 1997). Some of the opportunities, which include voluntary and compulsory rate levies, are also applicable to Greenways within the Perth Metropolitan Region.



MAP 1

KEY TO GREENWAYS

1 COASTAL STRIP
2 NORTHWEST WETLAND STRIP
3 MARMION AVENUE
4 BURNS BEACH ROAD
5 OCEAN REEF ROAD - MARMION AVENUE - BADGERUP LAKE - GNANGARA LAKE
6 STAR SWAMP - TRIGG BUSHLAND (ALSO SEE GREENWAY 8)
7 TRIGG BUSHLAND - LAKE GWELUP ALONG KARRINYUP ROAD
8 STAR SWAMP - TRIGG BUSHLAND (ALSO SEE GREENWAY 6)
9 MITCHELL FREEWAY / RAILWAY
10 HEPBURN AVENUE - ALEXANDER DRIVE - COAST
11 WANNEROO ROAD
12 MARANGAROO ROAD
13 ALEXANDER DRIVE - GNANGARA LAKE
14 BADGERUP ROAD AND OCEAN REEF ROAD (LAKE JANDABUP - LAKE BADGERUP - YELLAGONGA R.P.)
15 LAKEVIEW STREET (LAKE MARIGINUP - LAKE JANDABUP)
16 PINJAR ROAD (LAKE PINJAR - LAKE MARIGINUP - LAKE JANDABUP)
17 LAKE MARIGINUP - YELLAGONGA REGIONAL PARK
18 HERDSMAN LAKE - BOLD PARK
19 BOLD PARK - KINGS PARK
20 BOLD PARK TO LAKE CLAREMONT AND ALLEN PARK
21 WHITEMAN PARK - BENNETT BROOK
22 GNANGARA ROAD - WHITEMAN PARK - LAKE GOOLLELAL
23 HERDSMAN LAKE - LAKE GWELUP
24 SWAN RIVER
25 HELENA RIVER
26 TONKIN HIGHWAY - SWAN RIVER - PERTH AIRPORT
27 PERTH - FREMANTLE RAILWAY
28 PERTH - MIDLAND RAILWAY
29 ALEXANDER DRIVE LINKING GOLF COURSE
30 HERDSMAN LAKE - LAKE MONGER - FREEWAY - WANNEROO ROAD
31 OLD YANCHEP ROAD LINKING LAKE PINJAR - YANCHEP NATIONAL PARK
32 WHITEMAN PARK - SWAN RIVER - WANDOO CREEK
33 STAR SWAMP - LAKE KARRINYUP
34 BURNS BEACH - NEERABUP NATIONAL PARK
35 NEERABUP NATIONAL PARK - COAST
36 COASTAL PLAIN WALKTRAIL (COAST - WALYUNGA NATIONAL PARK)
37 GNANGARA REGIONAL OPEN SPACE - WETLAND
38 STAR SWAMP - WHITEMAN PARK
39 WHITEMAN PARK - SWAN RIVER - BENNETT BROOK
40 WHITEMAN PARK - MELALEUCA PARK
41 YELLAGONGA REGIONAL PARK - MELALEUCA PARK
42 CREEKLINE TO ELLENBROOK
43 NEEVES ROAD CREEKLINE TO ELLENBROOK
44 ELLENBROOK - ENTIRE LENGTH

WANNEROO
JOONDALUP
SWAN

MAP 1

WANNEROO

JOONDALUP

SWAN

24 SWAN RIVER
25 HELENA RIVER
26 TONKIN HIGHWAY - SWAN RIVER - PERTH AIRPORT
27 PERTH - FREMANTLE RAILWAY
28 PERTH - MIDLAND RAILWAY
29 ALEXANDER DRIVE LINKING GOLF COURSE
30 HERDSMAN LAKE - LAKE MONGER - FREEWAY - WANNEROO ROAD
31 OLD YANCHEP ROAD LINKING LAKE PINJAR - YANCHEP NATIONAL PARK
32 WHITEMAN PARK - SWAN RIVER - WANDOO CREEK
33 STAR SWAMP - LAKE KARRINYUP
34 BURNS BEACH - NEERABUP NATIONAL PARK
35 NEERABUP NATIONAL PARK - COAST
36 COASTAL PLAIN WALKTRAIL (COAST - WALYUNGA NATIONAL PARK)
37 GNANGARA REGIONAL OPEN SPACE - WETLAND
38 STAR SWAMP - WHITEMAN PARK
39 WHITEMAN PARK - SWAN RIVER - BENNETT BROOK
40 WHITEMAN PARK - MELALEUCA PARK
41 YELLAGONGA REGIONAL PARK - MELALEUCA PARK
42 CREEKLINE TO ELLENBROOK
43 NEEVES ROAD CREEKLINE TO ELLENBROOK
44 ELLENBROOK - ENTIRE LENGTH
45 LOWER JANE BROOK - WHITEMAN PARK (LINKS JOHN FORREST NATIONAL PARK - CAVERSHAM AIRFIELD - WHITEMAN PARK)
46 SUSANNAH BROOK
47 WALKING TRAIL (JOHN FORREST NATIONAL PARK - LAKE LESCHENAULTIA)
48 WALYUNGA NATIONAL PARK - AVON VALLEY NATIONAL PARK
49 KADINA BROOK
50 ROE HIGHWAY
51 WALKTRAIL STATE FOREST - GREENMOUNT NATIONAL PARK
52 POISON GULLY
53 WALKTRAIL JOHN FORREST NATIONAL PARK
54 HARDY ROAD - RAILWAY RESERVE - HELENA VALLEY
55 BIBBULMUN TRACK
56 TOODYAY ROAD
57 CHITTERING ROAD
58 WALYUNGA NATIONAL PARK - JOHN FORREST NATIONAL PARK (ROLAND RD - OBRIEN RD)
59 SAWPIT GULLY LINKING TO ELLENBROOK
60 OLD RAILWAY LINE - RAHNE ROAD - UTAH ROAD - AVON VALLEY NATIONAL PARK
61 CARDUP BROOK
62 BEENYUP BROOK
63 MANJEDAL BROOK LINKING DARLING SCARP WITH OAKFORD MAIN DRAIN
64 MENDULLA BROOK LINKING SERPENTINE NATIONAL PARK WITH SERPENTINE RIVER
65 SERPENTINE RIVER
66 MUNDIJONG ROAD
67 OLD TRAMWAY - SERPENTINE ROAD (LINKS WITH 93, 103 AND 94 TO SWAM RIVER)
68 BRIXTON STREET - ROE HIGHWAY - PERTH AIRPORT - SCARP - CANNING HIGHWAY
69 ARMADALE TOWNSITE - ARMADALE SETTLERS COMMON - FORRESTDALE LAKE - THOMSONS LAKE
70 SOUTHERN RIVER - CANNING RIVER - DARLING RANGE REGIONAL PARK
71 CANNING RIVER - SWAN RIVER - DARLING RANGE REGIONAL PARK
72 CANNING RIVER - GOLF COURSE
73 NORTH LAKE - BIBRA LAKE - ROE HIGHWAY EXTENSION
74 STOCK ROAD
75 STOCK ROAD TO BIBRA LAKE
76 RUSSELL ROAD - THOMSONS LAKE - WOODMAN PT REGIONAL PARK
77 SOUTHWEST HIGHWAY LINKING MUNDIJONG RD - SOUTHERN RIVER - DARLING RANGE REGIONAL PARK
78 THOMSONS LAKE - FORRESTDALE LAKE
79 SWAN RIVER - CANNING RIVER
80 KWINANA FREEWAY
81 FORRESTDALE LAKE - THOMSONS LAKE
82 PINEY LAKES - WIRELESS HILL - SWAN RIVER
83 PORT KENNEDY SCIENTIFIC PARK - ROCKINGHAM LAKES REGIONAL PARK - BEELIAR REGIONAL PARK
84 PORT KENNEDY SCIENTIFIC PARK - SERPENTINE RIVER
85 LINKS CHAINS OF WETLANDS PARALLEL TO AND EAST OF MANDURAH ROAD, INCLUDING STAKEHILL SUITE OF WETLANDS
86 LAKE RICHMOND - LAKE COOLOONGUP
87 LEDA RIDGELINES - ROCKINGHAM ROAD
88 MAIN DRAIN BIRREGA - OAKFORD
89 PAGANONI SWAMP - LAKE WALYUNGUP - PORT KENNEDY SCIENTIFIC PARK
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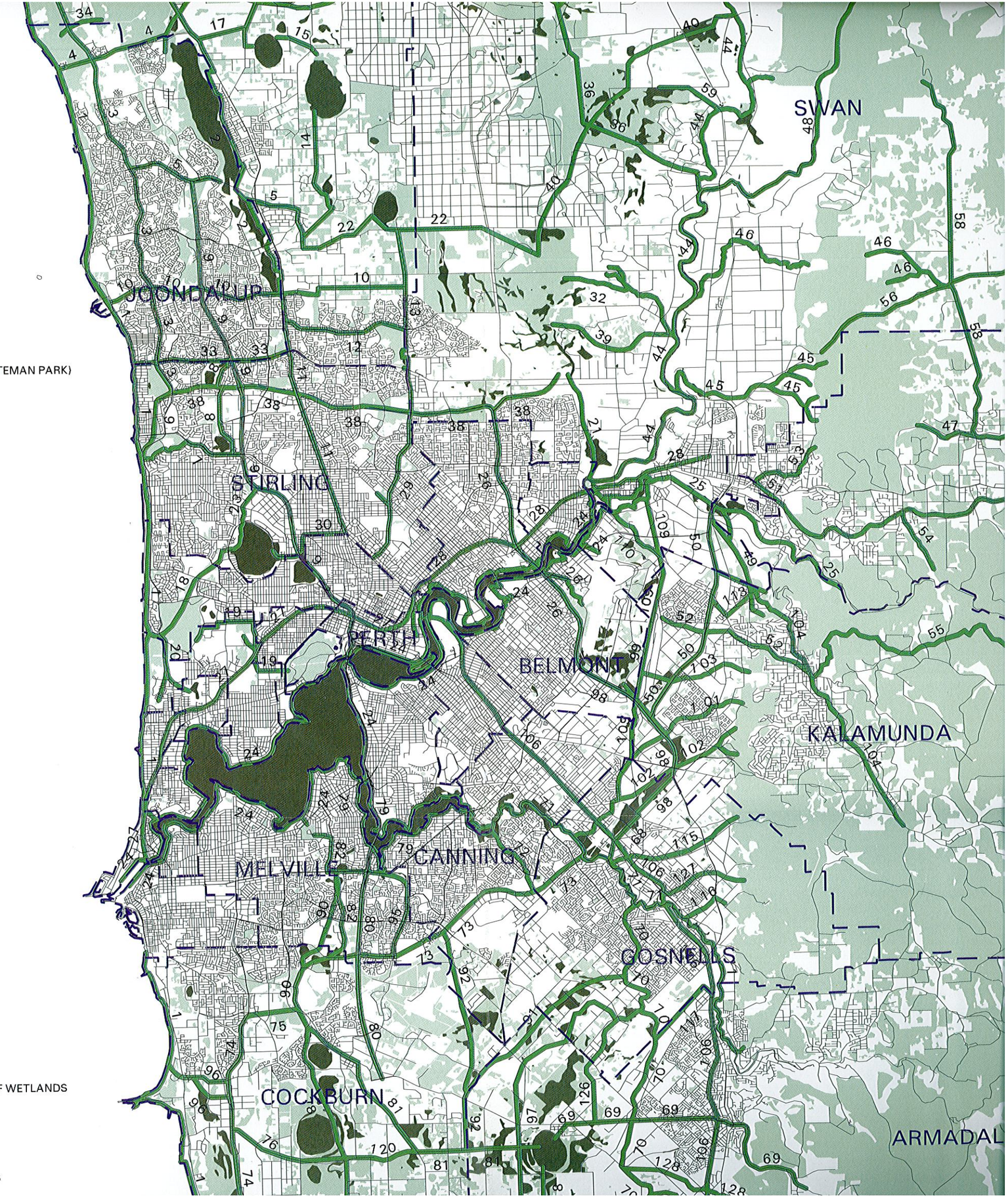

LD - WHITEMAN PARK)

K

UITE OF WETLANDS

N LAKES

JOONDALUP

STIRLING

PERTH

BELMONT

SWAN

MUNDARING

KALAMUNDA

MELVILLE

CANNING

COSNELLS

COCKBURN

ARMADALE

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92 JANDAKOT BOTANIC PARK - NORTH LAKE
93 CONNECTION TO COASTAL AREA - POINT PERON
94 LEACH HIGHWAY LINKING BULLCREEK WETLAND WITH PINEY AND BOORAGOON LAKES
95 BULLCREEK WETLAND ALONG KAREL AVE TO CONNECT WITH GREENWAY 73
96 STOCK ROAD - COAST (WOODMAN POINT)
97 SOUTHERN RIVER - FORRESTDALE LAKE - THOMAS ROAD - SPECTACLES - COAST
98 PERTH AIRPORT - HARTFIELD PARK - YULE BROOK
99 FORRESTFIELD MARSHALLING YARDS
100 TONKIN HIGHWAY LINKING HARTFIELD PARK & M53
101 WOODLUPINE BROOK (JOINS YULE BROOK)
102 YULE BROOK
103 CRUMPET CREEK
104 WALKING TRAIL NEAR RAILWAY ROAD
105 COAST - BUCKLAND HILL - SWAN RIVER
106 PERTH - ARMADALE RAILWAY LINE
107 BROCKMAN RIVER
108 CREEKLINE LINKING WALYUNGA NATIONAL PARK AND ELLENBROOK
109 EXTENSIONS TO FORRESTFIELD RAILWAY
110 KALAMUNDA ROAD
111 KADINA BROOK
112 ADELAIDE STREET
113 RIDGE HILL ROAD
114 OAKLANDS DRAIN
115 BICKLEY BROOK
116 ELLIS BROOK
117 DRAIN LINKING CANNING RIVER AND SOUTHERN RIVER
118 DRAIN LINKING FORRESTDALE LAKE WITH BIRREGA - OAKFORD DRAIN
119 WUNGONG BROOK
120 EXTENSIONS TO 76
121 PEEL MAIN DRAIN
122 TAMWORTH SWAMP
123 LINKS PAGANONI SWAMP TO SERPENTINE RIVER
124 DRAIN LINKING SERPENTINE RIVER AND SOUTH WEST RAILWAY LINE
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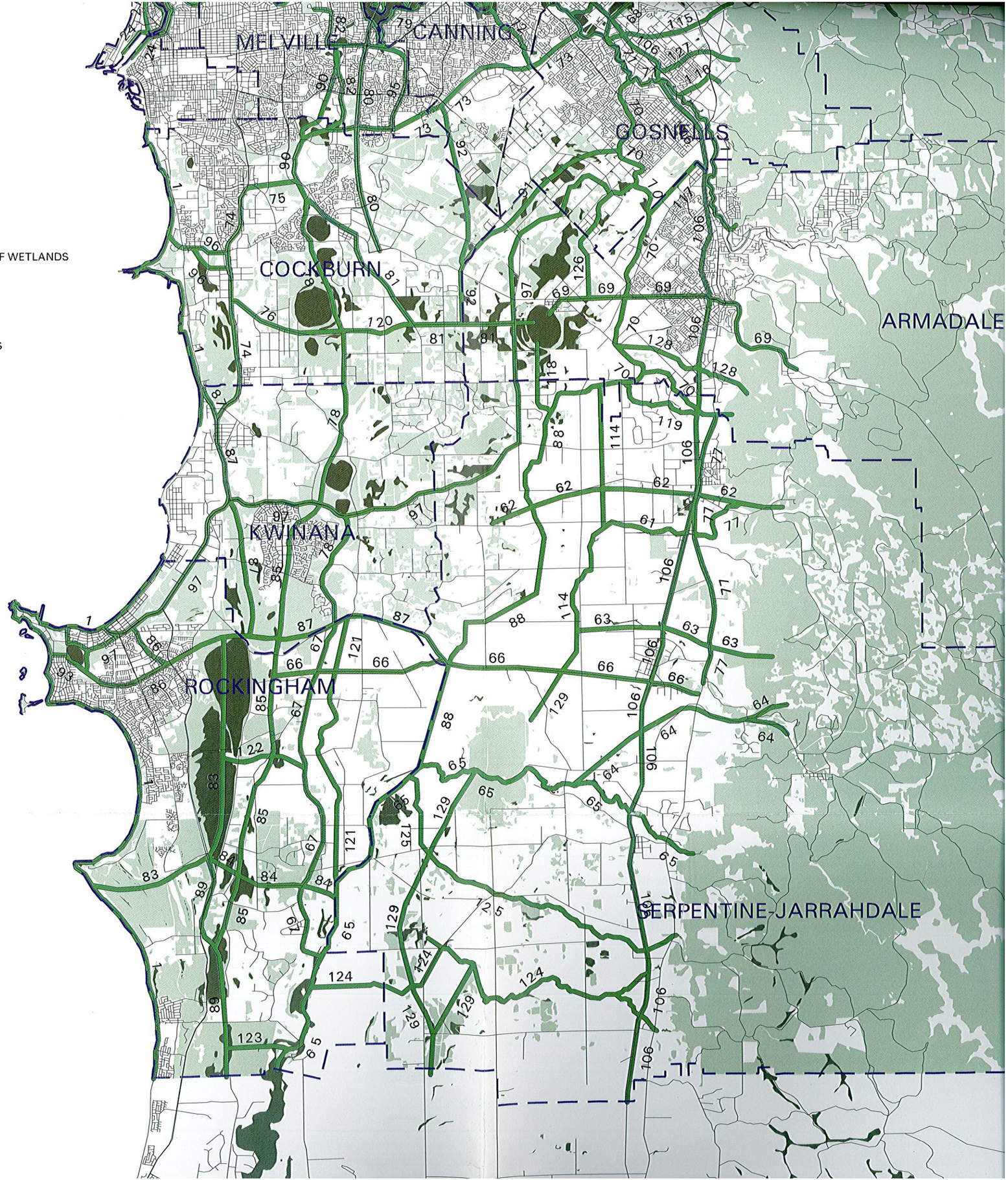
129 LINKING REMNANT VEGETATION AND WETLANDS IN SHIRE OF SERPENTINE - JARRAHDALE



N

K

GUITE OF WETLANDS

N LAKES

MELVILLE

CANNING

GOSNELLS

ARMADALE

COCKBURN

KWINANA

ROCKINGHAM

SERPENTINE-JARRAHDALE

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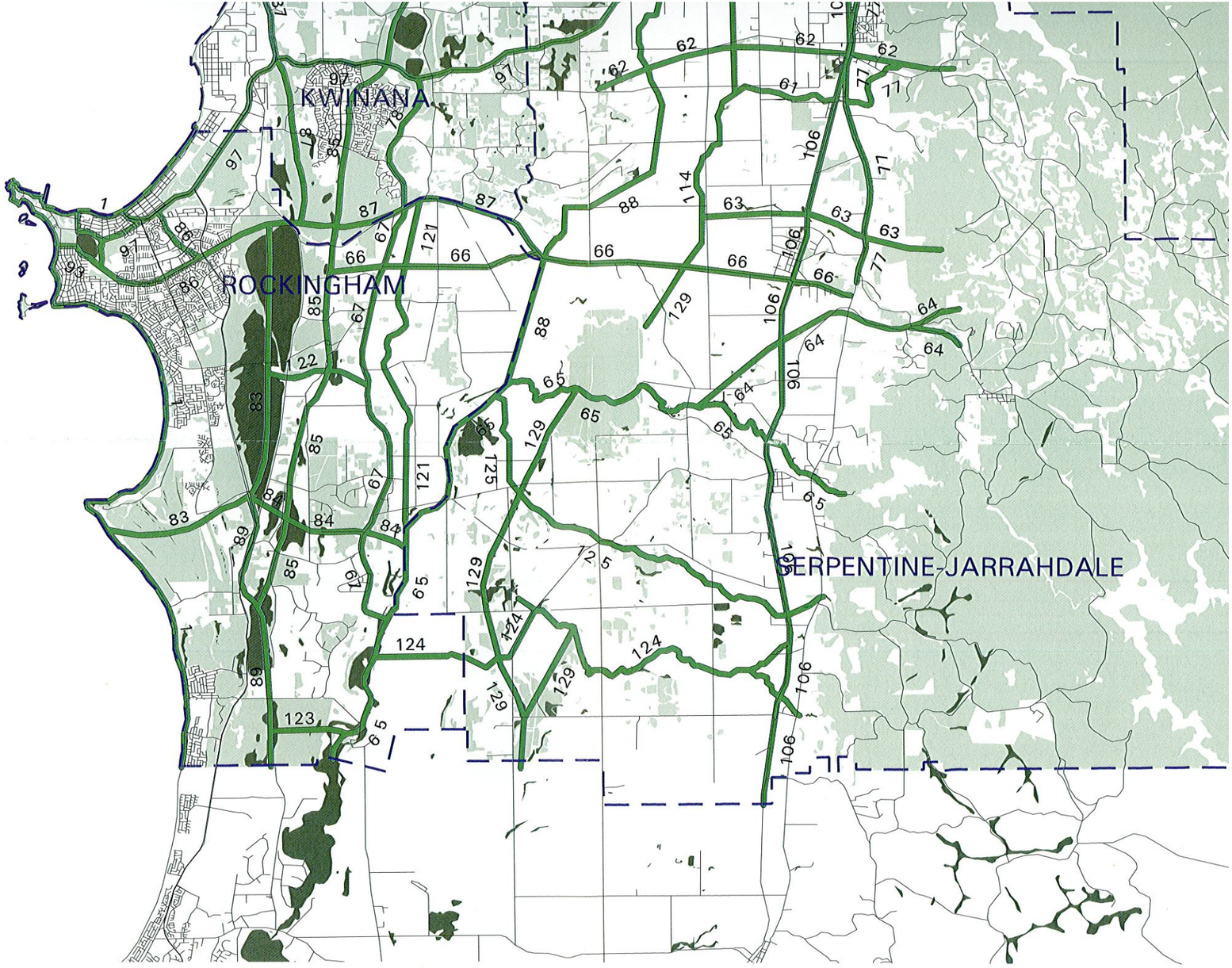

PLANNING
WESTERN AUSTRALIA
Ministry for Planning

Produced by the Land Information Branch, Ministry for Planning.
Perth, Western Australia.

05 November 1998

LEGEND

- Remnant Bushland
- Conservation Category Wetlands
- Proposed Greenways
- Local Government Areas (Metro)
- Street Centrelines

NOTES

Wetlands that are classified as being "Resource Enhancement" or "Multiple Use" Management Categories have not been shown, but should be considered in the development of Local Greening Plans.

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Co

KWINANA

ROCKINGHAM

SERPENTINE-JARRAHDALE

MAP 1

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PERTH'S GREENWAYS
Proposed Greenways with Remnant Bushland and Conservation Category Wetlands
Final

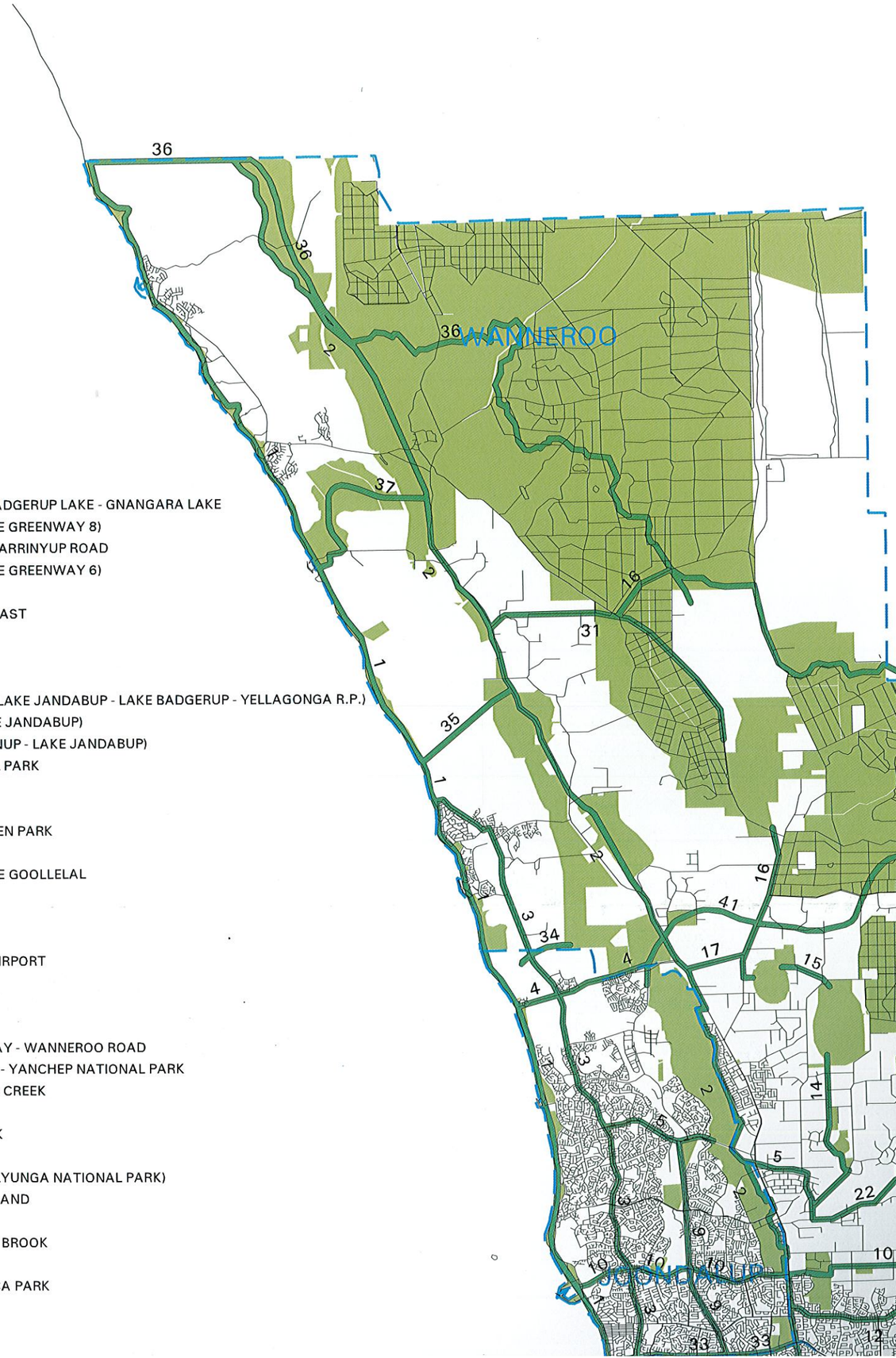
SCALE 1:175000

5km 0 5km 10km

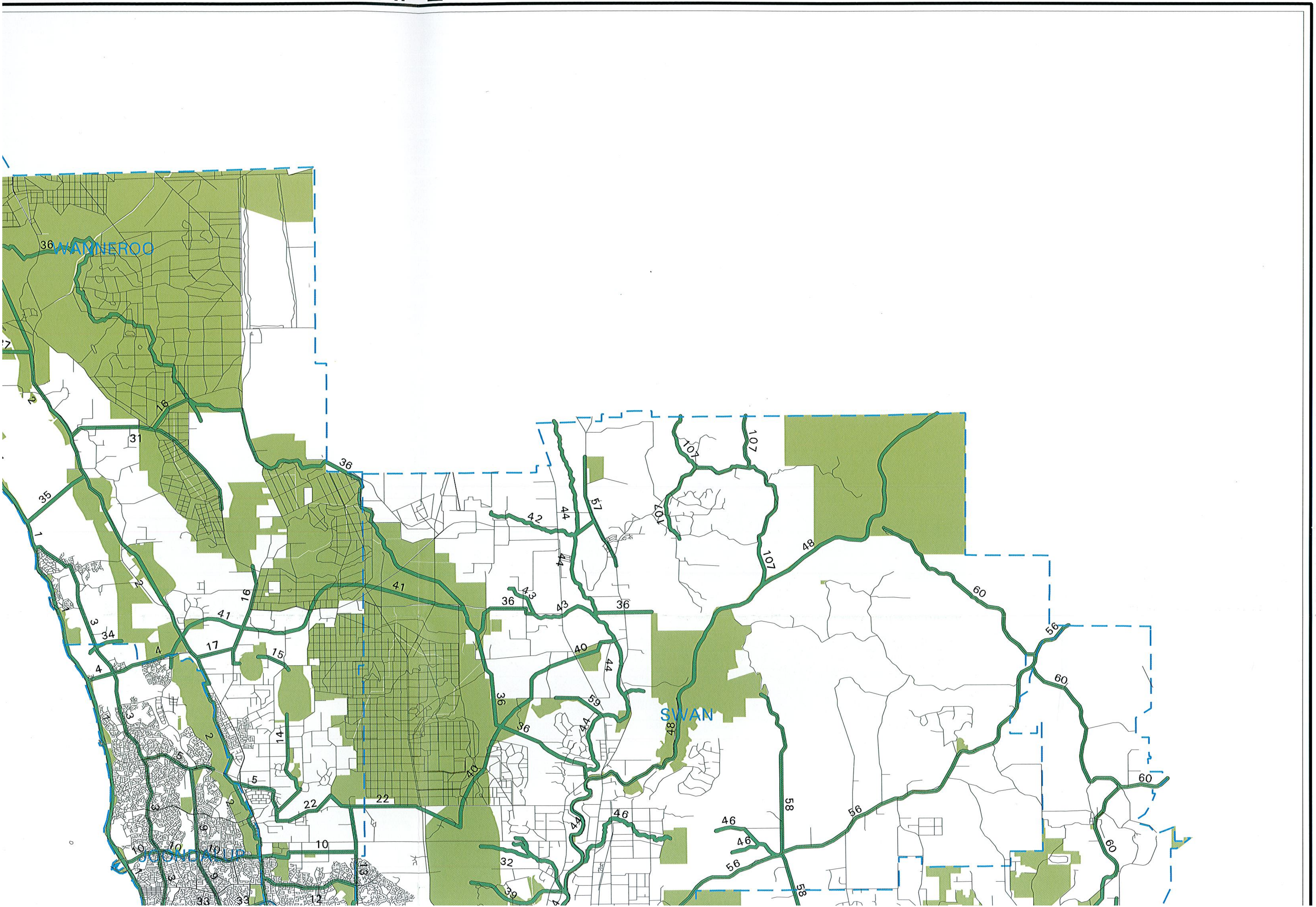
MAP 2

KEY TO GREENWAYS

1 COASTAL STRIP
2 NORTHWEST WETLAND STRIP
3 MARMION AVENUE
4 BURNS BEACH ROAD
5 OCEAN REEF ROAD - MARMION AVENUE - BADGERUP LAKE - GNANGARA LAKE
6 STAR SWAMP - TRIGG BUSHLAND (ALSO SEE GREENWAY 8)
7 TRIGG BUSHLAND - LAKE GWELUP ALONG KARRINYUP ROAD
8 STAR SWAMP - TRIGG BUSHLAND (ALSO SEE GREENWAY 6)
9 MITCHELL FREEWAY / RAILWAY
10 HEPBURN AVENUE - ALEXANDER DRIVE - COAST
11 WANNEROO ROAD
12 MARANGAROO ROAD
13 ALEXANDER DRIVE - GNANGARA LAKE
14 BADGERUP ROAD AND OCEAN REEF ROAD (LAKE JANDABUP - LAKE BADGERUP - YELLAGONGA R.P.)
15 LAKEVIEW STREET (LAKE MARIGINUP - LAKE JANDABUP)
16 PINJAR ROAD (LAKE PINJAR - LAKE MARIGINUP - LAKE JANDABUP)
17 LAKE MARIGINUP - YELLAGONGA REGIONAL PARK
18 HERDSMAN LAKE - BOLD PARK
19 BOLD PARK - KINGS PARK
20 BOLD PARK TO LAKE CLAREMONT AND ALLEN PARK
21 WHITEMAN PARK - BENNETT BROOK
22 GNANGARA ROAD - WHITEMAN PARK - LAKE GOOLLELAL
23 HERDSMAN LAKE - LAKE GWELUP
24 SWAN RIVER
25 HELENA RIVER
26 TONKIN HIGHWAY - SWAN RIVER - PERTH AIRPORT
27 PERTH - FREMANTLE RAILWAY
28 PERTH - MIDLAND RAILWAY
29 ALEXANDER DRIVE LINKING GOLF COURSE
30 HERDSMAN LAKE - LAKE MONGER - FREEWAY - WANNEROO ROAD
31 OLD YANCHEP ROAD LINKING LAKE PINJAR - YANCHEP NATIONAL PARK
32 WHITEMAN PARK - SWAN RIVER - WANDOO CREEK
33 STAR SWAMP - LAKE KARRINYUP
34 BURNS BEACH - NEERABUP NATIONAL PARK
35 NEERABUP NATIONAL PARK - COAST
36 COASTAL PLAIN WALKTRAIL (COAST - WALYUNGA NATIONAL PARK)
37 GNANGARA REGIONAL OPEN SPACE - WETLAND
38 STAR SWAMP - WHITEMAN PARK
39 WHITEMAN PARK - SWAN RIVER - BENNETT BROOK
40 WHITEMAN PARK - MELALEUCA PARK
41 YELLAGONGA REGIONAL PARK - MELALEUCA PARK
42 CREEKLINE TO ELLENBROOK
43 NEEVES ROAD CREEKLINE TO ELLENBROOK
44 ELLENBROOK - ENTIRE LENGTH



MAP 2



24 SWAN RIVER
25 HELENA RIVER
26 TONKIN HIGHWAY - SWAN RIVER - PERTH AIRPORT
27 PERTH - FREMANTLE RAILWAY
28 PERTH - MIDLAND RAILWAY
29 ALEXANDER DRIVE LINKING GOLF COURSE
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44 ELLENBROOK - ENTIRE LENGTH
45 LOWER JANE BROOK - WHITEMAN PARK (LINKS JOHN FORREST NATIONAL PARK - CAVERSHAM AIRFIELD - WHITEMAN PARK)
46 SUSANNAH BROOK
47 WALKING TRAIL (JOHN FORREST NATIONAL PARK - LAKE LESCHENAULTIA)
48 WALYUNGA NATIONAL PARK - AVON VALLEY NATIONAL PARK
49 KADINA BROOK
50 ROE HIGHWAY
51 WALKTRAIL STATE FOREST - GREENMOUNT NATIONAL PARK
52 POISON GULLY
53 WALKTRAIL JOHN FORREST NATIONAL PARK
54 HARDY ROAD - RAILWAY RESERVE - HELENA VALLEY
55 BIBBULMUN TRACK
56 TOODYAY ROAD
57 CHITTERING ROAD
58 WALYUNGA NATIONAL PARK - JOHN FORREST NATIONAL PARK (ROLAND RD - OBRIEN RD)
59 SAWPIT GULLY LINKING TO ELLENBROOK
60 OLD RAILWAY LINE - RAHNE ROAD - UTAH ROAD - AVON VALLEY NATIONAL PARK
61 CARDUP BROOK
62 BEENYUP BROOK
63 MANJEDAL BROOK LINKING DARLING SCARP WITH OAKFORD MAIN DRAIN
64 MENDULLA BROOK LINKING SERPENTINE NATIONAL PARK WITH SERPENTINE RIVER
65 SERPENTINE RIVER
66 MUNDIJONG ROAD
67 OLD TRAMWAY - SERPENTINE ROAD (LINKS WITH 93, 103 AND 94 TO SWAM RIVER)
68 BRIXTON STREET - ROE HIGHWAY - PERTH AIRPORT - SCARP - CANNING HIGHWAY
69 ARMADALE TOWNSITE - ARMADALE SETTLERS COMMON - FORRESTDALE LAKE - THOMSONS LAKE
70 SOUTHERN RIVER - CANNING RIVER - DARLING RANGE REGIONAL PARK
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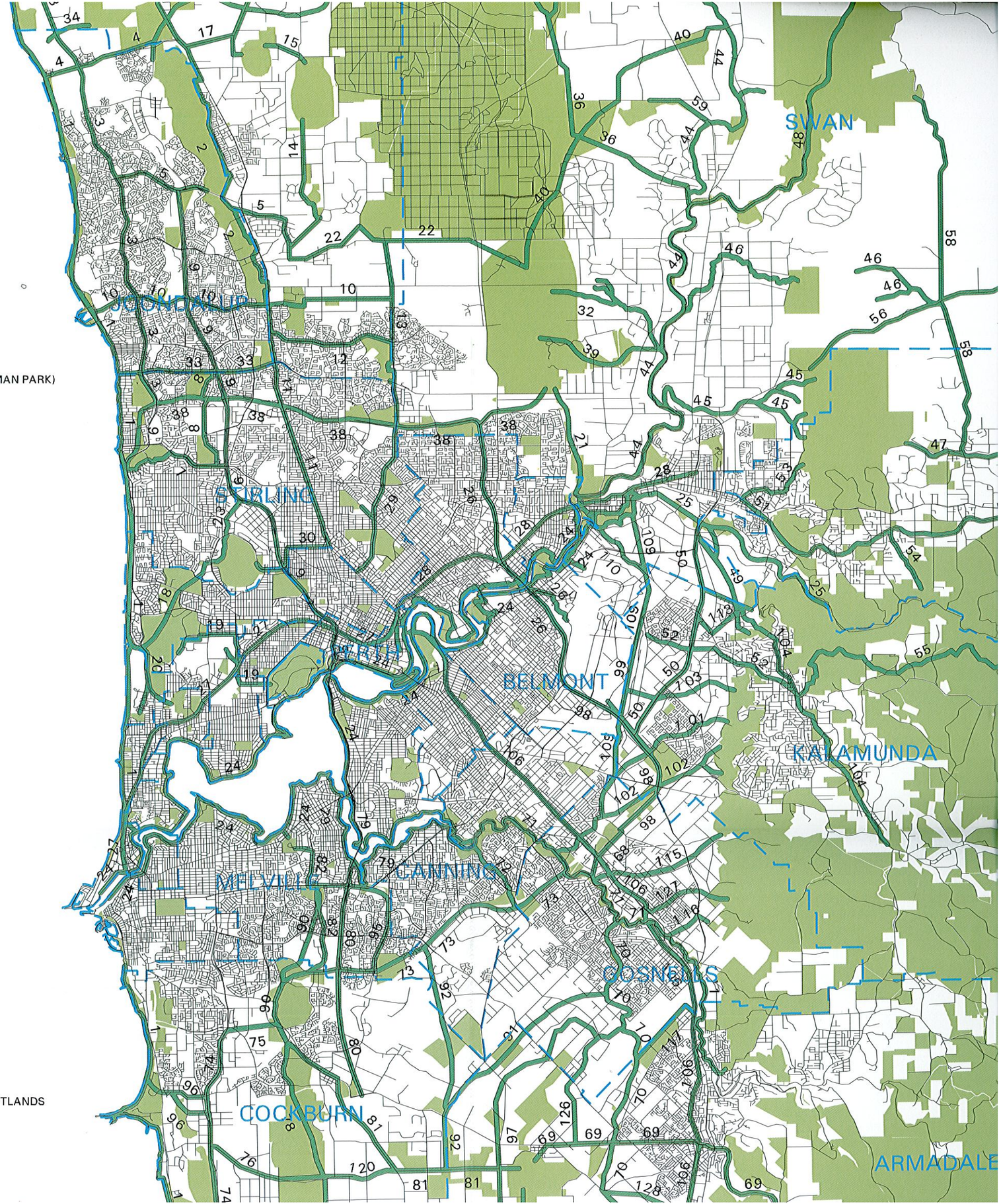

LD - WHITEMAN PARK)

K

UITE OF WETLANDS

N LAKES

JOONDALUP

SWAN

STIRLING

BELMONT

KALAMUNDA

MUNDARING

MELVILLE

CANNING

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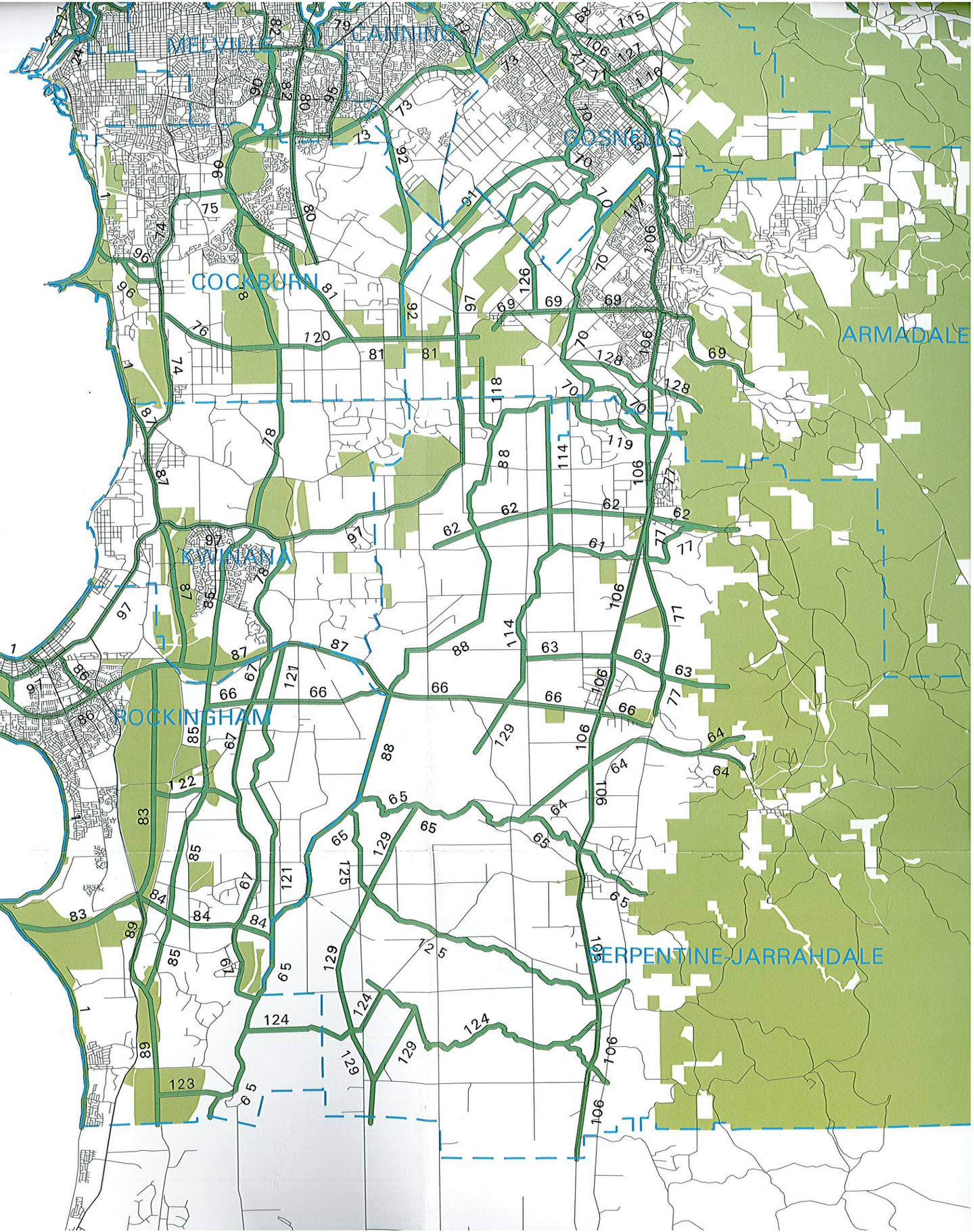

K

SUITE OF WETLANDS

N LAKES

MELVILLE

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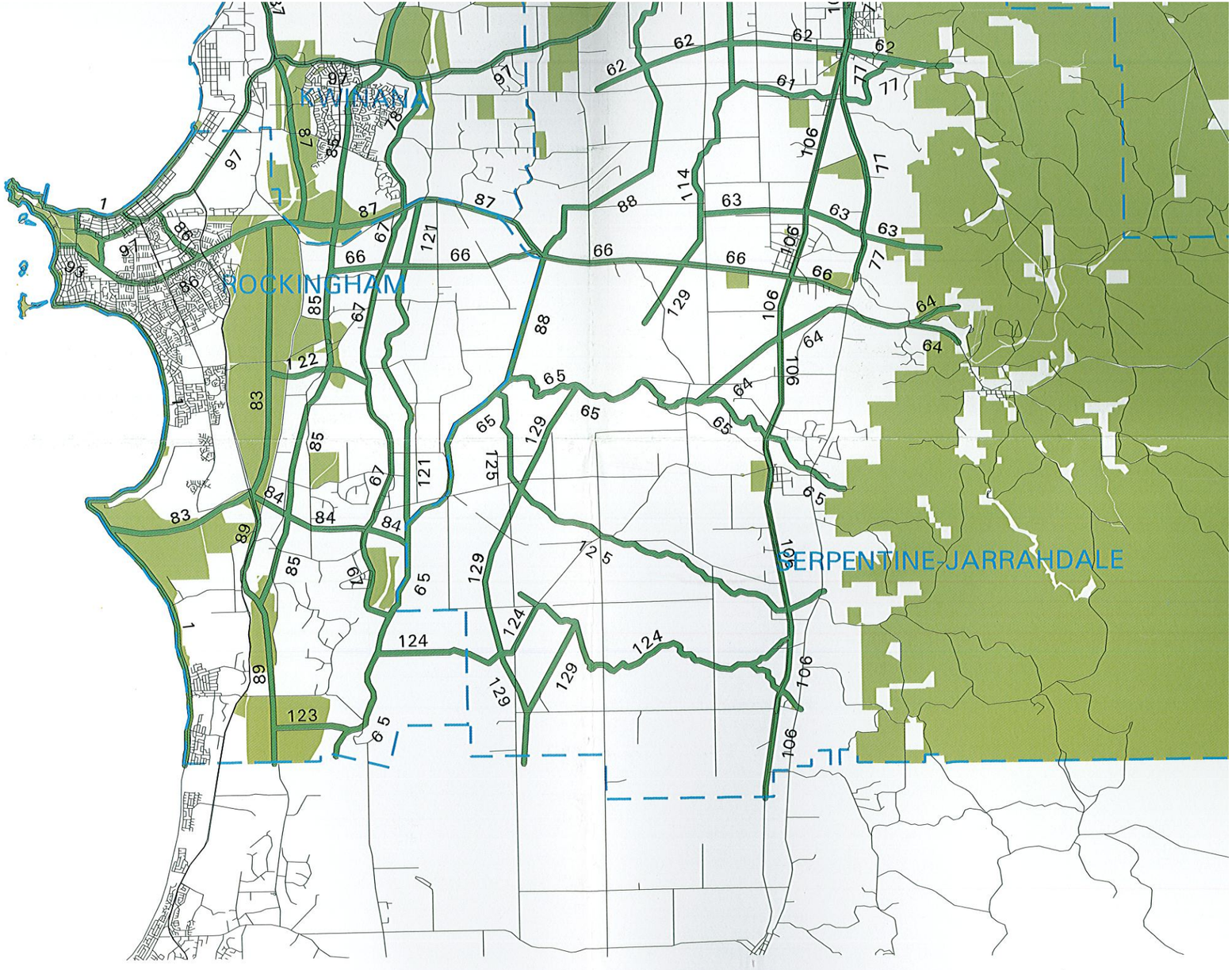

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WESTERN AUSTRALIA
Ministry for Planning

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Perth, Western Australia.

05 November 1998

LEGEND

- Secure Tenure Areas - includes areas in the CALM conservation estate, Parks and Recreation reserves under the Metropolitan Region Scheme and Regional Parks.
- Proposed Greenways
- Local Government Areas (Metro)
- Street Centrelines

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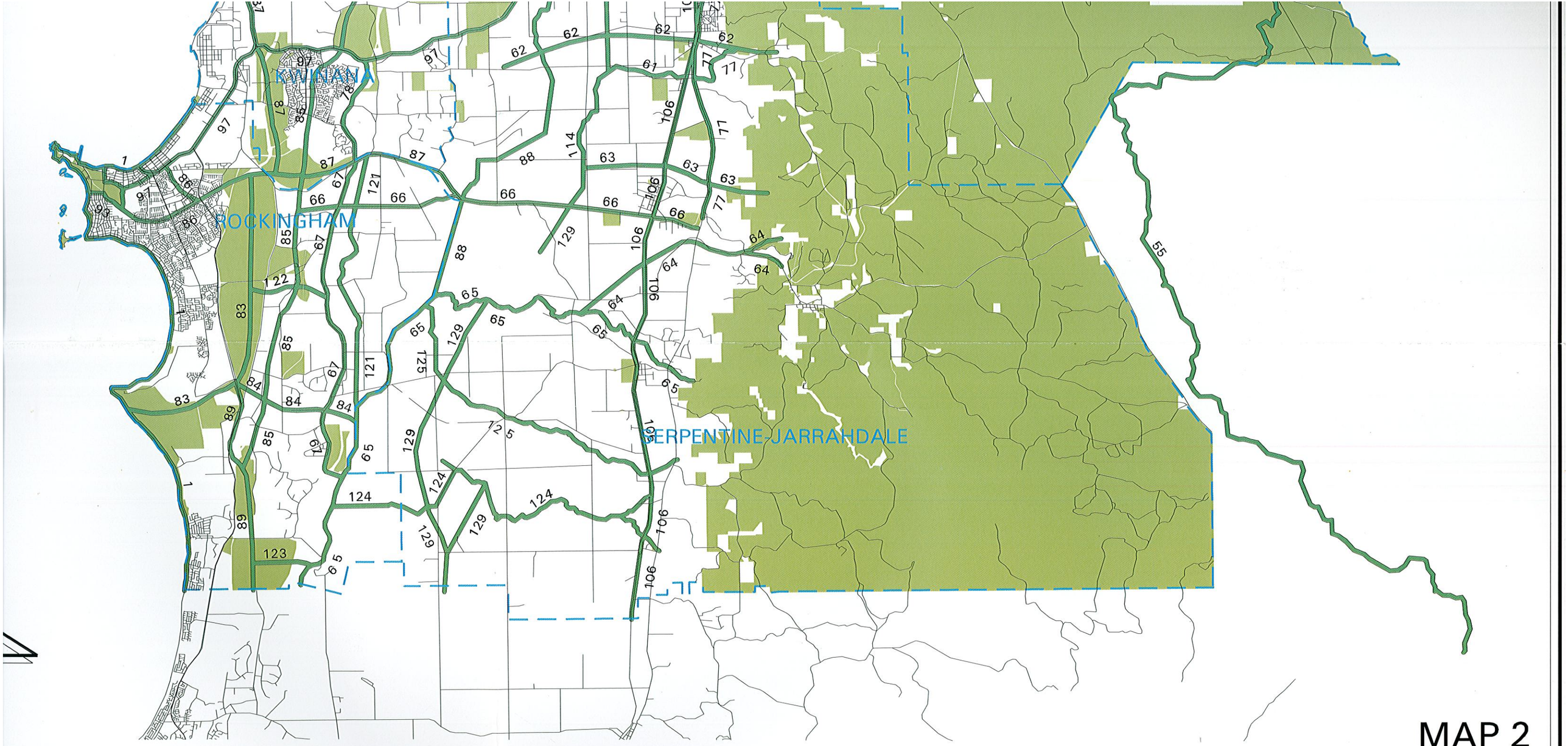

MAP 2

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reserves under the Metropolitan
Parks.

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PERTH'S GREENWAYS
Proposed Greenways with Secure Tenure Areas

Final

SCALE 1:175000

5km 0 5km 10km