

Section 1 Introduction

The aim of this Strategy is to ensure that the natural resources of the Swan Region (the Region) will be protected and managed sustainably. It also aims to enhance the quality of life for present and future generations.

The Strategy formalises the partnership between the wider regional community and Government in managing natural resources at a regional scale. In this way it addresses Australian Government and State Government expectations for accredited regional natural resource management (NRM) plans.

The Swan Catchment Council (the Council) is responsible for the development of the Strategy. The Council is a regional group involved in the coordination and delivery of NRM activities in the Region. The Council addresses wider regional community needs by working closely with Government agencies and other bodies to promote collaboration on key environmental issues.

The accreditation of this Strategy will lead to:

- Recognition of the desired regional natural resource management outcomes by the Australian Government and State Government.
- A strategically directed and clearly defined set of prioritised NRM targets.
- Stakeholder participation and ownership of goals and activities.
- Strategic and scientifically based sound investment of State and Australian Government funds.
- An ability to assess progress towards achieving the NRM targets.
- Increased regional capacity for ongoing adaptive management.

The Council has actively engaged and worked with the wider regional community and key stakeholders to ensure that the standards set through the accreditation criteria have been met. Significantly, this Strategy provides a mechanism for meaningful input into the delivery of current policy and statutes by the wider regional community. It also identifies mechanisms by which members of the wider regional community can influence any review of policy and statutes, particularly as they relate to planning and NRM.

In order to deliver effective regional NRM outcomes a number of key partnerships need to be developed. These partnerships will be between the Australian Government, State Government, Local Government, corporate bodies, non-Government organisations such as Greening Australia, WWF and Conservation Council of Western Australia and the wider regional community.

1.1 Purpose of the Strategy

This Strategy provides an integrated planning framework for the management of the Region's natural resources. The scale and intensity of threatening processes upon the Region's natural resources is greater than can be managed by any one Government agency or organisation alone, therefore an integrated approach is required. The enormity of investments required to address all threats and sustainably manage the Region's natural resources far exceeds the financial resources that are currently available. A strategic approach for investment is therefore essential to ensure that available resources are allocated towards actions with the greatest benefit.

A primary purpose of this Strategy is to identify and develop appropriate and sustainable management responses to the threatening processes that have been identified, as important strategic priorities for the Region. The Australian and State Governments have developed a formal accreditation process for all regional plans. Achieving accreditation is a prerequisite to be eligible for accessing Australian Government NHT investment funds.

The following steps identify how the purpose of the Strategy will be achieved. Specifically, the Strategy will:

- Identify the asset values and over-arching goals for the management of the Region's natural resources. It will specify targets that are agreed to by all partners.
- Establish priorities for action to meet defined goals.
- Address pressures placed on natural resources by the large and growing population in the Region.

- Identify gaps in the coverage of NRM instruments and activities and define how they will be addressed.
- Ensure regional objectives are locally relevant.
- Ensure that key National and State environmental policies and programs are addressed in the Region.
- Provide planning decision-makers with key priorities to ensure sound NRM practices are considered for adoption during land use change.
- Formalise the partnership between Government, industry and the wider regional community in the management of the Region's natural resources.
- Provide a guide for investment in regional priorities by Government, industry and the wider regional community.

1.2 Natural Resource Management (NRM)

Natural resources can be defined as a broad spectrum of biophysical (air, land, water, plants, animals and micro-organisms), and social and economic assets. These assets are inter-related, inter-connected and inter-dependent.

Natural resource management (NRM) can be defined as the management of these assets for the purpose of conservation and sustainability of the natural resource base. It involves the wider regional community including landholders, businesses, industries, residents, Local Government and State agencies. The sustainable, long-term health and productivity of the Region's natural resources and the conservation of its environmental values can best be achieved through the adoption of an integrated approach to NRM.

All human actions ultimately impact on the quality and quantity of natural resources. Environmental degradation is one of the first indications of incompatible management practices and unsustainable natural resource use. The Region faces many NRM challenges, including declining water quality, rising salinity, and loss of biodiversity. Maintaining healthy landscapes and the sustainable use of the Region's natural resources requires ongoing efforts to prevent and reverse natural resource degradation. The sustainable future of natural resources in the Region will rely upon the integrated management of these assets and the planning of future resource use. For the first time, the Region is now aiming for full integration across the catchment to the coast by embracing marine and coastal environs. NRM decision-makers need to understand how these different assets are inter-related to promote sustainable development.

Sustainability

Sustainability in Western Australia is guided by the framework *Hope for the Future: The Western Australian State Sustainability Strategy (2003)*. Sustainability is defined as "meeting the needs of current and future generations through an integration of environmental protection, social advancement and economic prosperity". Achieving sustainability involves: providing basic resource needs for all, equity across all generations, societies and species, ecological preservation and maintenance, expansion and transfer of intellectual and technological knowledge, the application of environmental economics and adoption of a long-term view. The guiding principles of sustainability form the foundation for sound NRM.

Recognition of the need for an integrated approach to sustainable development was initiated internationally within Agenda 21 of the 1992 United Nations Conference on Environment and Development. A fundamental principle of the agenda is the concept of environmental management at all levels. It specifically emphasised the importance of environmental action at a local level to achieve global targets.

Within the State Sustainability Strategy, sustainability in NRM is seen as addressing the triple bottom line of economic development, ecological integrity and social and cultural wellbeing. The concept of sustainable NRM is defined as using, conserving and enhancing natural resources so that ecological processes, on which life depends, are maintained and the total quality of life, now and in the future, can be increased (Department of Premier and Cabinet 2003).

The development of the Swan Region Strategy has been based on the key foundation and process principles identified in the State Sustainability Strategy. Understanding the key functions and processes of the Region's natural resources will enable appropriate management actions to be developed. To ensure sustainable NRM in the Region, criteria to select management options must focus on:

- Protection of the remaining identified environmental values of the Region.

- Restoration of the resource degraded by past management practices and land use activities.
- Maintenance of economic and social development.

Stakeholders

The Swan Region is the most heavily populated NRM region in the State, involving a diverse range of stakeholders. Collectively the primary stakeholders are made up of the wider regional community. Defining stakeholder roles and responsibilities will be central to the effective development, investment in and implementation of this Strategy.

Appendix 2 provides a broad description of some of the key stakeholders in the Region. Outlined below are some of the primary stakeholders with whom partnerships must be enhanced or developed for improved NRM outcomes:

- Australian Government
- Western Australian State Government agencies
 - Department of Environment
 - Department of Conservation and Land Management
 - Department of Agriculture
 - Department of Planning and Infrastructure
 - Department of Fisheries
 - Department of Land Administration
- Swan River Trust
- Avon Catchment Council
- Environmental Protection Authority
- Department of Defence
- Water Corporation
- Local Government Authorities
- NRM Regional Groups
- Natural Resource Management Council
- Cockburn Sound Management Council
- Heritage Council of WA
- Swan Valley Planning Committee
- Schools, academic and tertiary institutions
- Research organisations
- Chamber of Commerce and Industry (WA)
- Urban Development Institute of Australia
- Non-Government organisations (NGOs)
 - Conservation Council of Western Australia
 - Urban Bushland Council
 - Wildflower Society (WA)
- WA Farmers Federation and the Pastoralists and Graziers Association
- Industry associations
 - Fishing industry (e.g. Marine Stewardship Council, Recfishwest, Aquaculture Development Council, Marine Fishfarmers Association Council)
 - Tourism industry
 - Poultry industry
- Catchment and community groups
- Indigenous community
- Local communities
- Recreational groups
- Mineral and energy groups

The establishment and maintenance of partnerships is a recurrent theme throughout the Strategy and is seen to be central to the achievement of sustainable NRM outcomes. The importance of effective communication with the wider regional community cannot be underestimated.

NRM Planning

There are many NRM plans covering areas of the Region. Some of these plans are only specific to the local area, while others cover much larger areas. To avoid duplication and address gaps, spatial consistency between objectives and methods in the implementation of these various plans is needed. An historical lack of integration across the plans is a significant problem for effective and efficient NRM in the Region. This Strategy recognises the importance of integration across the Region and aims to facilitate processes to encourage an holistic approach to NRM. Such an approach would define protocols, responsibilities and the resources necessary for the periodic review of the state of local level NRM planning across the Region.

Clearly, for implementation of NRM in the Region to be effective, coordination between the three tiers of Government is critical. The three tiers are defined as the Australian Government, Western Australian State Government and Local Governments.

While power and responsibility for NRM resides largely with the States, the Australian Government has considerable influence via constitutional powers and responsibilities for trade, commerce and taxation. Its role as a financier of specific National programs and as a major landowner enhances this influence. Much of the Australian Government's involvement in NRM is coordinated through the Natural Heritage Trust (NHT) and National Action Plan (NAP) initiatives.

Other Australian Government initiatives such as the National Landcare, Coastcare, Bushcare, and Rivercare Programs have promoted and fostered the Landcare ethic (i.e. responsible stewardship) throughout rural and urban communities in Australia. These programs have been adopted with enthusiasm and led to the mobilisation of a massive voluntary workforce throughout the Region. They have encouraged the development of locally based community groups who have undertaken hundreds of NRM projects within their own areas, including the development of this Strategy.

The State Natural Resource Management Office is working with relevant Ministers to facilitate the development of an integrated NRM framework that will provide for the effective and efficient management of the State's natural resources.

A NRM Regional Chairs Group also advises the Minister for the Environment on regional NRM issues. This is comprised of the chairpersons of the six regional NRM groups in Western Australia which are the Swan, Avon, Northern Agricultural, and South West Catchment Councils, the South Coast Regional Initiative Planning Team and the Rangelands NRM Coordinating Group.

The State Government and these regional NRM groups, along with the Natural Resource Management Council, have signed a Natural Resource Management Memorandum of Understanding to work together to better manage natural resources within the regions and the State as a whole.

There are 33 Local Government authorities in the Region (Figure 1). Their participation and support is crucial to the success of NRM. They are important in developing and maintaining communication networks between the community, industry and Local Government. The key responsibilities of Local Governments in Western Australia are defined under the *Local Government Act (1995)* and the *Town Planning and Development Act (1928)*. These responsibilities relate mainly to the management of land uses, zoning and development approvals and to the management of land vested in Local Governments through the *Land Administration Act (1997)*. Town planning schemes are a key mechanism for Local Governments in managing natural resources. The preparation, review, amendment and implementation of town planning schemes are subject to statutory processes. In addition, community consultation forms a statutory component of the process required in the preparation, review and amendment of town planning schemes, as does environmental impact assessment.

Local Governments have a critical role to play in ensuring that land uses, zoning and developments are compatible with the biophysical features of the landscape. The Local Governments are responsible for the management of municipal services such as roads, drainage, waste disposal, parks, the provision of information services, environmental protection, and the management of bushland and natural areas, as reserves and freehold. Many Local Government Authorities and Regional Organisations of Councils (eg Eastern Metropolitan Regional Council, Western Suburbs Regional Organisation of Councils) have adopted a range of approaches that address natural resource management issues. Examples include local strategies, by-laws, policies, management plans and reporting documents (refer to Appendix 3).

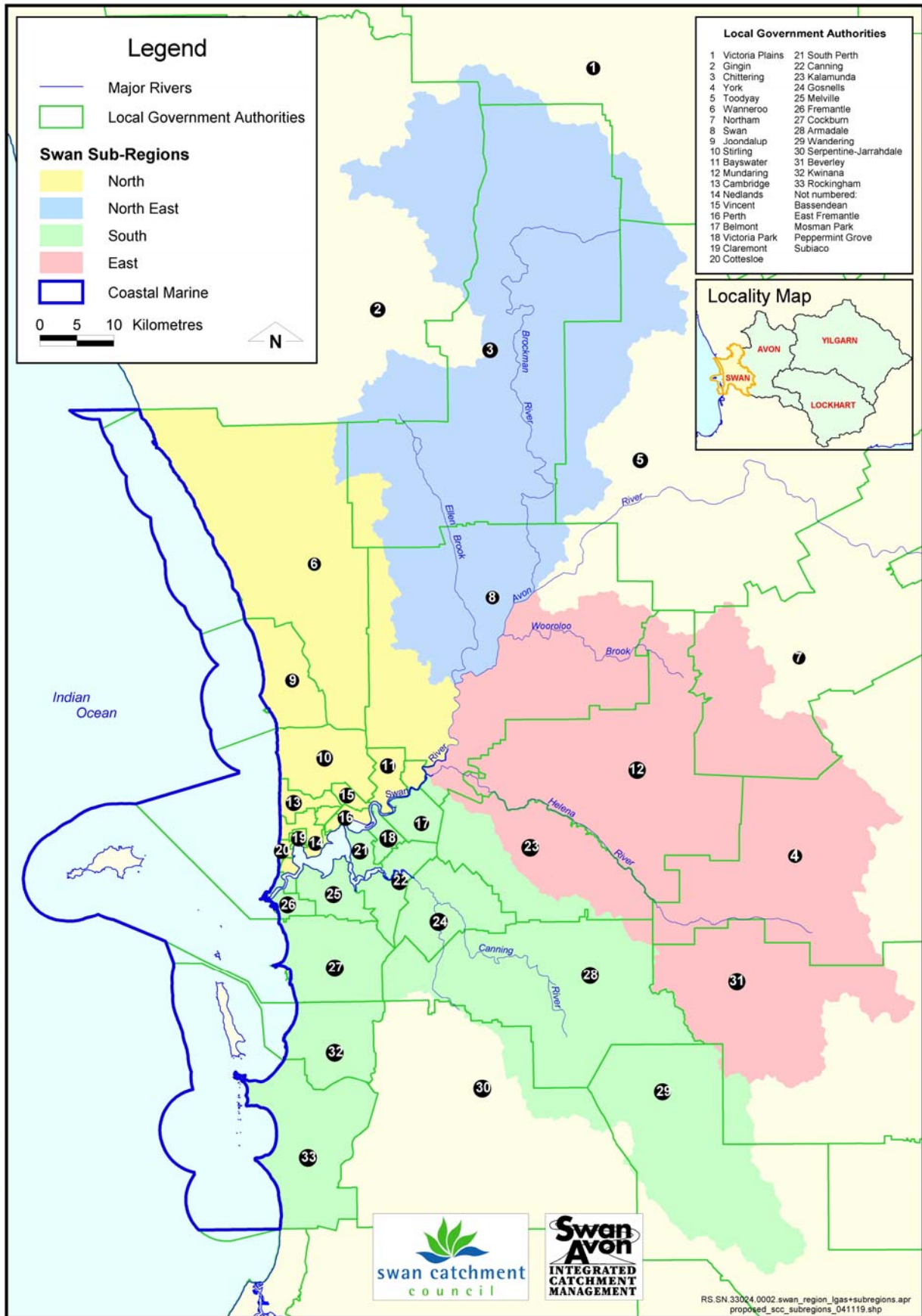


Figure 1: The Swan Region including Local Government boundaries

Just as government involvement in NRM is critical, so too the community has a pivotal role to play in the development of NRM strategies. Specifically the community can influence the determination of environmental values, the balance between social, economic and environmental factors and the effective implementation of NRM strategies or plans.

Once the community becomes aware of and interested in their Region, they can become more involved in decision-making as well as hands-on protection and restoration efforts. Through such involvement, the NRM process can help reduce conflicts, increase commitment to the actions necessary to meet NRM outcomes and ultimately, improve the likelihood of success for NRM initiatives.

Australian Government, State Government, Local Government and community approaches to NRM are changing rapidly as it becomes apparent that the problems faced are far more complex and widespread than previously recognised. Key features of these approaches are:

- endorsement of important National and international requirements for ecologically sustainable development and conservation of biological diversity;
- recognition that investment in NRM must occur in a coordinated way through the implementation of accredited strategies and action plans;
- development and political empowerment of partnerships between Government (Local, State and Australian Government) and local and wider regional communities in managing natural resources;
- tighter integration and rationalisation between environmental, social, cultural, economic and political components of NRM as a feature of NRM strategies;
- capacity building for institutional, cultural and behavioural change including education programs.
- greater community involvement in planning and land use decisions, and
- increased direct provision of public resources to community managed NRM activities.

NRM Legislation

The following list provides a general summary of State and Australian Government legislation relevant to NRM in the Region. Whilst the summary should not be construed as legal advice, it is intended to provide a broad overview of relevant legislation. It is anticipated that further legislative developments will take place through ongoing amendment of existing legislation, or the introduction of new legislation as and when the need arises. A more detailed summary of the following legislation appears in Appendix 4.

- *Aboriginal Heritage Act (1972)*
- *Agriculture and Related Resources Protection Act (1996)*
- *Associations Incorporations Act (1987)*
- *Bush Fires Act (1954)*
- *Conservation and Land Management Act (1984)*
- *Country Areas Water Supply Act (1947)*
- *Curriculum Council Act (1997)*
- *Environmental Protection Act (1986) (as amended 2003)*
- *Fish Resources Management Act (1994)*
- *Forest Products Act (2000)*
- *Government Agreements Act (1979)*
- *Heritage of Western Australia Act (1990)*
- *Land Administration Act (1997)*
- *Land Drainage Act (1925)*
- *Local Government Act (1995)*
- *Metropolitan Region Town Planning Scheme Act (1959)*
- *Metropolitan Water Supply, Sewerage, and Drainage Act (1909)*
- *Mining Act (1978)*
- *Native Title Act (1992)*
- *Pearling Act (1990)*
- *Perth Air Quality Management Program (2000), and its Implementation Plan (2002)*
- *Petroleum Act (1967)*
- *Pollution of Waters by Oil and Noxious Substances Act (1987)*
- *Rights in Water and Irrigation Act (1914)*
- *Sandalwood Act (1929)*
- *Soil and Land Conservation Act (1945)*

- *State Water Quality Management Strategy No. 6: Implementation Framework (2004)*
- *Swan River Trust Act (1988)*
- *Swan Valley Planning Act (1995)*
- *Town Planning and Development Act (1928)*
- *Water Agencies Powers Act (1984)*
- *Water and Rivers Commission Act (1995)*
- *Waterways Conservation Act (1976)*
- *Water Corporation Act (1995)*
- *Waterways Conservation Act (1976)*
- *Wildlife Conservation Act (1950)*
- *Western Australian Planning Commission Act 1985*

Various legislative developments are currently in progress, one notable example being the proposed Biodiversity Conservation Act. The proposed Act is anticipated to replace, amongst other things, the current *Wildlife Conservation Act (1950)*. The *WA Planning Commission Act (1985)*, *Metropolitan Regional Town Planning Scheme Act (1959)* and *Town Planning and Development Act (1928)* are proposed to be replaced by the Planning and Development Bill.

At the State level there are a number of strategies, plans and policies that complement this legislation:

- *Environmental Protection (Swan and Canning Rivers) Policy (1998)*
- *Environmental Protection (Swan Coastal Plain Lakes) Policy (1992).*
- *Environment and Natural Resources Statement of Planning Policy*
- *Environmental Protection Policies (eg Environmental Natural Resources Policy SPP 2.5)*
- *Environmental Weed Strategy for Western Australia (1999)*
- *The Government's Response to the Coastal Planning Task Force, entitled 'Coasts WA: Better Integration' (2003)*
- *The Government's Response to the Salinity Task Force (2002)*
- *Perth Air Quality Management Program (2000), and its Implementation Plan (2002);*
- *Riverplan (2003);*
- *State Coastal Planning Policy*
- *State Planning Strategy*
- *State Rural Water Plan*
- *State Salinity Strategy (2000)*
- *State Sustainability Strategy (2003)*
- *State Water Quality Management Strategy for Western Australia (2001)*
- *State Water Strategy (2003)*
- *State Weed Strategy (2001)*
- *Statement of Planning Policies (eg Agricultural and Rural Land Use Policy SPP 11)*
- *Wetlands Conservation Policy for Western Australia (1997)*
- *Draft Environmental Weeds Strategy*
- *Draft State Algal Management Strategy*
- *Proposed State Coastal Strategy*
- *Draft State Floodplain Management Strategy*
- *Proposed State Marine Planning Strategy*
- *Draft Strategic Direction for Waste Management in WA*
- *Draft Western Australian Greenhouse Strategy*
- *Draft Waterways WA Strategy*

Further development regarding strategies, plans and policies can be anticipated to support existing legislation. The State Biodiversity Conservation Strategy is one such strategy currently in development.

Australian Government Legislation

- *Natural Heritage Trust of Australia Act (1997)*
- *Environment Protection and Biodiversity Conservation Act (1999)*
- *Natural Resources Management (Financial Assistance) Act (1992)*
- *Natural Resources Management (Financial Assistance) Act (1999)*

At the National level, a framework for NRM is established through strategies, policies and plans that include:

- Agenda 21 (1992)
- Australia's Ocean Policy
- COAG Water Reform Framework
- Commonwealth Coast Policy
- Convention on Climate Change (1993)
- National Action Plan for Shorebird Conservation in Australia
- National Framework for Energy Efficiency
- National Framework for Management and Monitoring of Australia's Native Vegetation
- National Greenhouse Strategy
- National Objectives and Targets for Biodiversity Conservation 2001-2005
- National Pollution Inventory
- National Strategy for the Conservation of Australia's Biological Diversity
- National Strategy for Ecologically Sustainable Development
- National Water Quality Management Strategy
- National Weeds Strategy
- National Approach to Firewood Collection and Use in Australia
- National Greenhouse Strategy
- Threat Abatement Plans for Weeds of National Significance and Listed Key Threatening Processes
- Wetlands Policy of the Commonwealth Government of Australia

International Agreements

The Australian Government has the capability to enter into international agreements. Examples of such agreements that relate to this Strategy include:

- Agenda 21 (1992).
- Convention on Wetlands (Ramsar Convention, RAMSAR).
- Convention on Climate Change (1993)
- Convention on Migratory Species (Bonn Convention).
- Japan-Australia Migratory Bird Agreements (JAMBA)
- China-Australia Migratory Bird Agreements (CAMBA).
- Convention on Biological Diversity (1993)

Bilateral Agreements

Administrative arrangements regarding NRM between the Australian Government and the Western Australian State Government are dealt with primarily through Bilateral Agreements. Two key agreements include;

- *Bilateral Agreement Between the Commonwealth of Australia and the State of Western Australia to Deliver the Natural Heritage Trust* (December 2002).
- *Bilateral Agreement Between the Commonwealth of Australia and the State of Western Australia for the Implementation of the Intergovernmental Agreement on a National Action Plan for Salinity and Water Quality* (September 2003).

The *Bilateral Agreement between the Commonwealth of Australia and the State of Western Australia to deliver the Natural Heritage Trust* (2002) establishes the accreditation criteria for regional NRM plans. For example, schedule 2, section 4.3 (b) of the Bilateral Agreement sets out to identify or establish appropriate regional bodies to be responsible for developing regional NRM plans through a community consultation process for the Region. Other key sections of the Bilateral Agreement include schedule 2, section 4.12 which specifies involvement by all key stakeholders in the development of the regional NRM plan, and schedule 2, section 4.15 which identifies strategic, prioritised and achievable actions.

The Australian Government and State Government have recognised six NRM regional groups as peak community bodies in Western Australian (Figure 2). Each regional body is responsible for developing and implementing regional NRM strategies.

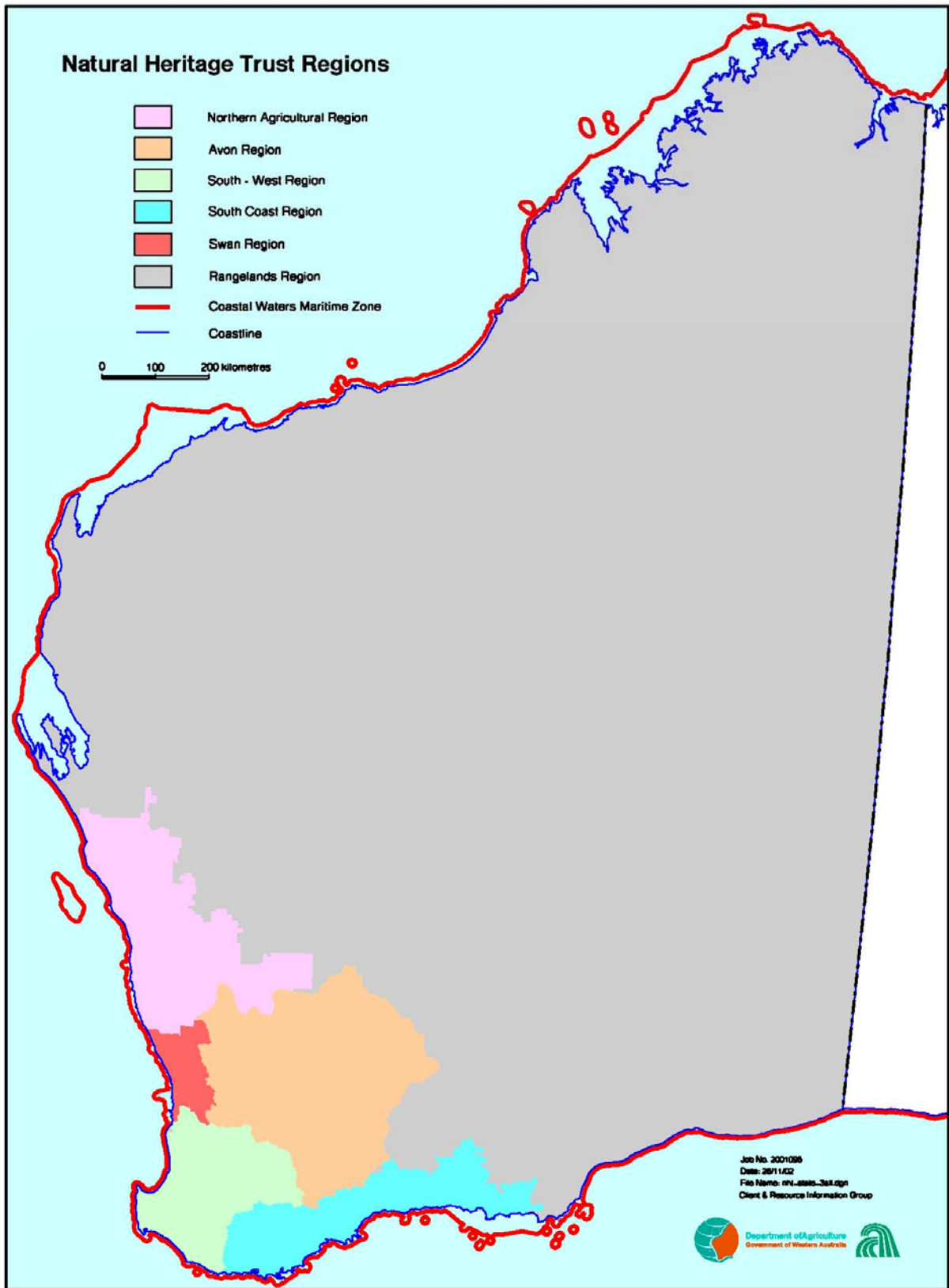


Figure 2: Natural Heritage Trust regions (Map courtesy of Department of Agriculture)

Regulatory and legislative approaches to NRM generally set out to establish minimum acceptable standards, and use punitive measures to address non-compliance to those minimum standards. Other approaches can be used to facilitate positive NRM outcomes. Such approaches include: partnership, best management practice, conservation agreements and/or covenants, education and awareness raising, stewardship ethic and environmental management systems.

Such approaches can yield effective outcomes in many circumstances, as they are positive in their approach and are focussed towards maximising performance rather than capping performance or simply achieving a minimum standard.

Memorandum of Understanding

Catchment issues faced by adjoining regions can significantly affect the Swan Region. The downstream impact of salinity provides a key example. This circumstance has given rise to the need for cooperative management with adjoining regions. The Avon-Upper Swan Memorandum of Understanding (MoU) (2002) is an example of a formalised cooperative approach between the Swan and Avon NRM Regions. The aim is to establish joint management goals and define the administrative arrangements for managing funding arising from the National Action Plan for Salinity and Water Quality (2000). The MoU provides an important basis for providing access to funding for activities and projects under the National Action Plan for Salinity and Water Quality. A copy of the MoU is provided as Appendix 10.

1.3 Strategy Development

1.3.1 Guiding Principles

In developing the Strategy the Council drew on a set of fundamental guiding principles which were adopted for the development of the original draft Swan Natural Resource Management Strategy (2000) and which have maintained their currency through the current planning process. These principles recognise the need to pursue sustainable development in the Region, and highlight the importance of a partnership approach. They are primarily concerned with:

- Managing pressures on environmental values across the whole Region. Conserving the Region's natural resources through the development and implementation of local, regional and State strategies
- Allocating the right to use and enjoy natural resources fairly, for the benefit of the natural environment, for current and future generations
- Enhancing and supporting the role of Local Government in planning for natural resource management, consistent with regional and State strategies
- Developing partnerships to manage natural resources between Government and the wider regional community
- Acknowledging future uncertainties and the need for a capacity to change
- Incorporating regular audit and review of plans and strategies
- Adopting a precautionary principle approach

To successfully manage and improve NRM outcomes in the Region, it is essential to recognise the high level of inter-dependence, inter-connection and inter-relatedness between assets. This concept provides a sound basis for investment in the Region and will have multiple benefits. The primary principle underlying the sustainable use of natural resources is that current society should meet its needs in ways to ensure that the health and diversity of ecosystems on which life depends is maintained, without reducing the capacity of future generations to meet their needs (Australian State of the Environment Committee, 2001). The guiding principles for development of this Strategy include an asset-based approach, the precautionary principle, an inclusive process, partnerships, integration across regions, risk management, responsibility, allocation of resources and adaptive management. These concepts are further explained below.

The scale and intensity of threatening processes and the uncertainty of response to some intervention actions has led to the requirement for a more strategic approach to investment of public funding in NRM. The basis of a regional strategic approach is to focus on management of priority assets. An asset-based approach recognises the advantages of targeted investment in high-value assets identified as important at the regional scale. Regional assets are identified in this Strategy as including those that are important at a National and State-scale as well as those that are important locally.

The precautionary principle is frequently used to guide NRM decision-making. It is applied when there are reasonable grounds for concern that an activity is, or could, cause harm but where there is uncertainty about the probability of the risk and the degree of harm. The principle states that if there are threats of serious or irreversible environmental damage, the lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

This principle is an accepted part of environmental decision-making in Australia and is one of the principles of the Inter-Governmental Agreement on the Environment (Commonwealth of Australia 1992). The extent of precaution is a matter of judgement, dependent on the level of uncertainty and the seriousness of potential degradation (Conservation Commission WA 2003).

Careful evaluation and assessment of the risk-weighted consequences is necessary when applying the precautionary principle. Such care by public and private decision-makers should help to avoid, wherever practical, serious or irreversible damage to the environment.

To achieve effective and efficient management of natural resources in the Region, the Council is committed to developing high levels of community ownership. The Council has made a commitment to maintain community momentum during this time of change to a regional NRM delivery model. This commitment has underpinned the inclusive approach taken in engaging with the community and stakeholders for the refinement of the Strategy.

Similarly, the Council recognises the importance of developing and maintaining effective partnerships. Specifically, the Bilateral Agreements between the Regional NRM groups and the Australian and State Governments have directly influenced the planning phase of the Strategy and will extend into implementation phases. As individuals and community groups continue to drive NRM in the Region, the Council clearly sees the partnership with local communities as the most critical.

No single organisation can hope to drive the necessary cultural change in the wider regional community to achieve a more sustainable use of our natural resources. Formal partnership agreements between Government, the wider regional community, industry and individuals are critical for effective management of the Region's natural resources. The Strategy defines the parameters for partnerships between these sectors that will increase the integration of effort and the effectiveness of outputs in managing natural resources. In particular, these partnerships will empower and strengthen the contribution made by the community to the management of natural resources in the Region.

By directing investment through the Strategy, Government, industry and the wider regional community will be making a commitment to share roles and obligations to achieve objectives. The Council will provide a strong community perspective, a capacity to deliver programs within a regional context and a flexible management structure that can respond quickly to changes in priorities. Other partners will provide statutory power and responsibility; Government policy direction, resources and management; and financial, environmental and social reporting structures and processes. The Council will play a critical role in driving the process, while these partners will retain ownership for the implementation of the Strategy.

Currently investment in NRM comes from public and private sources. The Swan-Canning Cleanup Program (SCCP) is an example of a major Government funded program managed by the Swan River Trust. SCCP aims to understand the mechanisms that trigger algal blooms and control their growth, reduce the frequency of their occurrence, help maintain water quality now and in the future, help change land uses, planning and development to reduce nutrient inputs, and inform and involve the public in the process. Through SCCP, the Swan River Trust has funded a large number of projects related to river and catchment monitoring and mapping, algae and nutrient research, computer modelling of estuarine dynamics, stormwater design, water quality management and Catchment Management Plans for key areas. This work has shown how important improved environmental management across the catchment is to the health of the river system.

Similarly, individuals and community groups invest by volunteering their time and commitment to enhance and protect the natural environment. Given the magnitude of the issues being faced in the Region, all available investment sources are valuable. Therefore, resources need to be targeted at activities that will reap the maximum result for the available dollars and time committed. Productive partnerships between investors will ensure the maximum effectiveness and efficiency of the investment in NRM.

As previously stated the role of Local Government is critical, specifically in regard to their role and responsibilities which include the incorporation of Statement of Planning Policies in Town Planning Schemes, Special Control Areas, and other planning mechanisms for the protection and management of

natural resources. Throughout the development of this Strategy the advice of the Western Australian Local Government Association (WALGA) has been vital. The Local Government Working Group of the Council has established strategies for engaging individual Local Governments and will continue to guide the Strategy through the accreditation phase.

Encouraging greater investment in NRM is a Nationally stated objective of the overall Government-industry-wider regional community partnership. Strategic delivery of programs through an accredited Strategy and investment plan, is likely to attract greater investment in NRM. Similarly, acceptance of this Strategy by Government, the wider regional community and industry is likely to lead to an increase in resources for NRM.

The conservation and effective management of natural resources is a common goal across NRM regions throughout Western Australia. The development of common approaches for working with Government could lead to efficiencies for all regions. Some of the key principles for working together are outlined below:

- **Relationship framework** – reaching agreement on regional strategies in the Bilateral Agreements, partnerships and investment plans.
- **Landscape approach** – coordinating working arrangements and investment priorities by integrating approaches to NRM across the landscape.
- **Government partnerships** – deliver effective and efficient NRM outcomes by defining clear partnership agreements between NRM regions and Governments.
- **Investment plans, priorities and methods** – develop investment plans according to State and National guidelines that define work priorities, methods, goals and targets. Such plans should lead to the open and transparent sharing of resources to carry out agreed work through management programs, plans and projects.
- **Institutional frameworks** – negotiate effectively with Local, State and the Australian Government, by defining common arrangements necessary for reaching goals and targets.
- **Regional partnerships** – share resources effectively through the development of strong partnerships across the NRM regions in Western Australia.

There can be little doubt that undertaking NRM carries a range of risks, risks that need to be managed. Protecting ecosystems from damage is far more cost-effective than attempting restoration once the damage is done. Assessing risk-weighted consequences of management options may help to avoid serious or irreversible damage to the environment. As previously stated, when dealing with threats of serious or irreversible environmental damage, lack of scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation (see “precautionary principle”).

Responsibility for NRM lies with all levels of Government, industry, the wider regional community and individuals, what have a clear interest and responsibility - or ‘duty of care’ (Industry Commission 1998), to ensure the protection, conservation, and sustainable use of natural resources. The present generation has a responsibility to ensure that the ecological integrity of the Region is maintained for future generations.

Adaptive management enables lessons learned from the past to contribute to more informed decision-making that will lead to appropriate adjustments in response.

1.3.2 Community and Stakeholder Engagement

The Council is firmly committed to the participation of the wider regional community and stakeholders in the development of this Strategy. A range of mechanisms have been used to facilitate this participation (Appendix 6).

Opportunities have been provided for broad community and stakeholder input through the use of sub-regional community consultation workshops and extensive liaison with catchment groups and indigenous communities.

The Working Groups of the Council (see Appendix 5) have provided a forum for the interests of individuals and community groups, organisations and other stakeholders to be represented.

In addition, expert panels were established to participate in target setting and identifying management options.

Stakeholder Engagement 2000-2002

The earlier draft Strategy (2000) was developed under NHT to extend the original Swan-Avon initiative, and to provide a guiding document for NRM in the Swan Region. This early draft, with all of its defined goals and actions, as well as the wide ranging consultation undertaken provides the basis for this current version. Refinement of the draft *Swan NRM Strategy* has been based on a participative approach, adapted to meet the constraints of limited timeframes for planning and stakeholder engagement. This has been in response to the commitment to develop an accredited Strategy as early as possible, so that community momentum can be maintained, and implementation continued.

The original draft Strategy was prepared over a 12 month period by a representative Sub-Committee of the Swan Catchment Council. Community and stakeholder input included:

- Information from previous community workshops and planning events held over the previous four years.
- Three community workshops held in March-April 2000. Over 50 people from a range of groups confirmed the issues of importance to be addressed, the desired outcomes, and provided input to objectives and strategies.
- Direct input from representatives of major community environmental organisations active in the Region, such as the Wildflower Society and the Urban Bushland Council.
- Representatives from relevant Government NRM agencies provided input on programs and activities, both current and planned.
- The draft document was released in July 2001 for a four month public comment period. Two public meetings to obtain feedback were held in September 2001.
- 22 written submissions from individuals, community groups, Local Governments, and State Government agencies contributed to further refinement.
- The final version was endorsed by an ordinary meeting of the Swan Catchment Council in April 2002.

Stakeholder Engagement 2003-2004

Natural resource management is in the midst of an enormous shift from an historically uncoordinated approach, to a strategic regional delivery model. In this period of change, the Council recognises that maintaining community momentum is critical. Engaging the wider regional community and other stakeholders is of the highest priority and directly underpins every aspect of this Strategy.

The intention was for stakeholder participation in the continued development of the Strategy and that community and key stakeholders such as indigenous communities and Local Government would have multiple opportunities over the planning phase to participate through a range of mechanisms.

This commitment has been maintained in the face of the need to be flexible in approach as the planning phase rolled out. The consultative approach designed to further develop the Strategy has been adapted to meet the many challenges, but to maintain the integrity of a participative approach to strategic planning.

In order to manage this complex process effectively, the Council developed a formal mechanism known as the "Communications Framework" (Appendix 6). The Framework was designed to provide strategic direction for all communications related to the development of the Strategy.

It clearly guided Council members and officers involved in Strategy preparation and implementation in policy, process, action planning, monitoring and evaluation related to communications and stakeholder engagement.

The Communications Framework was designed to be flexible for all stakeholder audiences, to be adaptable to meet the delivery and reporting needs of officers and Council members, to provide consistent key messages to all stakeholders, and to meet the information needs of all stakeholder groups. Implementation of the Communications Framework has been coordinated by the Swan Catchment Council.

Communication action plans, based on the Framework, were developed for coastal and marine communities, indigenous communities, Local Government, catchment officers and groups, and the wider regional community. These have been implemented via a range of activities and mechanisms appropriate to the target audience and the planning activities.

All communication activities have been recorded and will be used to fully evaluate the Communications Framework prior to developing communications plans for implementation phases of the Strategy. It is intended to evaluate this process via a capacity building and learning outcomes process, to be documented as a learning process. All contacts made through communication activities have been recorded on a strategic communications data base at Appendix 6.

Specific achievements in communications and engagement have meant that key objectives have been met for stakeholder groups that have been specifically targeted. Specifically, indigenous communities, Local Government and industry groups (small-medium enterprises) are now actively engaged in the planning and implementation of NRM objectives.

Consultation with the indigenous community involved regular meetings and workshops and included a joint EnviroFunds restoration project that is currently underway. Groups consulted included:

- Department of Indigenous Affairs
- South West Aboriginal Land & Sea Council
- Department of Conservation and Land Management
- Edith Cowan University
- Curtin University
- Murdoch University
- University of Western Australia
- Circle of Elders
- Gnangara Community
- Henley Brook Aboriginal Community
- Cullacabardee Aboriginal Community
- WAALITJ Corporation
- Aboriginal and Torres Strait Islander Commission
- Indigenous Land Corporation
- Moorditch Aboriginal School
- Native Title claimants

Anecdotal feedback and documented support has indicated that a very high proportion of the indigenous communities are aware of and supportive of the Strategy and the commitment to engaging and involving indigenous communities in NRM.

Community forums were held to initiate the ongoing strategic planning to confirm original goals and generate a set of NRM assets for the Region and to determine the environmental, social and economic values of those assets. These values for each asset category are represented as collective sets in Section 3.

Invitations were sent out extensively and forums advertised in community newspapers. Over 170 community members attended the forums which were held in the following sub-regions:

- Ellen Brockman region, 16 June 2003
- Urban North region, 5 July 2003
- Eastern Hills region, 10 July 2003
- South East region, 22 July 2003
- Coastal North region, 2 August 2003
- Coastal Marine region, 30 August 2003

A range of expert panels were engaged to identify, prioritise and plan for best-practice management of identified NRM assets, values and threats in the Region. Individual expert panels were convened (approximately 60 participants) from a range of stakeholder audiences, including community, State Government agencies and academia, which met over a two week period, and provided ongoing feedback to address the following natural resource assets:

- Water
- Air
- Land
- Biodiversity
- Indigenous Cultural Heritage
- Coastal and marine

The Swan Catchment Council has undertaken to provide opportunities through planning workshops, information forums and presentations to detail progress and update on new proposals or guidelines to the planning process.

Events

A number of strategic Swan Catchment Council events were held during the year to provide opportunities to promote and engage stakeholders in the Strategy development. These have included:

- The “Big Breakfast” in July 2003 (78 attendees, predominantly catchment groups, Local and State Government). This event brought together representatives that were to be actively involved in Strategy planning, implementation of interim priority projects and delivering communications objectives to their own broader networks.
- Joint Forum with the Conservation Council of WA in July 2003 (109 attendees, wide mix from State and Local Government, universities, recreation groups and community groups). This event provided the opportunity to report on progress related to community workshops, and to have a workshop discussion on the future policy and management relating to the Swan River.
- Catchment Officer Workshops in August 2003. Forty-five attendees from NRM professionals working with sub-regional and catchment groups and Local Government provided input to the Strategy for current and future management actions to meet targets.
- Swan Catchment Council Annual General Meeting, 17 September 2003 (45 attendees, community, industry, State and Local Government).
- Local Government Forum in December 2003 provided an opportunity for them to have input into the Strategy through scoping opportunities for investing in projects across boundaries. Local Government CEOs, Directors and officers totalling 56 attended the Forum.

Presentations and Forums

Presentations and information about NRM strategic planning and were also provided through:

- Local Government Week, August 2003.
- Swan-Canning Cleanup Program Big Day Out, 11 December 2003.
- Catchment Officers Support Network meetings held March, June and November 2003 and March and June 2004.
- Swan-Canning Industry Working Group meetings held July, September and November 2003 and March and June 2004.
- Canning Environmental Flows Steering Committee meetings held November and December 2003.
- Swan Catchment Council Working Groups, which include monthly meetings of Local Government, Natural Diversity and Environmental Education working groups to provide a reference group for Strategy development.

Prior to its release the Strategy was provided to key stakeholders in State and Local Government and community groups for a preliminary review. A range of comments were made and accordingly changes were incorporated into the Strategy.

All submissions from the public comment period have been addressed through a detailed analysis with appropriate changes to the Strategy to finalise the draft. Feedback and comments to these submissions will be provided by the Swan Catchment Council as a separate document.

Investment Planning

Investment planning followed from the development of the Strategy and the feedback from the public comment period. The investment planning process continued with the commitment to stakeholder engagement. Participants in two series of workshops were invited on the basis of representativeness of community and stakeholder organisations. It was a targeted investment planning process, and representation was taken from the wide ranging stakeholder database.

Media and Meetings

In addition to the focussed planning process, members and officers of the Council have engaged stakeholders regularly through meetings and participation at external workshops and forums. The Swan Catchment Council newsletter, "The Swan" updates stakeholders about Strategy development progress on a regular basis. The quarterly newsletter is distributed to approximately 1500 stakeholders. Regular NRM email updates from the Swan Catchment Council have specifically dealt with Strategy development and NHT information for stakeholders.

Incorporation of Community and Stakeholder Input

The Council has been committed to taking the lead from community and stakeholders throughout the NRM strategic planning phase, and has also been reflected in the prioritisation and implementation phases.

Input from the six regional community forums, catchment officer workshops, Local Government forums, Council working groups, indigenous communities, coastal and marine reference group, expert panels and the Swan Industry Working Group have been collated, analysed and interpreted by the Strategy team. The Strategy team is a multi-disciplinary team which has been guided by the principles of Strategy development outlined in Section 1.3.

Strategy development has also incorporated the detailed input of State Government agencies and the feedback from the Australian government. The Council and working groups have provided detailed feedback on process, format, priorities, and targets.

Regional assets, values and threats, Resource Condition Targets, Management Action Targets and management actions, selection of appropriate figures and maps, incorporation of the Nyoongah creation story, and explanatory text within the Strategy are all based on the input and guidance of all of the stakeholders listed above.

1.4 The Swan Region

The Swan Region (Figure 1) covers over 770,000 hectares of land of which approximately 410,000 hectares are included in the Perth metropolitan area. The Region extends out to sea three nautical miles (State Government waters) and includes offshore islands such as Rottnest and Garden islands. Located in the south west of Western Australia it is within one of 25 world biodiversity hot spots, due mainly to its high floral diversity and richness and also its high degree of endemism. The Region has a number of distinctive features that set it apart from the other NRM regions across the State.

Its social and economic life is dominated by the Perth metropolitan area, with its associated secondary and tertiary industries. Many of the NRM issues relate to the large and increasing demand for land, water and power to support a growing population.

A significant proportion of the Region retains its 'naturalness', mainly because the lands on the sandy Coastal Plains were found to be unsuitable for agriculture, and development was restricted in the Hills water catchment areas. This history has been fortuitous in providing this generation with a legacy of bushland and wetland to protect and conserve.

The Region has a large growing population and there is a steady demand for more natural resources to sustain social and economic life and a need to protect natural heritage. These factors have resulted in a very large number of policies, strategies, plans and instruments being managed by the State Government and Local Governments.

The level of community activity to protect the environment in the Region is high. Some 450 groups are active in environmental protection, bushland management, catchment management, weed and pest eradication, waterways and wetland rehabilitation, coastal rehabilitation, marine habitat monitoring, and land use planning. This voluntary effort is motivated by the value of the resources in their own right, and complements the efforts of Government in environmental protection.

The Region is home to an expanding population and increasingly complex economy. This situation creates a very challenging environment in which to achieve NRM objectives. Natural resource management in the Region is closely linked to statutory planning and environmental assessment processes largely due to

changes in land usage and the high demand for access to natural resources. The reliance on the use of planning processes plays a key role in the management of natural resources and is much greater in this Region than in any other NRM region in the State.

All the natural resources and ecological processes in the Region are assets in their own right; they have value because they exist. Issues or problems arising from the management of natural resources relate to the natural or human pressures exerted on those environmental values. The services derived from natural resources can be considered 'natural capital'. By assigning value to this natural capital using classical economic criteria the management of natural resources can be viewed in an economic sense to enable more effective assessment for good governance.

The Region's 1.4 million people seek a high quality of life, with clean air and water and access to open space and attractive landscapes. However, their demand for products and services to maintain current lifestyles puts enormous pressures on the natural resources in the Region. Current and projected population growth and incompatible planning processes (that do not effectively consider environmental constraints or land use capability) place considerable pressure on and are considered to be the most persistent threat to the management of natural resources in the Region (Appendix 7).

The sustainable use and management of the Region's resources need to be achieved in the face of a projected 60 per cent increase in Perth's population from 1.4 million in 2003 to 2.0 million in 2031.

1.4.1 Biophysical Features

For the purpose of this Strategy the major biophysical features of the Region are identified as land (geomorphology and soils), water (hydrology) and life-forms (biodiversity), and include aspects of climate.

Climate

The Swan Region has a Mediterranean climate with warm dry summers and mild wet winters. Mean temperatures vary from 24°C in summer to 13°C in winter. Rainfall is generally reliable, with a growing season for annual crops and pastures commencing on average in mid April, and finishing in October. Average rainfall varies from 800 millimetres on the coast to 1000 millimetres along the face of the Darling Scarp. June and July are typically the wettest months, with seasonal inundation common in low-lying areas across the Swan Coastal Plain. Summer rainfall is very low and erratic in incidence, with occasional downpours from cyclonic systems.

Long-term climate variability is affecting the west coast and hinterland environments from Geraldton to Cape Leeuwin. This area, which includes the Region, has experienced declining average winter rainfall over the last 30 years, with a general reduction of 30 millimetres in annual rainfall over that period. The main change is that the area no longer experiences the 'big wet' years that contribute to high averages. Given our improved understanding of long-term fluctuations, discussions about 'average climate' are meaningless unless the timescale over which the climate is being assessed is considered.

Further climate change promoted by increased greenhouse gas emissions has become an international issue with environmental, social and economic implications. By the year 2030 the frequency of summer days over 40°C is estimated to increase by at least 50 per cent in Perth (Government of Western Australia, 1998). Increased temperatures may lead to an increase in bushfires, which will impact upon many communities and ecosystems. Further greenhouse-induced rainfall decreases of about 10 to 30 per cent for winter and spring are expected in Perth with lower rainfall and higher temperatures putting strain on water resources. Rises in the sea-level may lead to greater saltwater intrusion into coastal groundwater aquifers, including the aquifer servicing Perth (Government of Australia, 1996).

The projected and current level of climate change that is occurring has significant implications for water management in the Region. Climate change in the south west of Western Australia over the last 28 years has contributed to a 10-20 per cent reduction in rainfall and a subsequent 10-50 per cent reduction in runoff into dams and reduced recharge to groundwater (Government of Western Australia, 2003). The implications of these climate changes include reduced stream flows and reservoir storages, lower water table levels in wetlands and increased need for water use efficiency by the Region's people.

Geomorphology

Geomorphology is the study of landforms and landscapes, including the description, classification, origin, development, and history of the earth's surface. The Region can be divided into four major geomorphic regions (Figure 3).

- Darling Plateau
- Darling Scarp
- Dandaragan Plateau
- Swan Coastal Plain

The Darling Plateau to the east of the Region is the uplifted western margin of the Yilgarn Block, which is variably dissected in this locality by the Avon-Swan River system. It consists of granitic rocks some 2,500 million years old, which outcrop most commonly close to the Darling Scarp that occur along the western margin of the Plateau. Granite occurs in the deeply incised valleys of the Swan-Avon, Helena and Canning rivers. Elsewhere on the plateau, extensive laterisation has occurred with the granitic rock basement covered by a deep layer of weathered regolith beneath a lateritic cap.

The Plateau is divided into three geomorphic elements: lateritic uplands; dissected valleys, spurs and valleys below the scarp surface, and; minor valleys and drainage depressions. The western edge of the Darling Plateau is formed by the Darling Fault, which separates it from the Dandaragan Plateau to the north.

The Dandaragan Plateau is a sand and laterite covered area overlying Cretaceous sedimentary formations. It is less dissected than the Darling Plateau and divided into three geomorphic elements; a gentle scarp; sandy (lateritic) uplands; and relatively shallowly incised valleys. The sandplain features dominate, and the western margin of the Dandaragan Plateau is formed by the Gingin Scarp, a moderately sloping topographical feature formed by shoreline erosion and rising approximately 90 metres above the Swan Coastal Plain.

To the west of the Darling Scarp is the Swan Coastal Plain, which consists of Quaternary superficial deposits overlying the Perth basin sediments. It is broadly divided into two geomorphic elements; the aeolian deposits (Quindalup and Bassendean Dunes) to the west, and the broad flat Pinjarra Plain fluvial deposits to the east.

Along the coast, beaches south of Fremantle and north of Trigg are low-energy beaches, while the beaches in between are high energy (Houghton, Eliot and Eliot, 2003). The linear offshore reef systems and islands protect the coast, influencing those lower-energy beaches between Fremantle and Trigg.

Soils

For the purpose of this Strategy the soils of the Region have been classified into the following:

- The Dandaragan Plateau to the north of Perth is composed of Jurassic and Cretaceous sandstones that have been laterised to produce lateritic and colluvial sandy soils.
- A narrow band (1–3 kilometres) of Foothills lies immediately below the granitic rises of the Darling Scarp and comprise alluvial and colluvial material from the scarp and ancient beach sands. Soils are light grey and white quartz sands.
- The Pinjarra Plain consists of relatively recent alluvium transported from the scarp by rivers flowing to the west. It occurs extensively in the Swan River valley and on the north eastern side of the Canning River in the Kelmscott-Gosnells area. Soils include clays, with silts, sands and peats and are generally well-structured and relatively fertile.

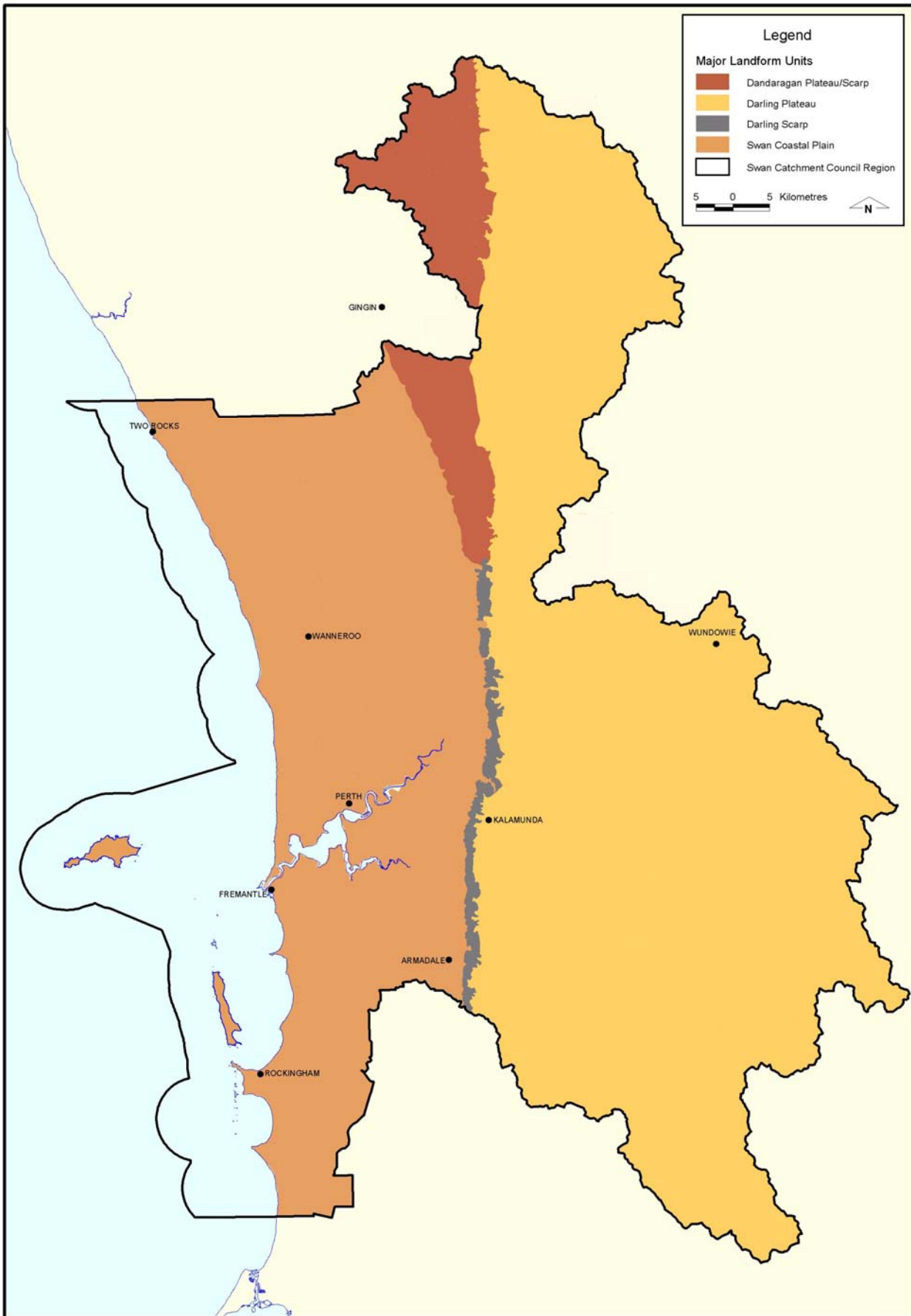


Figure 3: Major landform units of the Swan Region

- West of the Pinjarra Plain is a broad band (about 10 kilometres wide) known as the Bassendean Dunes. These are deep, heavily leached aeolian sands from Pleistocene times. The dunes are 40 to 80 metres high in parts comprising light grey quartz sands. The landform is internally drained, with groundwater fed wetlands occurring in lower areas – e.g. Bibra, Yangebup and Thomsons Lakes. These landforms are naturally nutrient-poor, with virtually no capacity to absorb introduced nutrients.
- Further to the west are the Spearwood Dunes are in-situ sands that have been formed by the weathering of in-situ rock formations, but which overlie occasionally outcropping Tamala limestone. Soils are white to pale yellow sands. The area is also internally drained, with extensive lakes and wetlands lying in a north-south orientation – including Lakes Monger, Herdsman and Joondalup. These sands are less leached and hence more fertile than the Bassendean Dunes.
- Between the Spearwood Dunes and the ocean lie the Quindalup Dunes which are calcareous recent aeolian deposits, also overlying Tamala Limestone. Soils are white infertile calcareous sands.

Hydrology

The dominant surface feature in the Region is the tidal Swan-Canning estuary. The estuary is connected to the Swan-Avon River system to the north-east and the Canning River system to the south-east. The estuarine system has a range of important environmental values in its riparian vegetation and is a very significant economic and recreational asset.

The Swan-Canning estuary is fed mainly by the Avon River Basin, which drains a very large catchment (121,000 square kilometres) east of the Darling Range. Clearing of most of this Basin has increased the salinity, sediment loads and nutrient levels in the streamflow that enters the Swan River below the Darling Scarp.

The fast flowing streams in the Darling Range rise in largely protected, forested catchments. Many of these waterways have been dammed to help meet the large demand for water supply both inside and outside the Region. For example, the Helena River was dammed to create the Mundaring Weir storage reservoir in the hills east of Perth. The Perth to Kalgoorlie water pipeline pumps approximately 23,000 cubic metres of water from Mundaring Weir lifting it 355 metres and delivers it over distances of 600 kilometres to support rural populations in the Avon region and mining and agricultural developments over a wide area of the State. A significant proportion of the Region's water supplies and most of the water distributed throughout the Goldfields and agricultural system now come from the catchments in the Darling Range which supply water of very high quality at minimum cost to the community.

The sandy, porous soils of the Swan Coastal Plain holds a large amount of fresh surface and confined groundwater, some of which nourishes chains of lakes and wetlands that occur north and south of the Swan-Canning estuary. Approximately 60 per cent of the water supplied to the Region area comes from groundwater supplies.

Groundwater in the Region generally consists of an unconfined or superficial aquifer overlying deeper, confined aquifers known as the Leederville, and Yarragadee aquifers (Figure 4). The superficial aquifer, forms the upper limit of the water table and is usually around 50 metres thick. It consists of two major groundwater mounds, the Gnangara groundwater mound and the smaller Jandakot groundwater mound. Both of these mounds are shallow sand aquifers formed by sediments deposited over the last two million years. The Gnangara groundwater mound covers an area of approximately 2140 square kilometres extending from Gingin Brook and Moore River in the north to the Swan River in the south. The Jandakot mound extends from the Swan River to the north to the Serpentine River in the south and covers an area of approximately 760 square kilometres. It is estimated that 18,800 million kilolitres and 4,200 million kilolitres of water is stored in the Gnangara and Jandakot mounds respectively, or approximately 11 million Olympic sized swimming pools (Water Corporation, 2004).

The confined aquifers in the Region, the Yarragadee and the Leederville aquifers, are found beneath the superficial aquifer. The water in these aquifers is confined and under pressure between relatively impervious layers. The largest and most extensive confined aquifer in the Region is the Yarragadee, which is often more than 1000 metres thick. The Leederville aquifer is smaller and typically several hundred metres thick (Water Corporation, 2004).

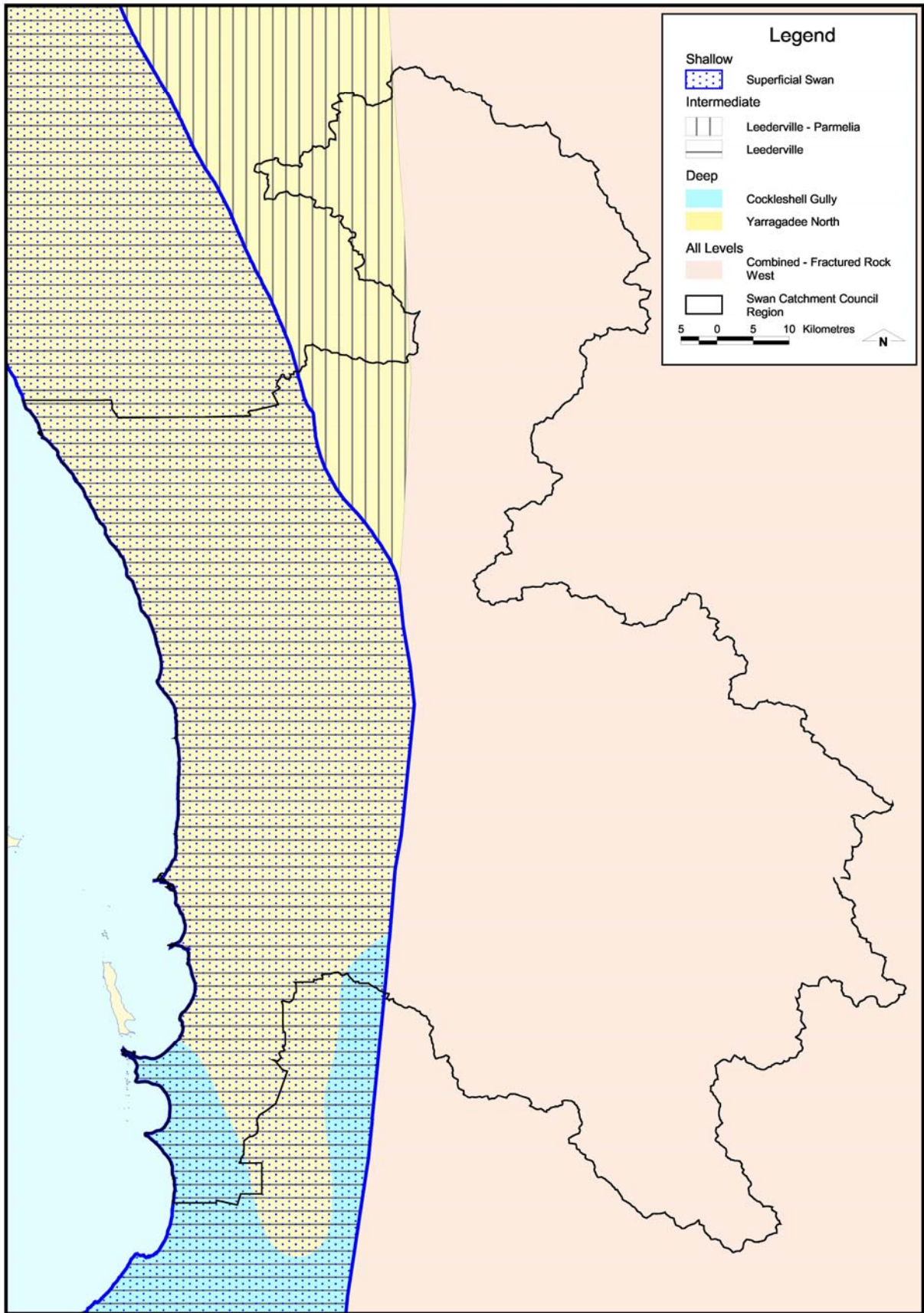


Figure 4: Groundwater resources of the Swan Region

Groundwater levels vary seasonally and in long-term cycles that are related to factors such as rates of recharge from rainfall, evapo-transpiration, changes in vegetation, land use, and groundwater extraction. The soils of the Swan Coastal Plain have a low capacity to assimilate pollutants applied to the soil. A large proportion of rainfall passes through these soils and becomes part of the unconfined aquifer. This water may collect chemicals not assimilated into the soil structure and carry them to the aquifer. Land use change has the potential to affect groundwater quality through the export of pollutants, especially nutrients to the aquifer.

Over 25 per cent of the Swan Coastal Plain is covered by wetland features. Of the 25 per cent of wetlands the large estuaries/small rivers and creeks account for approximately eight per cent, the lakes/sumplands/damplands account for approximately 22 per cent and the palusplain/floodplains approximately 69 per cent (Balla, 1994). These features are surface expressions of the groundwater level with their depth fluctuating according to the season, and vary in size, shape, water characteristics, and vegetation assemblages. Swan Coastal Plain wetland features are determined by regional factors, such as geology, geomorphology, soils, climate and hydrology. They are comprised of a variety of forms including permanently inundated lakes, perched wetlands, seasonally inundated swamps and seasonally waterlogged damplands.

Between 70 and 80 per cent of the Region's wetlands have been lost to development, with many of the remaining wetlands being substantially degraded. Clearing, filling, draining, market gardening and altered hydrological regimes (Balla, 1994) are some of the means that have led to this degradation. Protection and management of the remaining wetlands is therefore of high importance. In recognition of this, the Environmental Protection Authority adopted the Environment Protection (Swan Coastal Plain Lakes) Policy in 1992 to protect specified wetlands in the Region. The Government of Western Australia (1997) has also adopted a Wetlands Conservation Policy in recognition of the value and importance of wetlands throughout the State, while the Department of Environment is currently working on a Wetlands Restoration Manual.

Biodiversity

The Region is home to a variety and large number of terrestrial and marine species. Over many thousands of years, climate, geology and ocean currents have impacted the seabed, coastline and landforms, resulting in the evolution of the remarkable and complex natural and biological diversity (biodiversity) that is unique to the Region.

The Region abounds in a diversity of natural areas from offshore islands including Rottnest and Garden islands, the reefs, lagoons, sandbanks, embayments and shorelines of the coast. Other natural areas include the Swan-Canning estuary, the Swan-Canning River systems, the Swan Coastal Plain, the Darling Scarp and the Darling and Dandaragan plateaus. There is an enormous variety of bushland plant communities, wetland systems, cave systems and underground water resources. All of these, and the soils that contain a myriad of micro-organisms and fungi, play an extremely important part in the ecosystem that supports the economy and lifestyle of the community in the Region.

The flora and fauna of the Region that constitutes its rich biodiversity have slowly evolved over geological time. This evolution has been in unison with and in response to the rise and fall of the ocean and tectonic influences; the formation of aquifers and groundwater mounds; the seasonal influence of the Leeuwin Current from the tropics; and the cascading flow of water from the scarp and across the sandy and swampy landscape of the Coastal Plain.

The Swan Coastal Plain started to form 130,000 years ago at the beginning of the last ice age, when the coastline was 10 kilometres inland. Over thousands of years, the sea level gradually dropped. Approximately 18,000 years ago as the ice age was coming to an end, the sea level was approximately 130 metres below its present level. The shoreline had retreated to approximately 10 kilometres west of where Rottnest Island is today (Rippey and Rowland, 1995). The coastal dunes left exposed from the receding ocean were shaped and weathered by wind and rain. The sands were high in lime content, derived from shells and marine organisms. Weathering dissolved the lime, causing the sandy dunes to slowly harden and transform into limestone ridges. The sea level rose and inundated the ridges to form reefs and islands.

Today, these parallel linear offshore reef systems and islands protect most of the Region's coastline from the full force of wave action. The predominating south westerly winds and wave action continue to shape the Quindalup dunes and limestone outcrops along the forever dynamic coastline. The Coastal Plain is dotted with limestone ridges and outcrops. The Scarp protrudes in the east as a gateway to an ancient geology of Archaean crystalline granite rocks 2,500 million years old. These are mantled by laterite and give rise to extensive Jarrah Forests.

The complexity and uniqueness of the natural environment in the Region and the opportunity of “keeping the bush in the city” is a responsibility of the wider regional community, Local, State and Australian Governments. These places create “a sense of place” for Western Australians and hold spiritual importance for indigenous people. They also contain complex ecological communities and homes for many unique and rare native fauna. Their conservation is also important to ensure inter-generational equity.

The ancient and evolving landscape of the Region contains species and ecological communities found nowhere else in the world. It also contains habitats for species that range across the globe, such as visiting migratory birds and whale species. New species are being continually discovered and continue to increase understanding of the importance of the relationships between species, communities, climate, hydrology, geology and social well-being.

The Region’s biodiversity is strongly related to the landforms where it occurs. The following is a general description of the flora that occurs in various parts of the Region:

- The Dandaragan Plateau, on the north eastern edge of the Swan Coastal Plain contains open Marri woodlands, Jarrah, various Banksia species and Pricklybark (*Eucalyptus tottiana*).
- The Darling Scarp and Plateau contains a variety of vegetation complexes including open forests and woodlands (with several Jarrah, Marri and Wandoo are the most dominant but also include several Eucalypts), shrublands, herblands, sedgeland and grasslands.
- The Quindalup, Spearwood and Bassendean Dune systems of the Swan Coastal Plain contain woodlands, with the Banksia dominated Bassendean Sands covering the greatest area. There is considerable floral biodiversity on all of these dunal systems, with generally high species richness of understorey plants.

A full description of the Region’s major landform elements and corresponding vegetation complexes is shown in Appendix 8. The tree species typical of these areas all tend to contain a high diversity of understorey plant species.

The Region’s long-term sustainability is intimately and intricately linked to the natural environment, for clean air, clean water, and the places of inspiration, peace and economic opportunity.

There is a huge economic cost and loss experienced by communities from the degradation and destruction of biodiversity. This is being particularly felt by the impacts of salinity and the associated species extinctions in rural communities throughout Western Australia.

This Strategy is an opportunity for the wider regional community of the Region to care for its precious biodiversity. In so doing, the wider regional community can prevent further loss of natural heritage through habitat destruction and degradation from incompatible planning and development and inappropriate management practices. The Strategy aims to strategically implement new mechanisms for the coordination of Australian Government, State Government, Local Government and corporate sector initiatives. It also acknowledges the enormous effort made by volunteering individuals and communities to protect and manage bushland, wetlands, coasts, waterways and the special habitats unique to the Region.

1.4.2 Socio-Economic Profile

This section provides a broad overview of the socio-economic make-up of the Region including: the dollar value of the Region’s economy; population statistics; infrastructure; agriculture; forestry; mining; tourism and employment.

The Region has been home to Aboriginal people for more than 40,000 years. Despite major dispossession and dislocation at the time of European settlement, Aboriginal communities have maintained a cultural and economic attachment to the Region, parts of which are the subject of Native Title claims. Indigenous cultural heritage in sites and story is an important component of the socio-cultural landscape in the Region. This indigenous cultural heritage is recognised by many Local Governments and catchment groups which have established close ties with local indigenous communities. The Region was first settled by non-indigenous people in 1829 with the establishment of the Swan River Colony. A diversity of cultures now reside in the Region.

The Region contains Australia’s fourth largest metropolitan area, housing 1.4 million people. This concentration of people places high demands on land and water resources for industry, commerce,

residential, transport and lifestyle needs. The Region's environment sets it apart, and makes Perth, still, one of the most liveable cities in the world. But environmental quality is under severe threat on many fronts, and especially for the indigenous Nyoongar people, who know better than most the nature of the land.

Perth, the capital city of Western Australia, is the financial centre of the State. It is the central place from which enterprises through the State are managed. Fremantle is the principle port of entry for all manner of imported goods and the export of agricultural commodities. The industrial complex at Kwinana on the shore of Cockburn Sound is the State's principle centre of heavy processing industry and export of manufactured commodities.

The socio-economic make-up of this closely settled Region provides the context and principal pressures on the sustainable management of natural resources. The Region's population is growing faster than the Australian average, as the State's economy grows through developments in the minerals and energy industries, agriculture, its diversifying basic processing industries and tourism development.

Utilisation of the Region's natural resources to sustain a growing population will put increasing pressure on those resources. Current economic drivers for an increased standard of living, which includes better access to services and facilities is increasing the pressures on the natural resources and is also a basis for conflicts over land use in the Region.

Human occupation has had an enormous impact on the landscape and water systems. The operation of a large and growing city threatens air, biodiversity, rivers, lakes, estuaries, and coastal environments. This occurs through the sheer pressure of activity, materials and fuel consumption, waste products, recreational activities, and wastewater and stormwater discharges.

The city's water supply has been restricted for most of the last 15 years, following declining rainfall and runoff, and growth in usage as the population grows.

Vehicle and industry emissions, controlled and uncontrolled burning of the native vegetation plus the use of wood for heating homes creates an issue for air quality.

The naturally low nutrient status of the soils has led to high levels of fertiliser use in agriculture, horticulture, urban parks, sporting grounds and household gardens. This has produced serious impacts on aquatic environments, particularly algal blooms. Offshore sediments have been disturbed (e.g. for shipping access to Cockburn Sound), and sea grasses upon which much of the aquatic marine life depends have suffered from pollution. Recreational activities have had widespread impacts on water quality and aquatic biodiversity.

A primary purpose of this Strategy will be to deliver the best result for increasingly scarce public resource dollars. It will endeavour to ensure the ability of the Region to attract investment in an agreed outcome to meet the requirements of a modern city, whilst adhering to the principles of conservation and the sustainable use of natural resources.

Economy

The City of Perth is the dominant feature in the Region. Perth is the capital city of Western Australia, and the State's financial and administrative hub.

Effective and sustainable NRM must account for upstream and downstream economic inputs and outputs. Cost benefit analysis over the long-term, will help to identify economic inputs. It will also clarify the ability of the Region to include those inputs when using economic factors as a basis for sustainable NRM. In considering economic equity across regions, consideration must be given to the upstream economic benefits derived from the use of natural resources in other NRM regions. The role the Region plays in contributing to the Western Australian economy will become apparent when other regional NRM groups acknowledge the wealth generated through the export of natural resources and associated products.

The Regional Development Council of Western Australia publishes statistical information on population and demographics, regional economies, income and employment, health care, education and qualifications. Information is based upon defined regional boundaries from information sourced from the Australian Bureau of Statistics. Data for the "Perth" region most closely corresponds to the Swan NRM Region (see Figure 5). The following data also includes comparative data for the State of Western Australia.

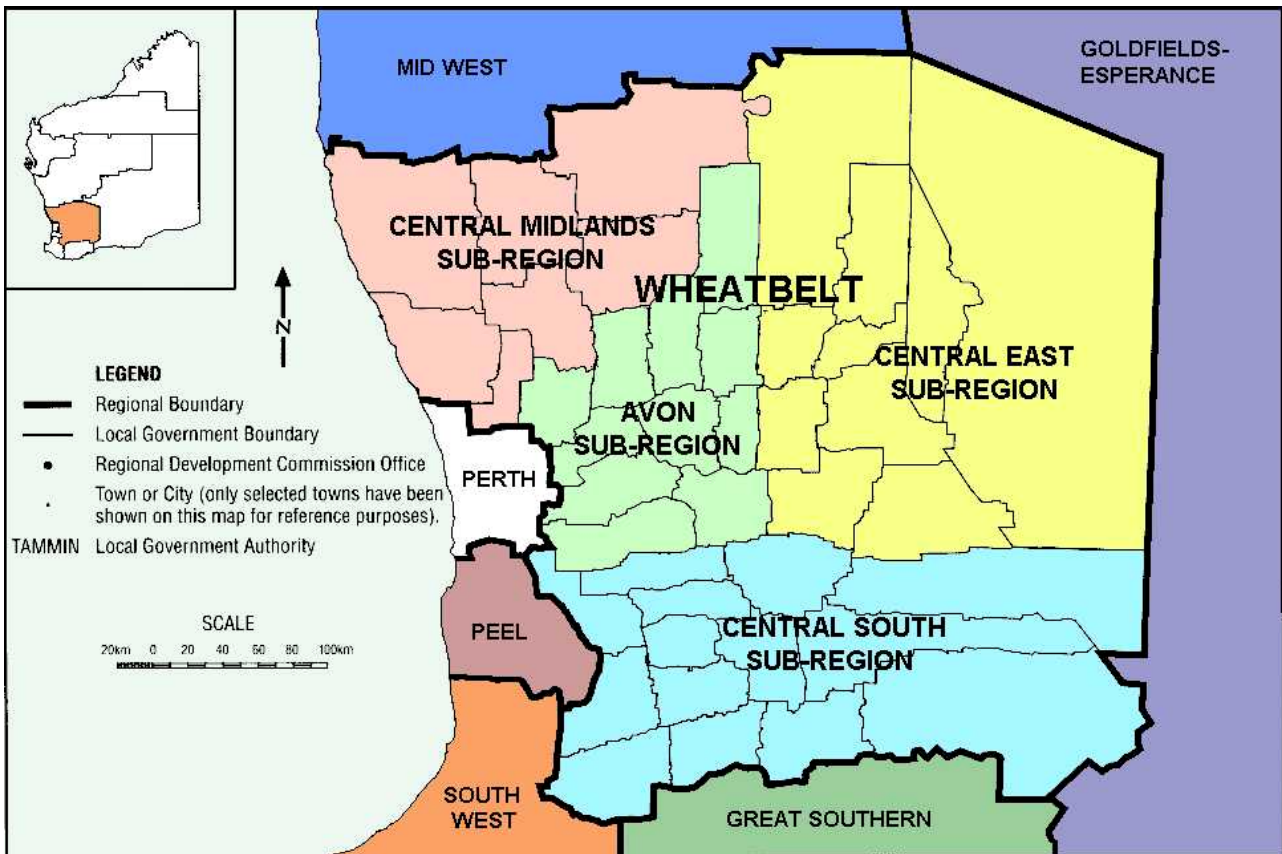


Figure 5: Regional Economic Boundaries, Perth and Adjacent Regions (Map courtesy of the Regional Development Council of Western Australia)

Table 1: Summary of economic activity by industry sector (\$ millions) between 1998-2003

Industry	Perth	Western Australia
Agricultural Production (2000/2001)	244.9	4,387.2
Mining Value (2001/2002)	693.9	26,318.6
Forestry Production (2001/2002)	7.1	88.6
Fishing, Total Catch by Value (2001/2002)	57.6	420.3
Manufacturing Turnover (1998 and 1999/2000)	13,759.0	18,629.1
Building and Construction Total Approvals Value (2002/2003)	3,635.5	4,791.0
Retail Estimated Turnover (2001/2002)	13,060.6	16,893.0
Domestic Tourism Visitors, Overnight Domestic Visitor Expenditure (2001)	1,000.0	2,561.8

The economic activity summarised in Table 1 clearly demonstrates the Region’s role in multi-million dollar primary production activities. The significance of the Perth region in terms of economic activity is further highlighted by Table 2, which indicates that approximately 70 per cent of the gross regional product is generated within the Region.

Table 2: Gross regional product (2002 / 2003)

Outputs	Perth	Western Australia
Gross Regional Product (\$ million)	57,999	82,405
% of State Total	70.4%	100.0%
Gross Domestic Product per capita (\$million)	41,377	42,756

Source: Department of Local Government and Regional Development

The data presented above clearly demonstrates the value of economic activity within the Region and its importance to Western Australia. NRM is strongly linked to economic activity within the Region. On this basis, investment in NRM in the Region will assist in maintaining productive and beneficial economies for Western Australia.

Population

The Region now supports approximately 1.4 million people, or about 70 per cent of the State's population (Table 3) with approximately 19,500 of these are Aboriginal people (Aboriginal and Torres Straits Islander Commission, 2001). The concentration of people, places high demands on land and water resources for industry, commerce, residential, transport and lifestyle needs and sets this Region apart from the other regions in the State. Population density for the Region is characterised by heavily settled areas around the Swan and Canning Rivers and along the coast (Figure 6). The Region has an ageing population with the median age in metropolitan Perth predicted to rise from 35 years in 2001 to 40.3 years in 2031 (Australian Bureau of Statistics, 2002). The median age for Aboriginal people in the Region is 18 years, which is significantly lower than the non-indigenous population (Aboriginal and Torres Straits Islander Commission, 2001). The socio-economic make-up of this closely settled Region provides the context and principal pressures on NRM. The annual growth rate is 1.5 per cent (Table 4).

Table 3: Population (2002)

	Perth	Western Australia
Population (preliminary 2002)	1,401,739	1,927,322
% of State Total	72.7%	100.0%

Source: Australian Bureau of Statistics – Estimated Resident Population

Table 4: Average annual population growth rates (1992 – 2002)

	Perth	Western Australia
1992 to 2002	1.6%	1.5%
1997 to 2002	1.4%	1.4%
2001 to 2002	1.5%	1.4%

Source: Australian Bureau of Statistics – Estimated Resident Population

The Region's population is growing at about 1.5 per cent per annum. Net migration to Western Australia is a source of population growth, with 70,000 additional people coming to the State between 1986 and 1991. There is also a rural to urban migration trend affecting population growth in the Region and surrounding rural areas. Increased employment and education opportunities in the metropolitan area contribute to this trend. Population growth is causing an increased demand for residential land – between 1993 and 1996, 12,500 hectares were converted from Other Zones to Urban Deferred. This land was predominantly previously intact bushland or for agricultural use.

Seventy five per cent of Perth's urban residents live in detached houses with generous space for garden and outdoor activities (Australian Bureau of Statistics, 2002). By 2031 it is projected that the Region will have to accommodate 375,000 new dwellings (Department for Planning and Infrastructure, 2003). Western Australian Planning Commission guidelines outlined in *Liveable Neighbourhoods* encourage the use of small lot sizes as the guiding document for subdivision. Perth residents are also high users of water and energy compared to residents in other capital cities, although average levels are lower than in some other parts of the State. Annual residential water use in Perth is about 300 kilolitres/customer and electricity consumption is almost 5,000 kilowatts per household. Total fuel consumption was 1,523 million litres in 1995, or about 1,200 litres per person. Solid waste generation per capita is being reduced through a range of targeted recycling campaigns conducted mainly by Local Governments, and through the Draft State Waste 2020 Strategy (Government of Western Australia, 2000e). It has been calculated that the 'ecological footprint' of an average Perth resident is equivalent to between 17 to 31 hectares per person.

The State Government initiated "Dialogue with the City", which indicated that the community wants population growth managed more sustainably. They want more active and diverse local centres and they want to preserve opportunities for suburban living as well as expanding opportunities for other lifestyles.

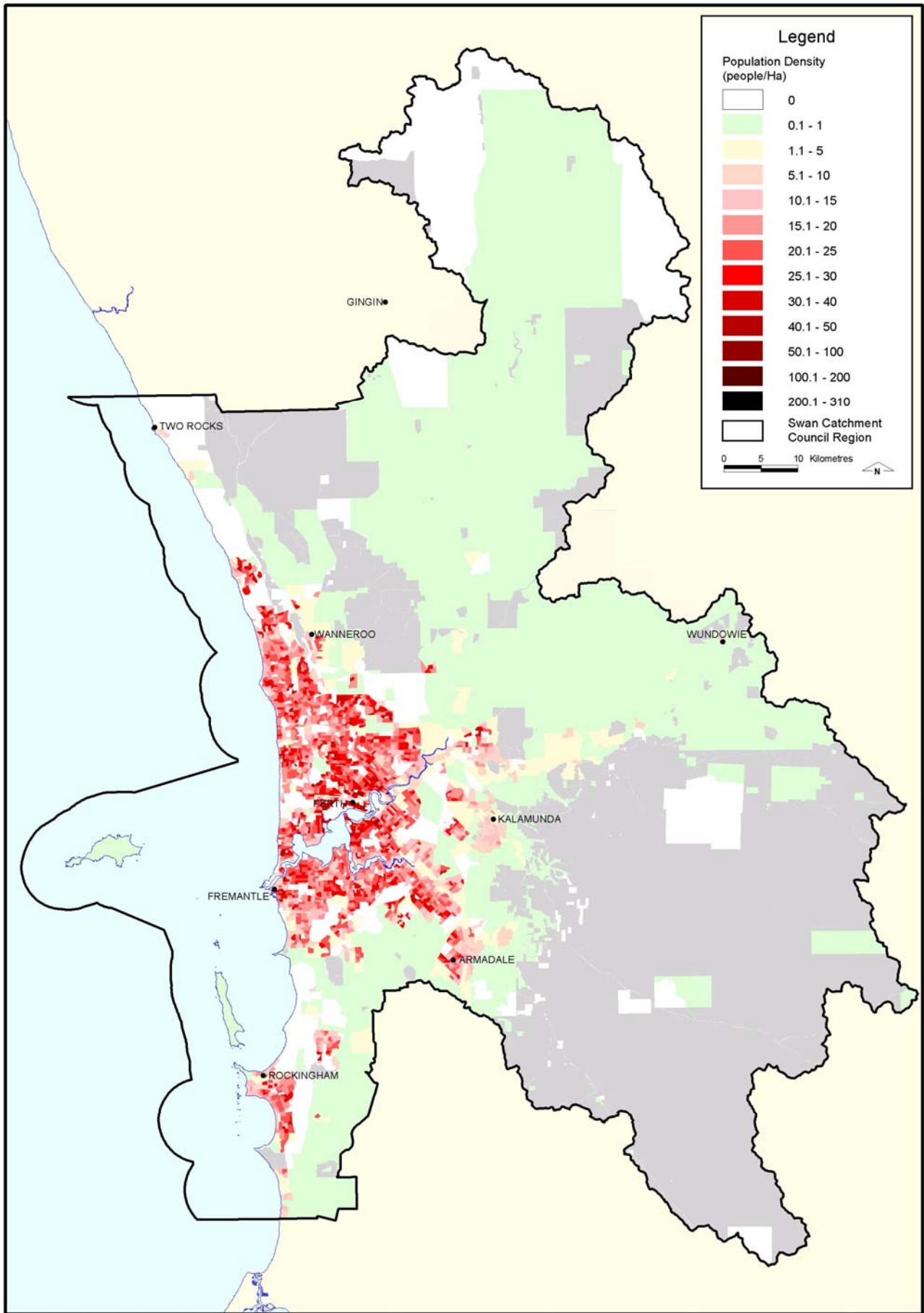


Figure 6: Population density in the Swan Region

The State Sustainability Strategy (Government of Western Australia, 2003) sets a target of achieving sustainability in Western Australia by 2030.

An economic push to improved standards of living, including better access to services and facilities, is increasing the pressure on natural resources. It is also a basis for conflicts over land use in the increasingly densely populated Region.

Infrastructure

The Region includes some major infrastructure assets for the State (Figure 7). Perth Airport, Fremantle Port and a comprehensive road and rail system in the Region enable the transport and distribution of products throughout the State and nation. Air exports of commodities that are transported through Perth Airport are substantial. Approximately 33,000 tonnes of food and live animals, 2,100 tonnes of machinery and transport equipment and 1,700 tonnes of manufactured goods were exported from Western Australia through Perth Airport in 2001 (Australian Bureau of Statistics, 2002).

Port installations in the Region cover 183 hectares and include ports at Fremantle and Kwinana. Approximately 2.9 million tonnes of wheat, 2.7 million tonnes of Alumina, 2.4 million tonnes of refined petroleum and 3.5 million sheep are exported through the Fremantle Port each year (Fremantle Port Authority, unpublished). Mineral and silica sands are also major exports through the Port of Fremantle with approximately 347,000 tonnes and 230,000 tonnes respectively leaving the Port each year. There are 9781 hectares of major roads and 1507 hectares of railways that also significantly contribute to transfer of goods into and out of this Region.

Schools, education institutions, hospitals and industry provide substantial health care, employment and education opportunities for people living both within the Region and throughout the State.

Agriculture

Approximately 20 per cent of the Region consists of rural and semi-rural land supporting a range of land uses including intensive and extensive agriculture, rural and semi-rural subdivisions. These uses are of significant economic benefit to the Region, both from production and from the tourism associated with the activities.

The gross value of agricultural production in the Region is estimated at \$277 million and the total value added impact of agriculture is estimated at \$692 million. Agricultural industries create wealth in other industry sectors such as manufacturing, retail and wholesale, adding to the total value created by agriculture. The following provides a snapshot of the value of agriculture in the Region (Agriculture Western Australia, 1996/97):

- 100 per cent of south west and 96 per cent of WA poultry production
- 69 per cent of south west and 46 per cent of WA nurseries, turf and flower production
- 91 per cent of south west and 79 per cent of WA egg production

Agricultural activity in the Region is characterised mainly by many small, diversified rural properties, which makes the Region unique. The area of land used for extensive agriculture such as cropping, grazing and pasture is 170,650 hectares. Intensive agriculture comprises an area of 26,200 hectares, and includes horticulture, irrigated pastures and cropping, animal production and horticulture. The major agricultural product in the Region is poultry, which contributed \$86 million in 1996/97. This constituted approximately 32 per cent of all farm output in that year and had a total value added contribution of \$258 million (Agriculture Western Australia, 1996/97). Other major agricultural products in the Region include nurseries and vegetables (\$40 million and \$49 million respectively), eggs and fruit (\$23 million and \$34 million), while beef and grapes contributed \$19 million (Agriculture Western Australia, 1996/97).

Dollars per hectare are higher from intensive animal products and horticulture than pasture products. Intensive animal products return \$144,092 per hectare and horticulture \$22,277 per hectare compared with \$195 per hectare for animal products derived from pasture (Agriculture Western Australia, 1996/97).

Forestry

A significant portion of the Region, mostly on the Darling Plateau, is managed as State Forest. This includes both native vegetation and plantations that are predominantly comprised of introduced pine species. That is, 252,273 hectares (approximately 33 per cent of the Region) is managed as State Forest. A Forest Management Plan (FMP) was recently released by the Conservation Commission of Western Australia. This plan outlines that this State Forest is used for providing timber, water catchment protection, conservation, recreation and tourism, and sustainable firewood, wildflower collection, and honey production. Timber production remains a significant contributor to the Regional economy.

The FMP includes a framework relating to the sustainability of the timber industry, including conservation of biodiversity, the conservation and maintenance of productive capacity, ecosystem health and vitality, soil and water, forest contribution to the global carbon cycle, heritage, and of socio-economic values. It also includes significant recommendations relating to the formal conservation reserve system, and to the informal reserve system and protection of specific habitat. (Conservation Commission WA 2003).

Mineral Extraction

Mineral extraction and processing contributes significantly to the economy in the Region. Annual mineral sand extraction and processing contributes approximately \$220 million per year (Tiwest Joint Venture, 2003) to the economy of Region comprising:

- 420,000 tonnes of ilmenite
- 70,000 tonnes of zircon
- 25,000 tonnes of rutile
- 15,000 tonnes of leucoxene

Sand, limestone/limesand, gravel, silica sand and sandstone are also extracted from the Region. Extraction on State Crown Land in the Region during 2003, under the *Mining Act (1978)*, comprised the following (Department of Industry and Resources, 2003):

- 2.4 million tonnes of limestone/limes at an approximate value of \$10.3 million
- 1.0 million tonnes of sand at an approximate value of \$5.2 million
- 0.4 million tonnes of silica sands was extracted at an approximate value of \$4.4 million
- Gravel and sandstone contributed approximately \$0.6 million

These activities tend to be high impact but very localised and amount to a relatively minor land use within the Region. There is a wide area of the Region under mining and exploration leases, which could indicate future activity (Figure 8).

Tourism and Recreation

As the Region includes the Perth metropolitan area, it attracts tourists who are a major contributor to the regional economy. Approximate total visitor expenditure in the Region by day visitors and domestic and international overnight visitors was \$2.46 billion for 2002-03. Of this, it is estimated that \$1 billion was spent by approximately two million visitors involved in nature-based tourism activities (Bureau of Tourism Research 2003). Protection of the natural and cultural assets in the Region is critical to maintaining the tourism industry in this Region. Many of the Region's natural areas (eg. King's Park, Swan River, national parks, the ocean and coastline) and some agricultural landscapes (eg. the Swan Valley) are the focus for much of this activity.

Therefore one economic value of those natural areas can be expressed based on the tourism income they provide. However, while tourism can be a benign or sustainable industry, it can and does have negative impacts on NRM values.

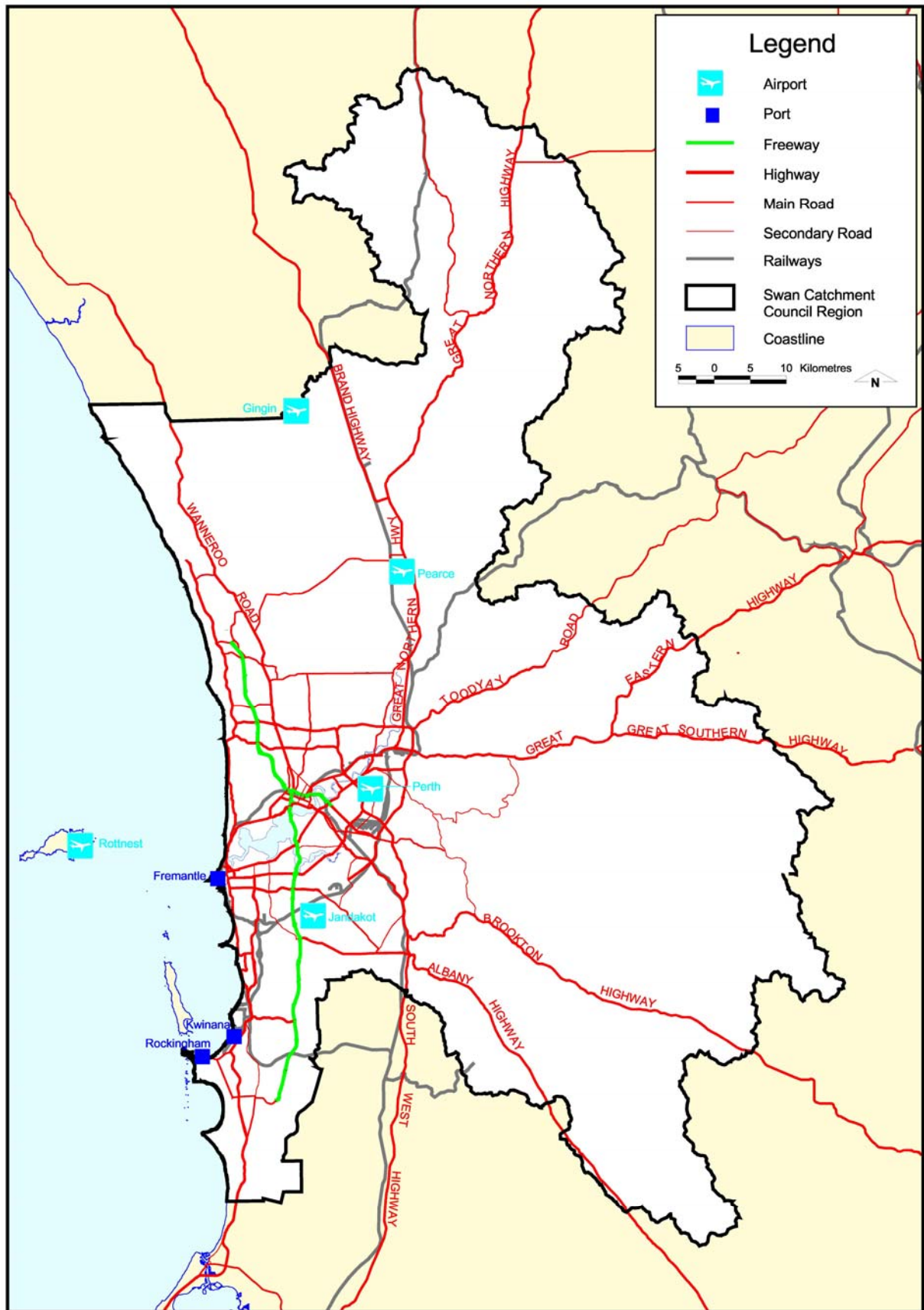


Figure 7: Infrastructure assets in the Swan Region

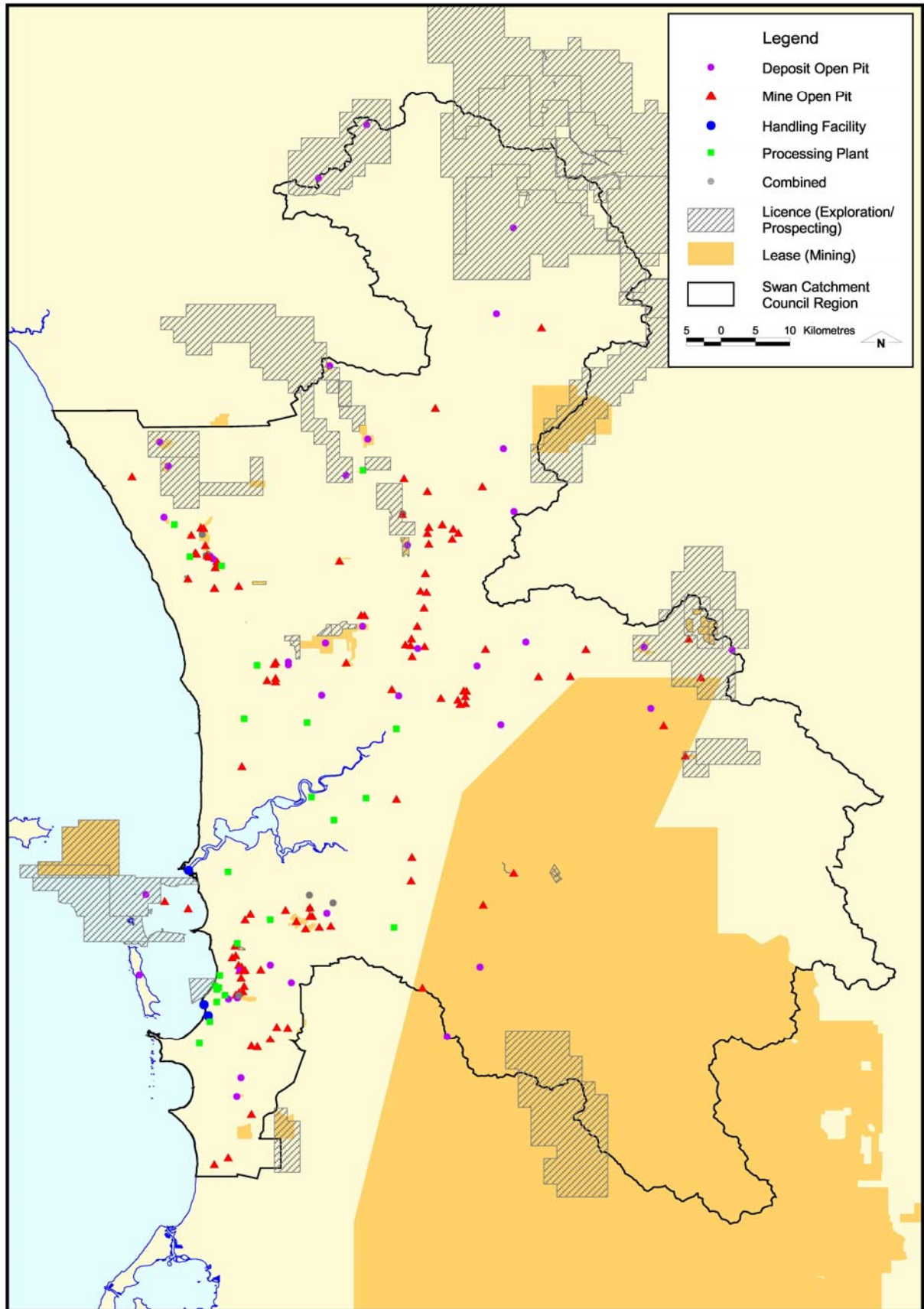


Figure 8: Mining and exploration leases in the Swan Region

Employment

At the 2001 Census there were 50,408 unemployed people in the Perth to Mandurah region which represented an unemployment rate of 7.9 per cent (Australian Bureau of Statistics, 2002). In 2000, the national unemployment rate for Aboriginal people was 18 per cent compared with seven per cent for the non-indigenous population (Aboriginal and Torres Strait Islander Commission, 2001). The spread of unemployed people across the Region is similar to the distribution of people without qualifications and correlated with high percentages of Government-owned rented dwellings (Australian Bureau of Statistics, 2002).

Distinct concentrations of unemployed people aged 45 years or older were found in areas that also had high proportions of one-parent families with dependant children, low income households and low proportions of home ownership. In the 15-24 age group, areas with high proportions of unemployed people also had high percentages of low income households and people without qualifications (Australian Bureau of Statistics 2002).

According to the recent "Dialogue with the City" (Department of Planning and Infrastructure, 2003):

- One in two households do not have children at home
- 95 per cent of new jobs are likely to be in service industries
- In future there will be a bigger part-time workforce
- Most people live within two hours travel time from central Perth
- More businesses are being conducted from home

These trends will have an impact on the Region's environment. Consideration must be given to the way land is used and developed. The challenges faced are varied and include the need to use land more efficiently, creating suburbs with mixed density to reduce travel and fossil fuel usage. There is also the need to protect the Region's water resources for the future, and ensure existing suburbs are able to deal with employment and demographic change (Department of Planning and Infrastructure 2003).