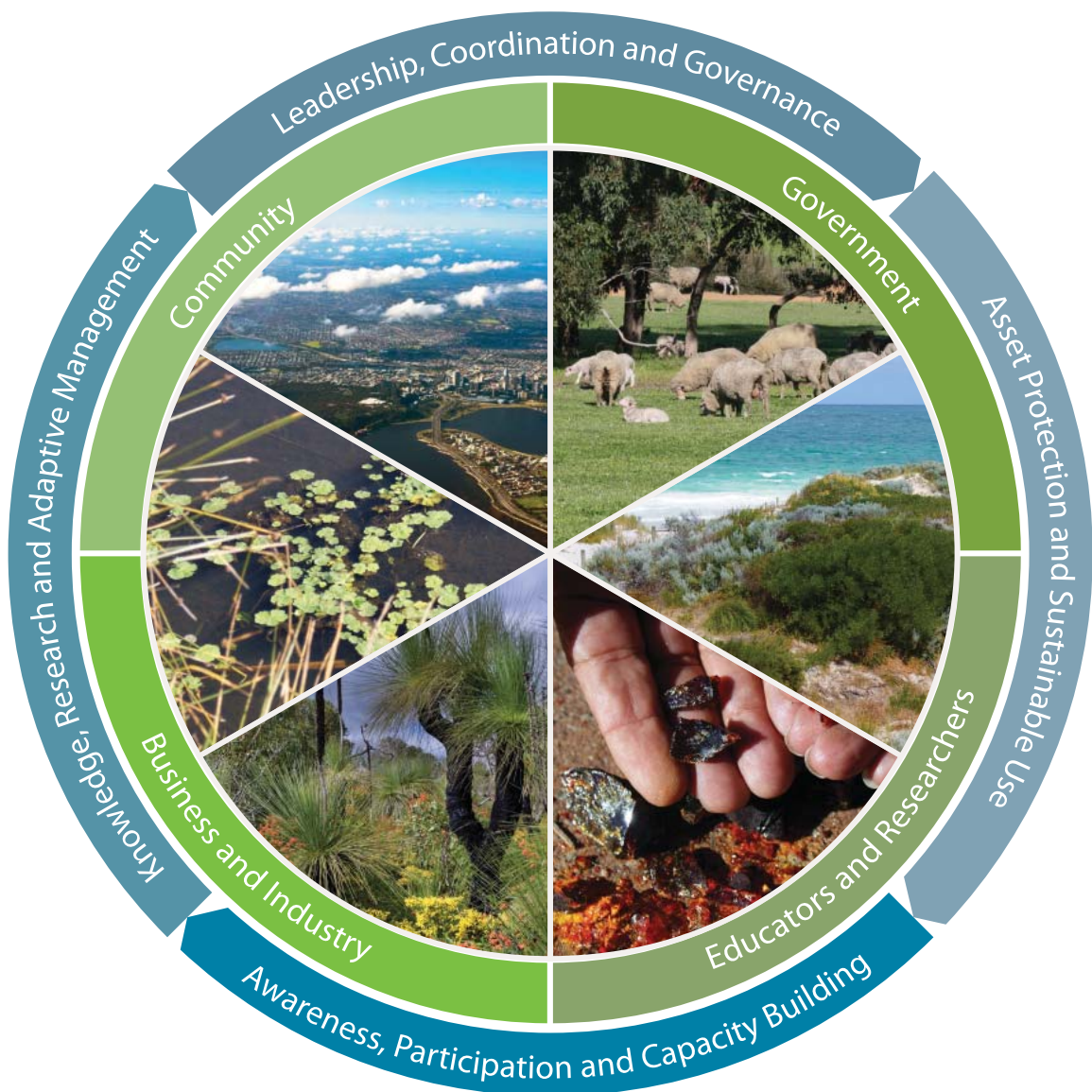


# SWAN REGION STRATEGY

FOR NATURAL RESOURCE MANAGEMENT

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2015 to 2020



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**Perth NRM**

Creating a sustainable  
environment

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### Acknowledgements

This update of the Swan Region Strategy for Natural Resource Management has been funded by the Australian Government.



**Australian Government**

## Chairman's Forward

This Strategy is intended to guide natural resource management in the Swan Region. It is the culmination of a region wide consultation process which has drawn upon the knowledge, experience and insights of experts in government, community, industry and research institutions to identify key directions for natural resource management in the Region.

As a whole-of-region, multi-stakeholder Strategy, this document is built on the foundation of partnerships and collaboration, and acknowledges that everyone that lives or works in the Region is an environmental custodian. Through our decisions and actions, everyone has a part to play in the protection and management of our natural heritage and the sustainability of our way of life.

The challenges of managing natural assets in a major metropolitan centre means that collective commitment is needed to ensure future generations are able to continue to access and enjoy the natural assets that sustain us today. That commitment will be essential to ensure the natural environment can continue to deliver the invaluable ecological services that sustain the incredibly diverse flora and fauna of the region, and we as humans.

This Strategy acknowledges that Perth's economic prosperity and way of life has been built on its natural resources, from our clean air and water through to our agriculture, forestry and fisheries. Our natural landscapes, seascapes and waterways not only provide important cultural, recreational and spiritual opportunities but also form part of our unique identity. There will be significant costs to the economy and our health and wellbeing if these assets are allowed to degrade. To ensure future generations have the opportunity to enjoy the benefits of our natural environment, a collaborative plan of action is needed. In a time of rapid change and development, it is incumbent upon each of us to take action to ensure our vision for a vibrant, resilient, living city of the future can be realised.

I would like to acknowledge the contribution of the Swan NRM Committee and the former Chair, Garry English, for guiding the development of this Strategy, and for their commitment to integrated and collaborative natural resource management. I would also like to acknowledge the organisations, groups and community members who participated in the consultation process and came along on this journey over the last two years. Lastly I would like to thank the team at Perth NRM for their contribution to and work in compiling this Strategy and I would like to particularly recognise the role played by Greer Gilroy, NRM Strategy Coordinator.

**Mr Peter Nash**

Chairman, Swan NRM Committee

## Executive Summary

The purpose of the Swan Region Strategy for Natural Resource Management, is to provide a strategic, integrated framework for natural resource management in the Swan Region of Western Australia. Perth NRM has facilitated the development of this Strategy as part of its core role as a regional NRM body.

The Strategy is based on best available knowledge at the time of writing, as well as on previous and existing work, and has been developed with community and stakeholder consultation. It is a whole-of-region and multi-stakeholder strategy intended to provide a focus for natural resource management in the Swan Region and to improve integration and coordination of planning and activities, particularly between sectors and agencies.

The Strategy is intended to reflect stakeholder aspirations and priorities for the Region. Responsibility for the management of the Region's natural resources rests not only with government and natural resource management custodians, but with the entire community. As a consequence, this Strategy seeks to engage all relevant stakeholders in the management of the Region's natural resources. These stakeholders include business and industry, research and education institutions, government and the community.

### The way forward

The Vision, Aspirational Goals and Action Areas form the Strategic Framework of the Strategy. The Vision describes the ultimate goal for natural resource management in the Swan Region. The eight Aspirational Goals describe what success looks like and the four Action Areas define what needs to happen.

The Strategic Framework is focused on the achievement of outcomes for the environment and the broader community.

### Making it happen

The Strategic Objectives and directions in the Strategy are acted upon through a two year Implementation Plan developed in collaboration with Swan NRM Committee members and other key stakeholders in the Region. The Implementation Plan includes existing activities that align with the Strategy, along with new actions that address the critical gaps or opportunities.

Implementation of the Strategy is also supported by a Monitoring, Evaluation, Reporting and Improvement (MERI) Plan. This will allow progress against the priorities and delivery of outcomes to be monitored and measured over time and assist in the identification of adaptive management opportunities.

Implementation of the Strategy will be reviewed annually by the Swan NRM Committee to monitor progress and identify improvement opportunities.

# SWAN REGION STRATEGY FOR NRM

Vision	
The natural resources of the Swan Region are protected and managed sustainably in their own right and for the enhancement of the quality of life for present and future generations.	
Aspirational Goals	
Perth is an eco-city where natural assets are valued and used sustainably	Water quality (marine and freshwater) is maintained and water resources are used sustainably
Land use and development is sustainable and appropriate to land capability and suitability	Biodiversity and ecosystem function is protected, managed and restored
Residents and visitors value and enjoy access to high quality natural areas	Air is healthy for the community and the environment
Aboriginal cultural heritage values are integral to the way we view and manage the environment	Climate change is addressed to ensure the Swan Region remains liveable and resilient
Action Areas and Strategic Objectives	
<b>1 Leadership, Coordination and Governance</b> <ul style="list-style-type: none"> <li>1.1 Work towards agreed priorities and outcomes</li> <li>1.2 Work collaboratively</li> <li>1.3 Apply environmental accounting approaches</li> <li>1.4 Invest in natural assets</li> <li>1.5 Ensure policies, legislation and standards are effective</li> <li>1.6 Reflect Aboriginal cultural heritage values in policy and practice</li> <li>1.7 Ensure land use planning is environmentally sensitive</li> </ul>	<b>3 Awareness, Participation and Capacity Building</b> <ul style="list-style-type: none"> <li>3.1 Build community awareness and participation</li> <li>3.2 Support environmental community groups</li> <li>3.3 Involve the Aboriginal community</li> <li>3.4 Build the capacity of local government</li> <li>3.5 Enhance the environmental sustainability of businesses and organisations</li> <li>3.6 Support environmental stewardship</li> <li>3.7 Recognise and celebrate achievements</li> </ul>
<b>2 Asset Protection and Sustainable Use</b> <ul style="list-style-type: none"> <li>2.1 Manage assets within a landscape system</li> <li>2.2 Address drivers, risks and threats</li> <li>2.3 Enforce regulations and approval conditions</li> <li>2.4 Support voluntary environmental standards</li> <li>2.5 Transform Perth into an eco-city</li> </ul>	<b>4 Knowledge, Research and Adaptive Management</b> <ul style="list-style-type: none"> <li>4.1 Focus research, development and innovation on critical needs and knowledge gaps</li> <li>4.2 Ensure essential knowledge is accessible to decision-makers</li> <li>4.3 Integrate scientific and traditional ecological knowledge</li> <li>4.4 Monitor and report on resource condition</li> <li>4.5 Monitor and evaluate environmental programs</li> </ul>
Implementation	
Implementation Plan	Monitoring, Evaluation, Reporting and Improvement Plan



## 1. Introduction

### 1.1 About the Strategy

The Swan Region Strategy for Natural Resource Management ('the Strategy') provides an integrated framework for the management of the Swan Region's natural resources. It is the result of an eighteen month consultation process with key stakeholders across the Swan Region and a review of emerging issues and trends in natural resource management.

This Strategy articulates the long term vision for natural resource management and highlights the importance of achieving outcomes in the community in order to deliver outcomes for the environment.

It builds on the foundations of the original 2004 Strategy and translates it into a contemporary, holistic and integrated framework that is accessible and practical for the broad range of stakeholders in our Region.

A comprehensive, big picture view of natural resource management in the Region is presented so that decision makers and natural resource managers can make informed choices about where action is most needed.

#### The structure of the document

Introduction	Describes the purpose of the Strategy and provides an overview of the review and update process
Regional Overview	Provides an overview of the Swan Region's socio-economic profile, history and natural assets
Strategic Issues and Threats	Describes the strategic issues and threats to natural assets in the Swan Region
The Strategy	<p>Presents an overview of the Strategic Framework – Vision, Aspirational Goals, Action Areas and Strategic Objectives</p> <p>For each of the four Action Areas there is an:</p> <ul style="list-style-type: none"><li>• overview</li><li>• description of the key issues</li><li>• description of the proposed responses</li><li>• strategic objectives and measures of success</li></ul>
Implementing the Strategy	Describes the key stakeholders involved in delivering the Strategy and how the Implementation and Monitoring, Evaluation, Reporting and Improvement (MERI) Plans will support implementation

# SWAN REGION STRATEGY FOR NRM

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## 1.2 Vision and aspirations

The vision for the Swan Region Strategy for Natural Resource Management ('the Strategy') is that:

**The natural resources of the Swan Region are protected and managed sustainably in their own right and for the enhancement of the quality of the life for present and future generations.**

Outlined below are the Strategy's eight Aspirational Goals for the sustainable management of the Region's natural resources. These originated from the 2004 Strategy and have been refined and expanded through further consultation.

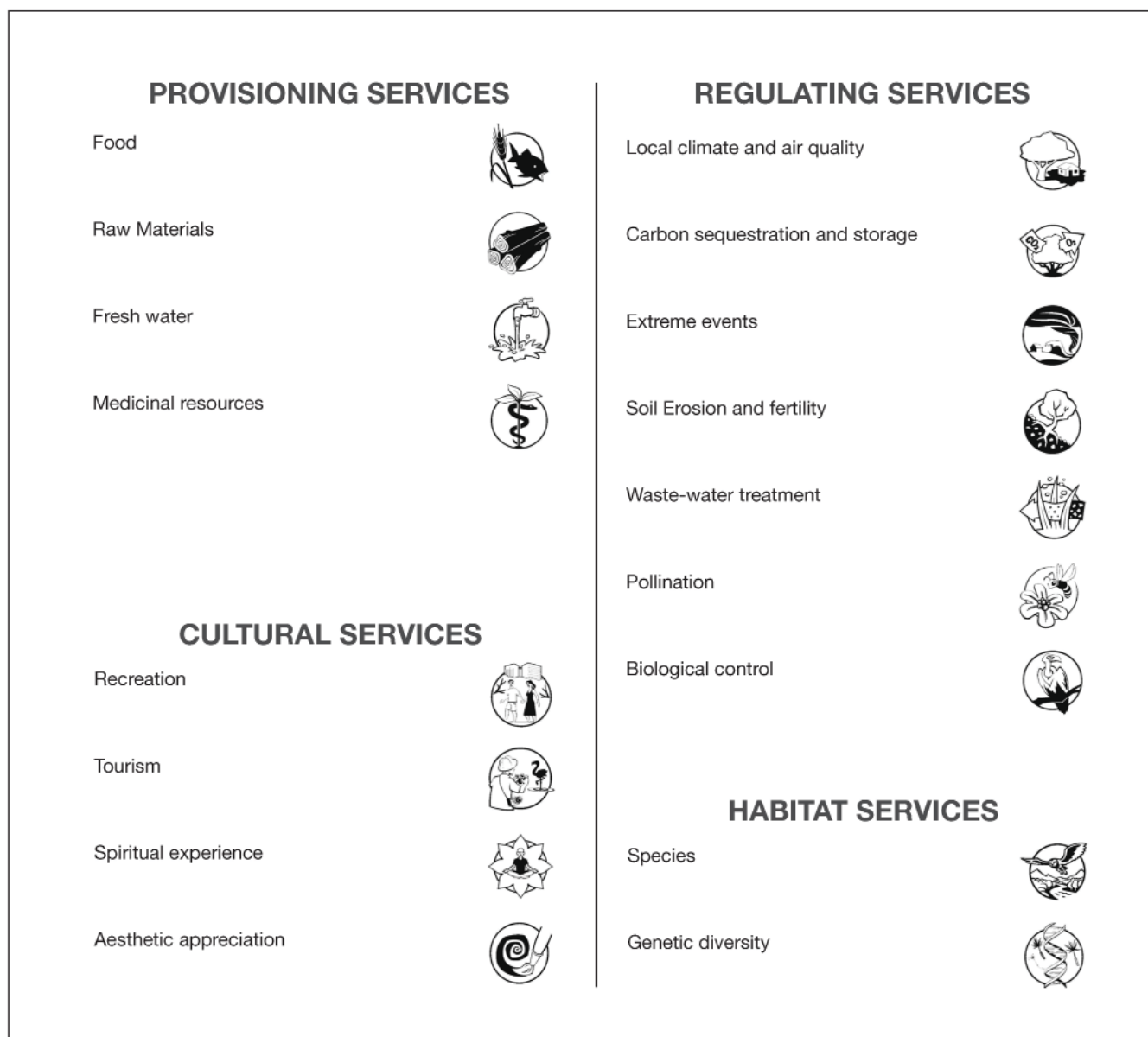
- Perth is an eco-city where natural assets are valued and used sustainably
- Land use and development is sustainable and appropriate to land capability and suitability
- Water quality (marine and freshwater) is maintained and water resources are used sustainably
- Biodiversity and ecosystem function is protected, managed and restored
- Air is healthy for the community and the environment
- Aboriginal cultural heritage values are integral to the way we view and manage the environment
- Residents and visitors value and enjoy access to high quality natural areas
- Climate change is addressed to ensure the Swan Region remains liveable and resilient

With these aspirations in mind, the Strategy will work towards opportunities and innovative solutions to ensure the Region's natural assets and productive ecosystems are sustainably managed.

## 1.3 Natural resource management

The Australian Government broadly defines natural resource management as the sustainable management of Australia's natural resources (our land, water, marine and biological systems) for ongoing social, economic and environmental wellbeing.

Natural resource management recognises the interdependence between humans and their natural environment. The sustainability of the environment, economy and our society are dependent upon our ability to understand this interdependence and effectively manage competing priorities. It recognises that people and their livelihoods rely on healthy ecosystems to provide vital services such as clean air, food and water (Figure 1), but also that the health of these ecosystems rely on our actions as environmental stewards.



[Source: Sukhdev *et al.* 2014]

**Figure 1: Categories of ecosystem goods and services**

Successful natural resource management requires sound technical practices, good policy and collaboration between individuals and groups with different interests. It is difficult to satisfy the interests of all stakeholders all of the time, which is why a shared vision with agreed outcomes is critical. A focus on outcomes can create the space for collaboration and innovative thinking by embracing multiple pathways towards a common goal.

### 1.4 Guiding principles

The development of this Strategy has been guided by the fundamental principles from the 2004 Strategy along with new information and thinking in natural resource management.

These principles recognise the need to pursue sustainable development in the Region, and highlight the importance of partnerships and collaboration. They are primarily concerned with:

- **Integrated Management** – The management of natural resources should be integrated within regions and catchments as well as across industry sectors, government agencies and specific issues
- **Priority Based** – Natural resource management actions should be undertaken according to priorities that are based on the best available science and information and a rigorous assessment of cost-effectiveness and relative value compared with other options
- **Intergenerational Equity** – The current society should meet its needs in ways to ensure that the health, diversity and productivity of the environment are maintained, without reducing the capacity of future generations to meet their needs
- **Shared Responsibility** – Everyone, including government, industry, business and the wider community play a vital role in protecting and managing the Region's natural assets
- **Partnerships** – Effective natural resource management requires partnerships across government, non-government organisations, community, business and industry to achieve large scale, lasting change
- **The Precautionary Principle** – Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation
- **Prevention is Better than Cure** – Protecting natural systems from damage is far more cost-effective than attempting rehabilitation once the damage is done, as some biodiversity assets once lost can never be recovered
- **Audit, Review and Adaptive Management** - Regular audit, review and improvement of legislation, policies, plans and strategies are essential for efficient and effective natural resource management

## 1.5 The role of Perth NRM

Perth NRM is one of 56 regional NRM groups across Australia charged with the responsibility of developing and maintaining a natural resource management strategy for their region. The seven NRM groups in Western Australia are all non-profit community-based organisations with responsibilities for coordinating and delivering natural resource management activities in their region.

Within the Swan region, Perth NRM is one of many organisations and groups who will implement the Strategy through their investment and activities. Perth NRM will provide leadership on NRM matters at a regional level and develop partnerships with regional stakeholders for the successful implementation of the Strategy. Perth NRM will also coordinate the monitoring and review of the Strategy in consultation with key stakeholders.

## 1.6 The 2004 Strategy

The first Swan Region Strategy for Natural Resource Management was released in December 2004 when Perth NRM was known as the Swan Catchment Council. The Strategy formalised a partnership between the Australian Government, the Western Australian State Government and the wider regional community, articulating how collectively they would develop, implement and evaluate programs for sustainable natural resource management outcomes.

The 2004 Strategy was a culmination of a comprehensive consultation and engagement process with the wider regional community and key stakeholders to identify the priority assets, issues and actions. The Region's assets were classified as either biophysical or social/economic and Aspirational Targets, Resource Condition Targets, Management Action Targets and associated management actions were developed for each asset category to address key regional threatening processes.

The bilateral agreement signed in 2002 between the Commonwealth of Australia and the State of Western Australia to deliver the Natural Heritage Trust reflected their intent to work as joint investment partners in natural resource management at the regional level. As part of this agreement, regional Strategies were required to be accredited by both the State and Commonwealth Governments in order to secure investment. Investment plans were developed for each Regional NRM Strategy identifying the funding required and the prioritisation of projects and activities at the regional level. Funding was then allocated through the National Action Plan (NAP) for Salinity and Water Quality and the Natural Heritage Trust (NHT).

## 1.7 Renewing the Strategy

### 1.7.1 Rationale for renewing the strategy

Perth NRM commenced a review of the Strategy in April 2013. The main aim of the review was to ensure the content was current and the priorities were meeting the needs of the Region. Two critical issues that were considered in the review were the institutional arrangements for natural resource management in Western Australia and the impact of climate change.

## SWAN REGION STRATEGY FOR NRM

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After the National Action Plan for Salinity and Water Quality and Natural Heritage Trust (NAP/NHT) program came to an end in June 2008, the bilateral agreements between the State and Commonwealth Governments ceased. Similarly, regional strategies were no longer required to be accredited by the State and Commonwealth Governments. Although this reduced the prescriptive nature of regional strategies in terms of structure and targets, the fallout has been a weakening of institutional support for regional strategies, particularly in Western Australia where NRM bodies are non-statutory. Given these changes, a key goal of the Strategy review process was to establish a commitment to partnerships and collaboration, in order to build a firm foundation for implementation.

Another driver of change has been a general movement away from asset-based approaches to natural resource management, towards integrated systems thinking and resilience models that can deal with large scale impacts such as climate change. Under the NAP/NHT program, regional NRM strategies were required to be structured around seven key assets: air, land, water, biodiversity, coastal and marine, cultural heritage and regional capacity. By the time the program ended in 2008 and the requirement for asset-based strategies ceased, there was growing recognition that a focus on assets did not adequately address the large-scale biophysical and social processes that underpin the viability of natural assets (Curtis and Lefroy 2010). As a result, many regional NRM strategies have adopted a systems thinking or ecosystem resilience approach (e.g. Wheatbelt NRM, NSW CMAs). To reflect this paradigm shift, the review of the Strategy has focussed on translating the asset-based approach of the 2004 Strategy into an integrated framework.

### 1.7.2 Review and engagement process

To inform the update of the Strategy, Perth NRM hosted a number of stakeholder workshops and forums to discuss the issues and opportunities for natural resource management in the Swan Region. Workshops were either focussed on specific natural resource assets (biodiversity, water, coastal/marine environment, air, land) or targeted specific stakeholder groups (e.g. local government, non-government organisations, the Aboriginal community). More than 170 people from 84 different organisations and groups participated in workshops between 2013 and 2014 (Appendix 5.1).

The Swan NRM Committee was established in December 2013 to oversee the development and implementation of the Strategy and drive a more coordinated approach to natural resource management in the Region. The committee is made up of representatives from all three levels of government, sub-regional natural resource management groups, industry bodies, research institutions and other key stakeholders, who each bring a diversity of knowledge, views and expertise to the table (Appendix 5.2). The Committee has an independent Chair, with executive support provided by Perth NRM.

Perth NRM developed the Strategic Framework of the Strategy in consultation with the Swan NRM Committee in late 2013. In early 2014, the consultation feedback was used to develop a number of Strategic Priorities. These priorities were tested with Committee members and key stakeholders in one-on-one meetings during April and May 2014 and finalised in June 2014.

In December 2014, the Draft Strategy was released for public comment for a period of nine weeks. A total of 43 submissions were received, with the majority of submissions expressing their support for the Strategy and the framework presented (See Appendix 5.3). Where possible, the recommended changes were incorporated into the final version of the Strategy.

## 2. Regional Overview

### 2.1 The Swan Region

The Swan Region (Figure 2) covers over 1 million hectares which includes the Perth Metropolitan area, the Swan and Canning river catchments and extends three nautical miles offshore to include islands such as Rottnest and Garden Island. The Swan Region has a Mediterranean climate, with mild wet winters and hot dry summers. The average annual rainfall across the Region is 850mm per annum, primarily falling between May and October.

The Traditional Owners of the land and waterways within the Swan Region are the *Whadjuk* People of the Noongar Nation. Noongars have lived and had a cultural connection to the *booja* – land for more than 40,000 years. Through lore, customs and language, Noongar people have maintained a spiritual connection to *booja* country which has been passed on through stories, art, song and dance. Sites of particular significance to the *Whadjuk* are *Ngooloomayup*, known as Carnac Island; *Meeandip*, known as Garden Island; *Wajemup*, known as Rottnest Island; *Gargangara* north of Armadale; and *Goolamrup*, the suburb known as Kelmscott (Figure 3, Appendix 5.4).

Waterways lie at the heart of Noongar culture, both literally and spiritually. Waterways such as *Dyarlgarro Beeliar*, known as the Canning River, and *Derbal Yiragan*, known as the Perth estuary, and the flow of lakes and wetlands that run parallel to the coast and at the foot of the Darling Scarp, are a vital spiritual and natural resource that continue to have significant economic value to Aboriginal people. These waterways were created by the *Wagyl*, and the Noongar people were entrusted by the *Wagyl* to protect the rivers, lakes, springs and wildlife.

Perth is the capital city of Western Australia and covers almost half the Swan Region (~47%). It is Australia's fastest growing city, with the current population of 1.9 million expected to rise to 5 million in 2055. The combination of rich and productive natural assets and outdoor lifestyle choices have made the Region a highly sought after destination for visitors and migrants.

The Region's social and economic life is dominated by the Perth metropolitan area, with its associated manufacturing and services industries. The metropolitan area supports a business turnover of \$64 billion per annum (Regional Development Australia 2014), with the largest employing industries being Health Care and Social Assistance (11%), Construction (11%), Retail Trade (10%) and Professional, Scientific and Technical Services (9%) (Australian Bureau of Statistics 2011). Car ownership and use is relatively high in Perth with 58% of residents owning two or more vehicles and more than two thirds of workers driving to work as opposed to only 10.6% using public transport.





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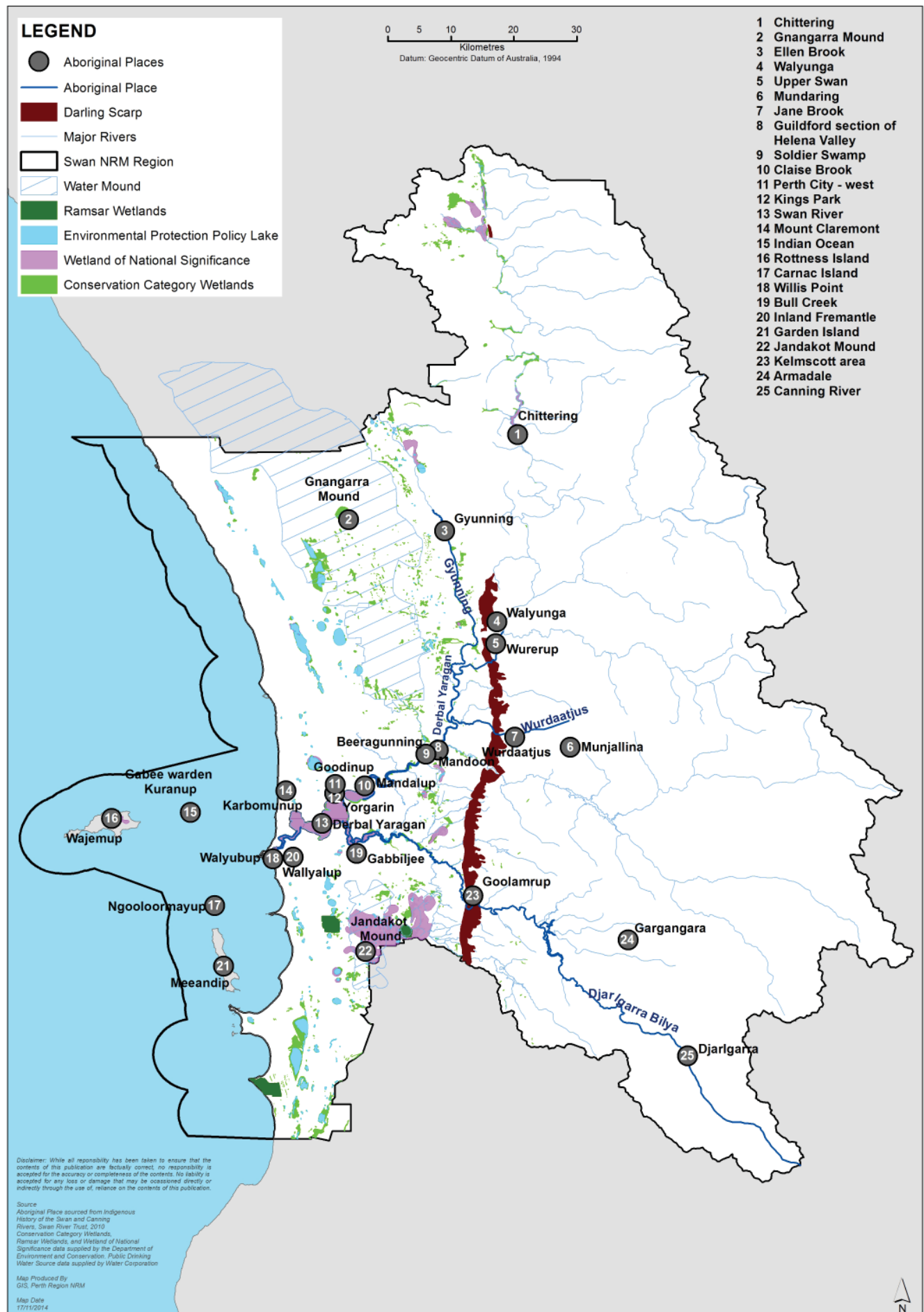


Figure 3: Aboriginal place names in the Swan Region

### 2.2 The Region's Natural Assets

#### 2.2.1 Land

The land assets of the Region include productive agricultural land, soil, mineral and forestry resources, and conservation areas (Figure 4). There are a number of discrete physical environments that contribute to the visual character of the Region and provide important places for aesthetic appreciation, recreation and tourism. They include the Hills sub-region, the Darling Scarp, high dunes on the Coastal Plain, limestone cliffs either side of the Swan River, coastal dunes, lake and cave systems, as well as unique features such as the internationally significant dunal systems located in the north of the Region.

The agricultural assets for the region are rich and diverse, with large areas of the east and north-east subregions well suited to agricultural production (Figure 5). The Swan Region is a major contributor of fresh food for the Perth market, with around 5,000 hectares of irrigated land utilised for this purpose. In addition, there is around 190,000 hectares of land utilised for the production of cereal and other crops. The farm gate value of irrigated agriculture, grains and livestock production for the Region is valued at over \$320m in 2010/11 (Australian Bureau of Statistics 2014a).

The key threats to agricultural assets in the region include urban expansion, competing land uses, high production costs, declining soil health and climate change (Perth NRM 2014a). The Department of Agriculture and Food's (WA) report card for the south west of Western Australia on sustainable natural resource use in agriculture revealed that progress has been made in terms of managing water and wind erosion, however, soil acidity, water repellence and nutrient export continue to be of concern (Department of Agriculture and Food WA 2013). Other issues include dryland salinity in the Ellen Brook and Brockman River catchments and soil compaction in viticultural areas.

Basic raw materials (BRM) such as sand, limestone, gravel and clay are vital for the housing and construction industry. Lime sand is also exported to inland areas to correct soil acidity and is an essential treatment for the sustainability of inland farming systems, particularly cropping systems. These materials are always assumed to be readily available, however, a series of reports from government and industry have highlighted growing problems in the availability of BRMs. This was one of many factors that triggered the Strategic Assessment of Perth and Peel to address land and resource availability for further development and the impact on natural assets.

# SWAN REGION STRATEGY FOR NRM

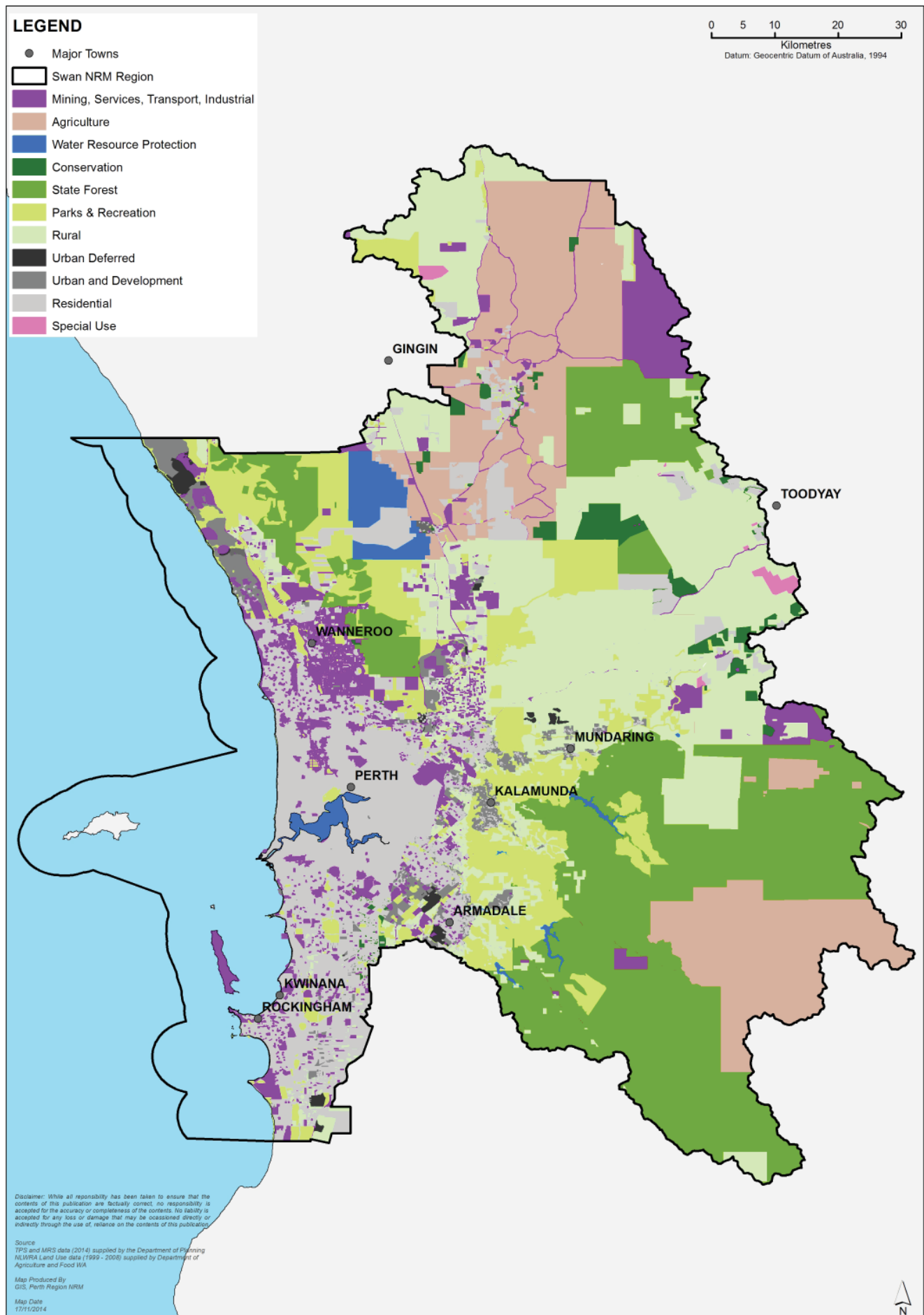


Figure 4: Land use in the Swan Region

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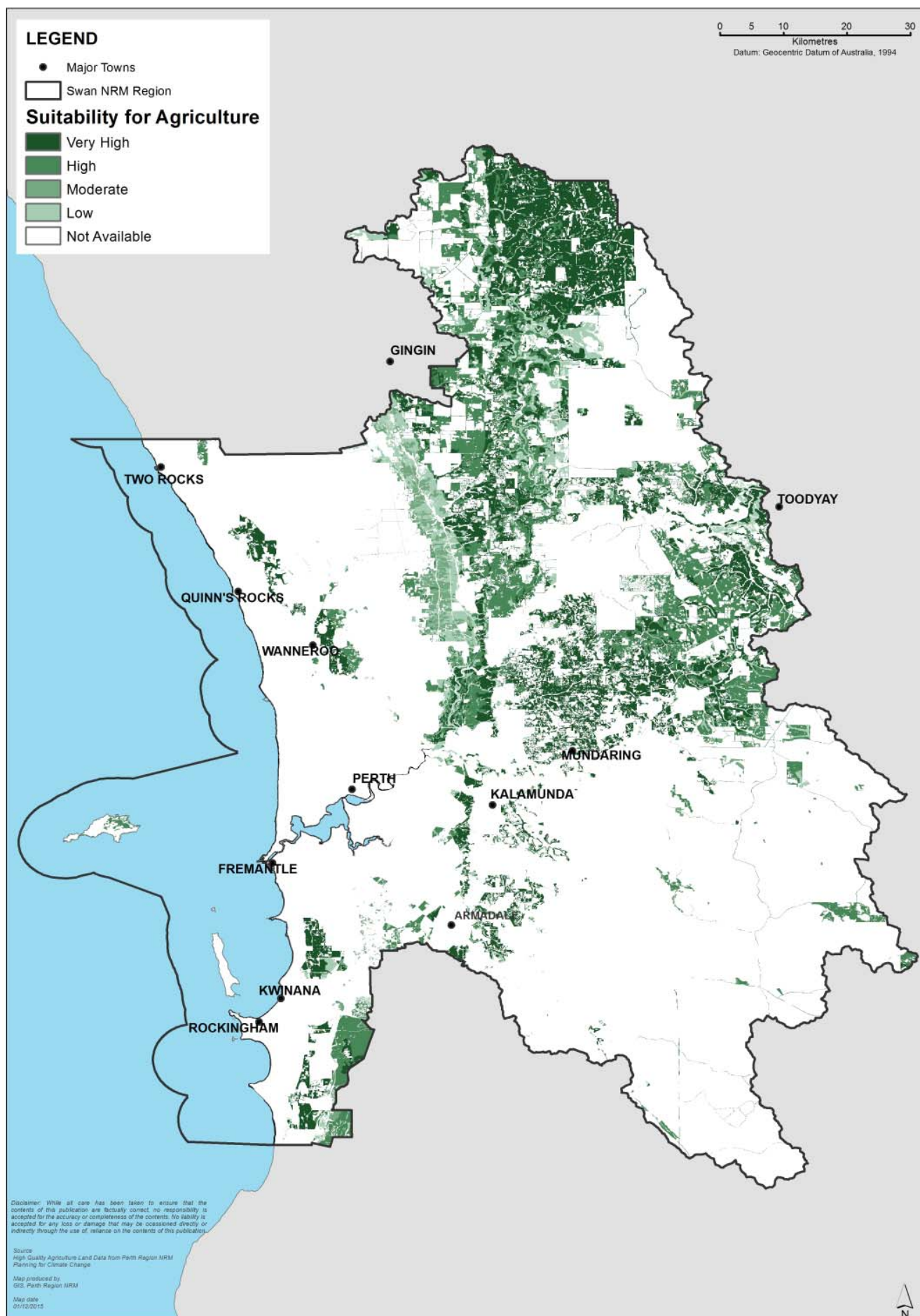


Figure 5: Land suitable for agricultural production in the Swan Region



## SWAN REGION STRATEGY FOR NRM

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### 2.2.2 Water

The Region's rivers, wetlands and groundwater resources are vital for sustaining our population and water dependent ecosystems. The Swan Canning river system runs through the heart of Perth and has been the lifeblood for both the Aboriginal people and the Europeans who settled the Swan River colony. Declared the State's 'first heritage icon' in 2004, the Swan River is an important historical, economic and recreational icon for Western Australia.

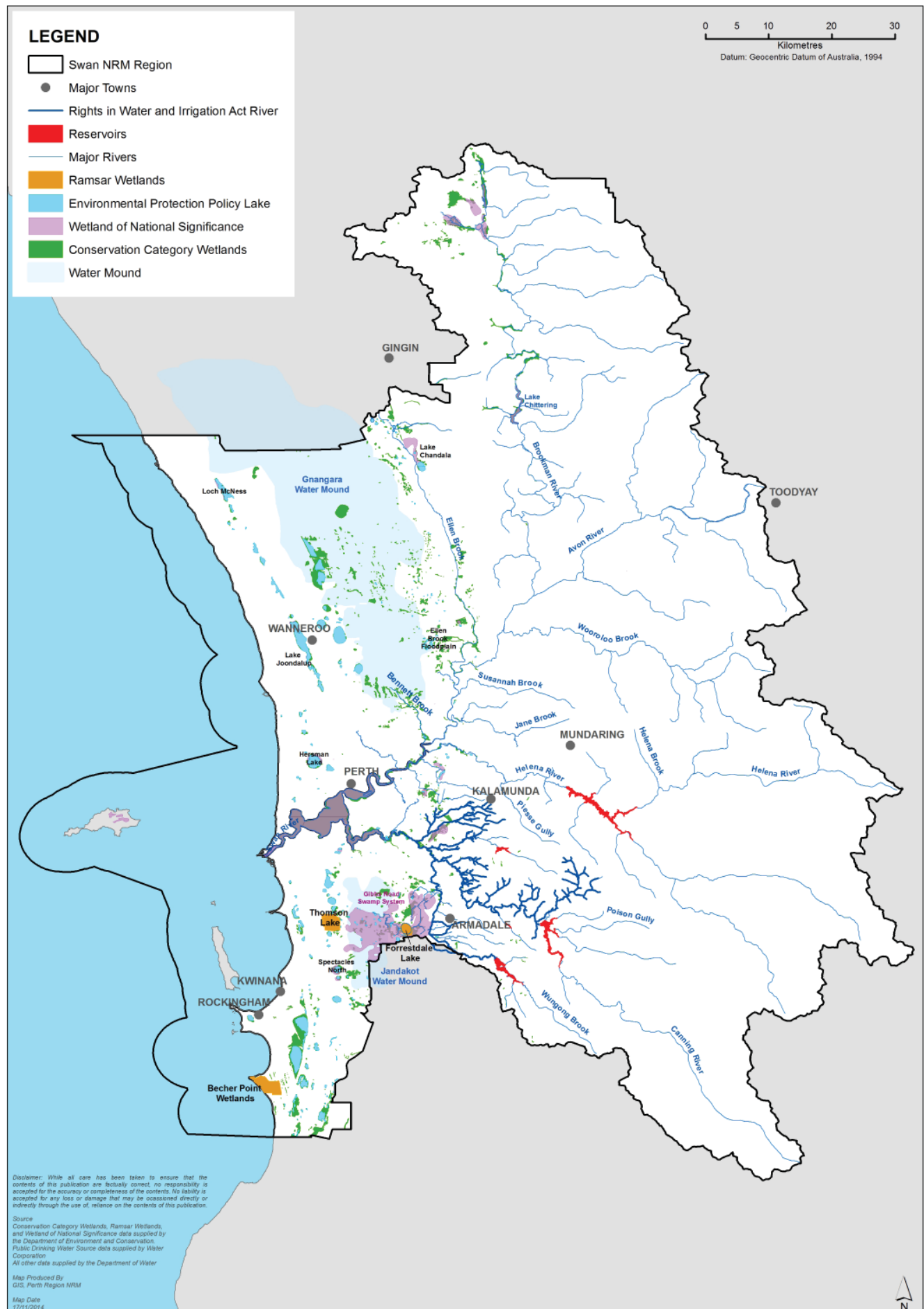
The Swan Canning river system consists of 31 sub-catchments which drain a catchment area of 2,090 square kilometres (Figure 6, Figure 7). The Swan River and the Avon River are part of the same river system, flowing 280 kilometres from Wickpin to the Indian Ocean at Fremantle. The Swan-Avon River drains a total catchment of approximately 126,000 square kilometres. Land use along the Swan and Canning Rivers is primarily urban development along the lower estuary and middle reaches, with the upper estuary and river zones also including cattle grazing, horticulture and light industry. The Swan Canning Estuary supports a rich diversity of plants and animals including seagrasses, bottlenose dolphins, sea horse colonies, sea stars, Perth Herring and Mulloway.

Rapid population growth and increased urban development in the Swan Canning catchment has contributed to a decline in the quality and quantity of water resources over time. The poor sandy soils of the Swan Coastal Plain increase the risk of nutrients from neighbouring urban and agricultural areas flowing into the Swan Canning system which have led to eutrophication, algal blooms and fish kills. A major toxic blue-green algal bloom occurred in 2000 after two unseasonably large rain events which resulted in the unprecedented closure of the whole estuary and its rivers to fishing and recreation for twelve days. Other key threats facing the rivers include erosion and sedimentation, climate change, changes to the quantity of water flowing through rivers and drains, loss or degradation of salt marshes and shoreline vegetation, non-nutrient contamination and acidification (Auditor General 2014).

The wetland systems of the Swan Coastal Plain extend across three NRM regions from Moore River in the north to Mandurah in the south. The Swan Region is home to three Ramsar wetlands: Becher Point, Forrestdale Lake and Thomsons Lake. According to the Directory of Important Wetlands in Australia, the Swan Coastal Plain Interim-Biogeographic Regions of Australia (IBRA) Region has the greatest number of nationally significant wetlands in Western Australia, with 29 sites recorded. Of those, 13 are found in the Swan Region such as Becher Point Wetlands, Booragoon Lake, Brixton Street Swamps, Ellen Brook Swamps System, Forrestdale Lake, and the Gibbs Road Swamp System. Wetlands of the Swan Coastal Plain have been heavily affected by urban and industrial development, with only 20% of the original wetlands remaining (Environmental Protection Authority 2004). Of the remainder, only 15% have retained high ecological values. Dewatering and soil excavation associated with residential development and groundwater abstraction have resulted in sulphide oxidation and acidification of wetlands. The increasing use of groundwater and the significant decline in rainfall has severely affected already vulnerable wetlands.

The Gnangara and Jandakot groundwater systems provide more than half of Perth's drinking water supply, and are also accessed by private users to irrigate gardens, crops, schools, parks and playing fields. The groundwater systems also support high value wetlands, cave systems and other water dependent ecosystems. The Ramsar listed Forrestdale and Thomsons Lakes are fed by the Jandakot groundwater mound and the Yanchep Caves unique stygofauna communities are reliant on water from the Gnangara mound. The Jandakot and Gnangara mounds also recharge the deeper semi-confined Leederville and Yarragadee aquifers. The abstraction of groundwater to support Perth's growing population, along with reduced rainfall as a result of climate change, is posing a significant threat to groundwater resources and their dependent ecosystems.

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### Figure 6: Surface and groundwater features in the Swan Region

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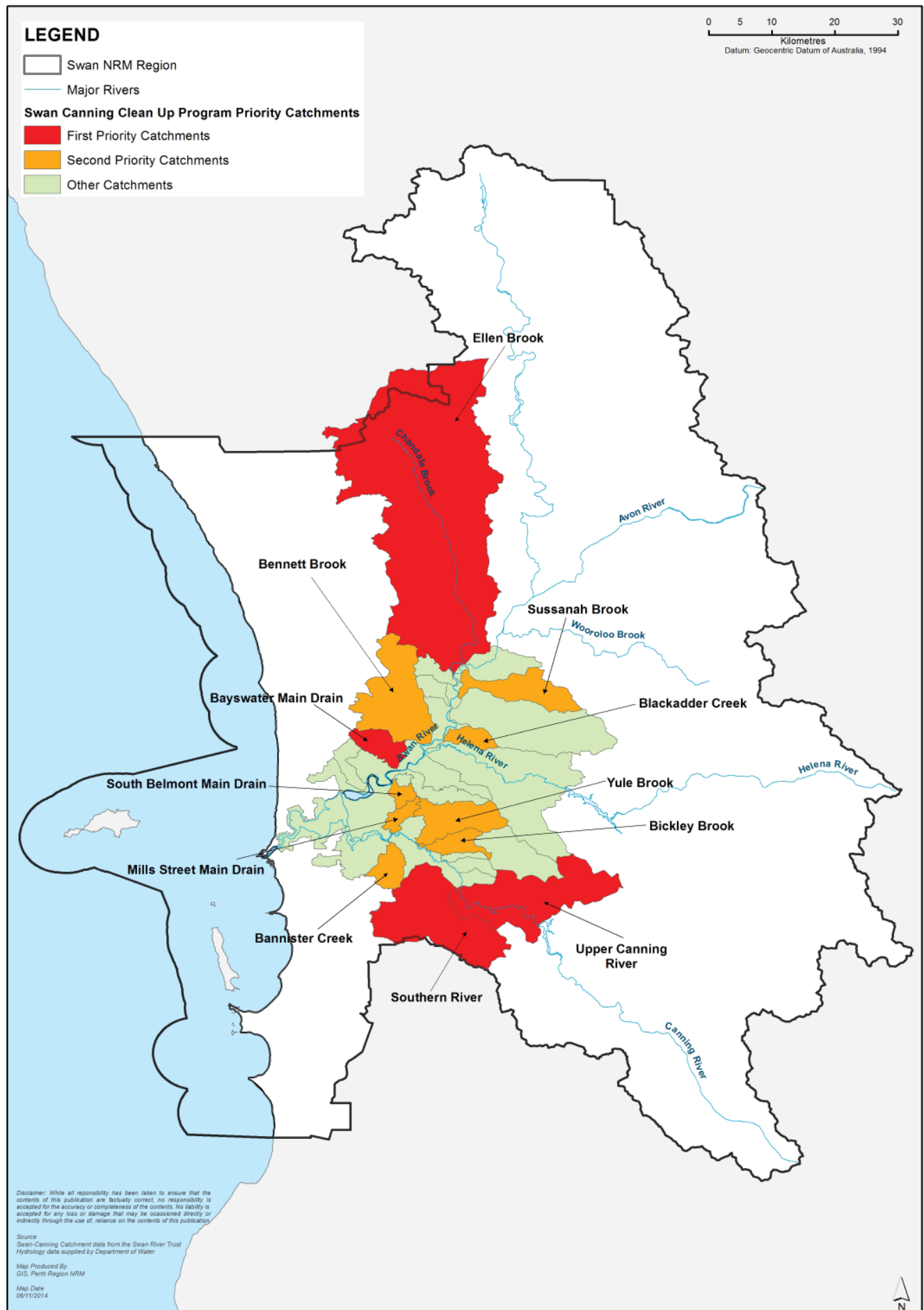


Figure 7: Swan-Canning clean up priority catchments

### 2.2.3 Biodiversity

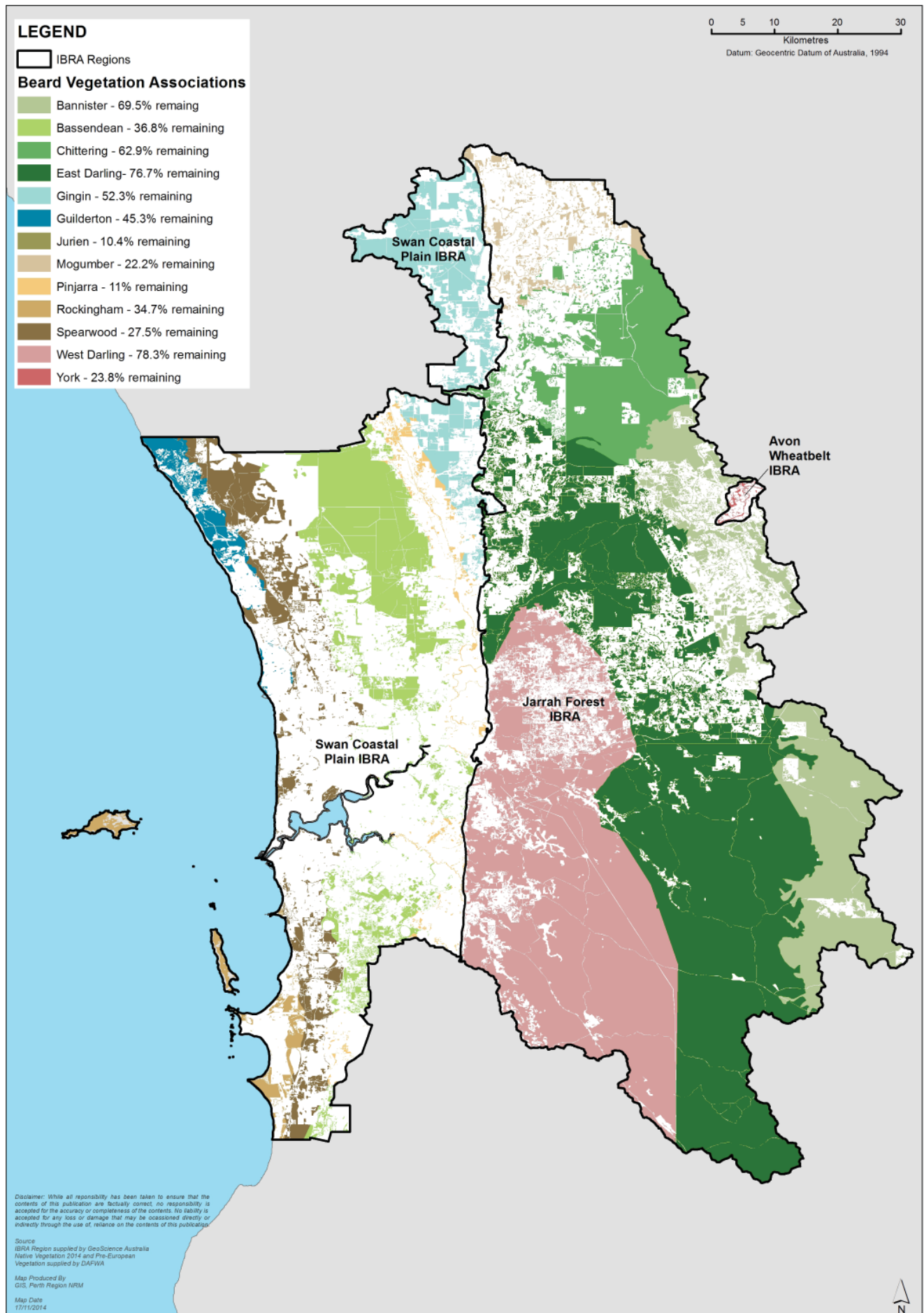
The Swan Region is part of an internationally recognised biodiversity hotspot, due to its high floral diversity and endemism (uniqueness) and the fact that less than 30% remains (Critical Ecosystem Partnership Fund 2014). The south west of Western Australia contains around half of Australia's known flowering plants, ferns and cycads, with 79% of the plants species unique to the area (Beard *et al.* 2000). Within the Swan Region, there are over 2,200 species of plants, with diversity concentrated on the Pinjarra Plain, the Foothills of the Darling Escarpment and the Bassendean Dune woodlands. The Region is also known for its diverse herpetofauna, including 16 frogs, 2 freshwater turtles, 51 lizards and 24 snakes (Hopper *et al.* 1996).

The Swan Region includes the Swan Coastal Plain Interim Biogeographic Regionalisation for Australia (IBRA) region and the Jarrah Forest IBRA region (Figure 8). Extensive clearing across the Swan Coastal Plain IBRA has resulted in this region having one of the highest densities of threatened flora, fauna and ecological communities of anywhere in Western Australia (Environmental Protection Authority 2007). Both the Jarrah Forest and Swan Coastal Plain IBRA regions are considered to be under a high level of biodiversity stress, with clearing, fragmentation, and infestations of *Phytophthora dieback* and exotic weeds the major threats (Department of Conservation and Land Management 2002).

The Bush Forever program was originally established in the year 2000 to meet the World Conservation Union's standard for protecting 10% of the original vegetation types on the Swan Coastal Plain. It identified 51,200 hectares of regionally significant bushland and their associated wetlands, covering 26 vegetation complexes. This area was grouped into 287 Bush Forever sites, ranging in size from 1 hectare to over 9,000 hectares and were comprehensively catalogued, mapped, and their natural values described. Currently, 72% of Bush Forever sites are reserved for Parks and Recreation, of which only 21% are protected with some form of conservation tenure (Office of the EPA 2015) (Figure 9). The target of protecting 10% of the vegetation complexes is no longer possible for five vegetation complexes (Guildford, Forrestfield, Serpentine River, Beermullah, Dardanup) which have already been cleared to below 10% (Office of the EPA 2015). Without adequate protection and management of Bush Forever sites, long term conservation outcomes will be limited.



# SWAN REGION STRATEGY FOR NRM



**Figure 8: Beard vegetation associations in the Swan Region and the proportion of vegetation remaining**

# SWAN REGION STRATEGY FOR NRM

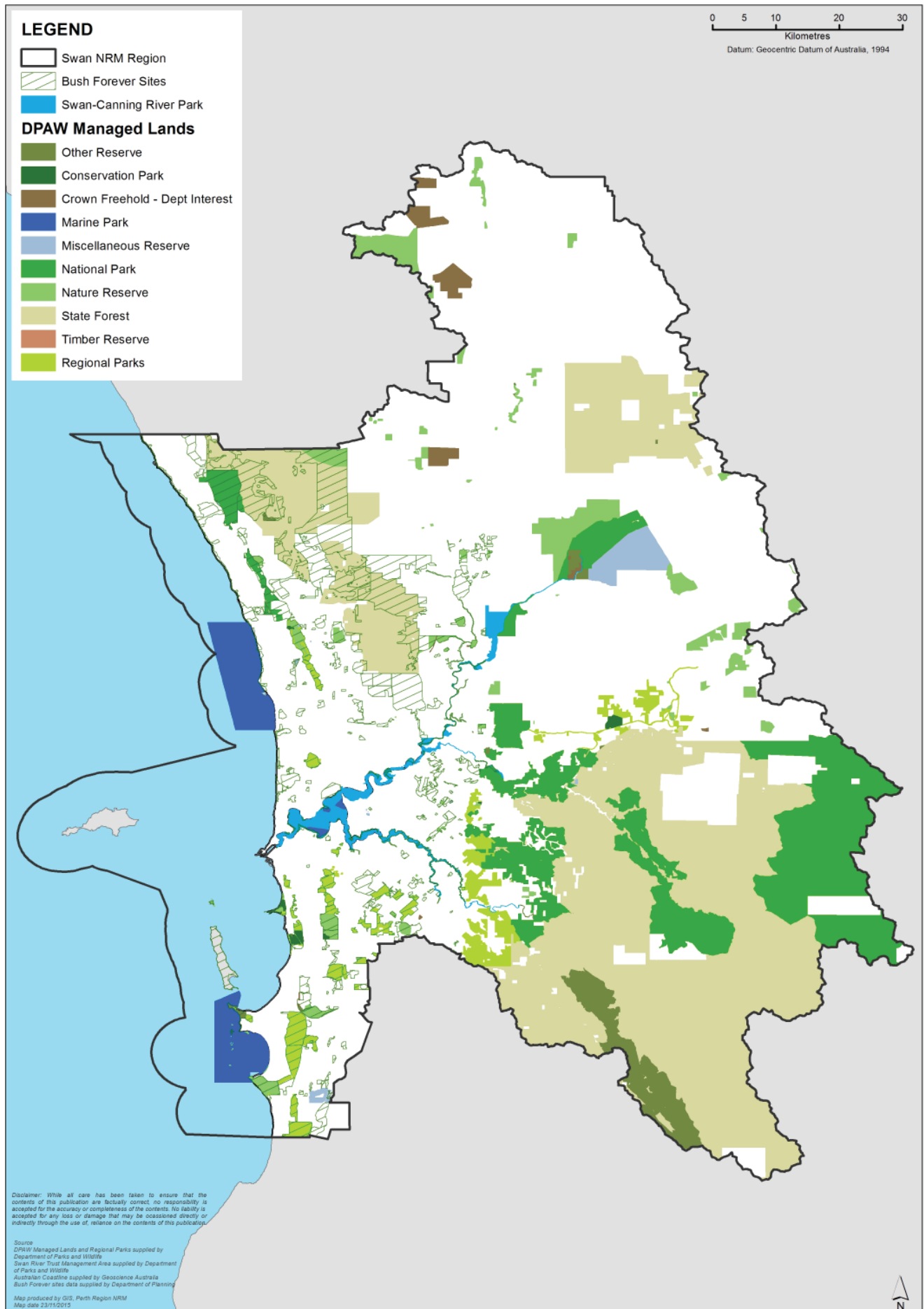


Figure 9: Conservation reserve network and bush forever sites in the Swan Region

### 2.2.4 Marine and Coastal Environment

The Region's marine and coastal area falls within two Integrated Marine and Coastal Regionalisation of Australia (IMCRA) bio-regions: Central West Coast (Perth to Kalbarri) and the Leeuwin-Naturaliste (Perth to Black Head). The coastal and marine zones and their protection status are presented in Figure 10.

Much of the marine biodiversity is unique to the Region, due to the mixing of southern temperate waters with the warm tropical water of the Leeuwin Current which flows from the north. The Region is home to extensive seagrass meadows that act as major nursery areas for fish species and the western rock lobster (Fletcher and Santoro 2014).

Key industries in the Region include mussel farming in southern Cockburn Sound and the commercial western rock lobster fishery, which is Australia's most valuable single-species wild capture fishery. In terms of recreational fishing, the south west coast is the most heavily used of any other region across Western Australia (Fletcher and Santoro 2014).

Key threats to the region's marine biodiversity are driven by water quality issues in the surrounding catchments and direct loss of habitat through coastal infrastructure and physical disturbance, e.g. dredging (Fletcher and Santoro 2014). The high rates of commercial trade occurring in the region's ports also increases the risk of introduced pests and diseases transported in ballast water, on ship hulls, or within a vessel's internal seawater pipes.

The Swan Region's coastline is characterised by long sandy beaches, with occasional rocky cliffs and headlands (Department of Planning 2008). Coastal dunes provide important habitat for coastal plant communities and fauna. Offshore islands such as Rottnest, Garden and Carnac provide vital breeding habitat for migratory birds and refuges for small mammals such as the Rottnest Island Quokka (*Setonix brachyurus*) and the Tammar Wallaby (*Macropus eugenii*).

A major threat to Perth's coastal environment has been the extensive clearing of vegetation to make way for a growing population and developing industries (Environmental Protection Authority 2007). Other threats include uncontrolled pedestrian access, littering and the introduction of exotic plants and animals (rabbits, foxes, cats). In addition, climate change is predicted to have a significant impact on coastal settlements, infrastructure and ecosystems through sea level rise and an increasing frequency and severity of storm surge (Department of the Environment 2014).

# SWAN REGION STRATEGY FOR NRM

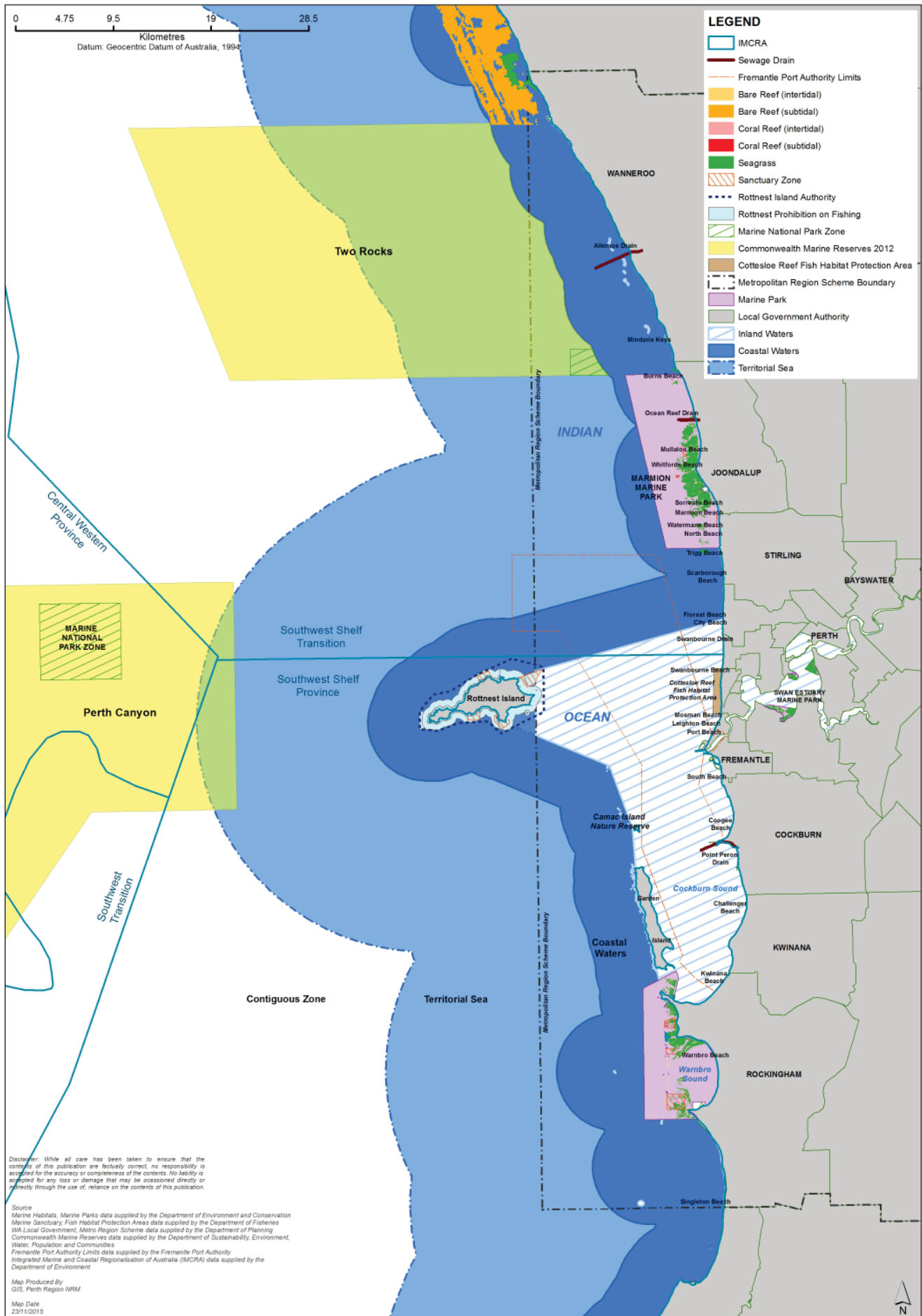


Figure 10: Coastal and marine areas in the Swan Region

### 2.2.5 Air

Air is essential to sustain life. Air quality refers to the condition of the air we breathe compared to measured acceptable guidelines such as the National Environmental Protection Measure (NEPM) Guidelines. Pollution of air occurs when a contaminant or polluting substance does not disperse. Such pollution can have negative consequences for human health and the environment.

Air pollution can arise from human activity and natural processes. Man-made sources include the combustion of fossil fuels and wood, emissions from motor vehicles, oil and gas refineries and industrial processes, and particulate matter associated with mining, land clearing and fire. Natural sources of pollutants include bushfires and wind erosion. Some pollutants can chemically react in the atmosphere to form secondary pollutants. For example, photochemical smog occurs when ozone, nitrogen oxides and volatile organic compounds react with sunlight at high temperatures (Environmental Protection Authority 2007).

Perth's air quality is measured according to the National Environment Protection (Ambient Air Quality) Measure (Air NEPM). Overall, Perth's air quality meets the minimum standards, with the levels of some pollutants being exceeded at certain times of the year (Environmental Protection Authority 2007). The most recent air quality monitoring report revealed that the levels of carbon monoxide, nitrogen dioxide and sulfur dioxide did not exceed the NEPM standards at any of the monitoring sites (Department of Environment Regulation 2014). The two key pollutants where standards were exceeded were ozone (a key component in photochemical smog) and particulates associated with smoke haze (Department of Environment Regulation 2014).

Two critical factors currently influencing Perth's air quality are population growth and climate change. With the growth of urban centres, there has been a rapid growth in vehicle numbers and vehicle kilometres travelled, which has resulted in an increase in vehicle emissions. The effects of global climate change on local air quality are significant. The potential impacts of drought include an increase in the frequency and severity of bushfires and dust storms, which result in higher levels of particles and dust in the air. Higher temperatures will enhance the production of photochemical smog, leading to an increase in ground level ozone.



### 2.3 Strategic issues and threats to natural assets

Since European settlement, the landscapes, seascapes and waterways of the Swan Region have undergone rapid transformations that have permanently altered the natural environment. Effective natural resource management requires a deep understanding of the risks, threats, issues and drivers of change that are having an influence on the natural environment.

The consultation process for the Strategy, and a scan of the literature, revealed the following strategic issues and threats for the Swan Region.

#### 2.3.1 Legacy of Loss

Historical policies over the last 180 years have supported or facilitated the unsustainable use or removal of natural resources, resulting in significant losses of natural and cultural heritage. Across the south west, it is estimated that only 40% of native vegetation present before European settlement still remains (Environmental Protection Authority 2007). The concentration of settlement on the Swan Coastal Plain has resulted in the loss of 65% of habitat (Department of Environment and Conservation 2009) and approximately 80% of wetlands have been either cleared, filled or developed (Environmental Protection Authority 2004).

The Region's past land management actions have resulted in the loss of species and communities, and created an ongoing risk of future losses. Many threatened species, such as the Western Swamp Tortoise, occur in remnant or fragmented landscapes where the work required to recover them is intensive, expensive and long-term.

The Swan and Canning river system has been permanently altered since European settlement. The creation of Fremantle harbour in the 1890s has meant that the lower reaches of the river system have become a permanently open estuary, leading to more saline conditions upstream. The construction of weirs and dams has altered the hydrology of the system, reducing flows and contributing to the degradation of ecological values in the river system and associated wetlands. Historical land uses along the waterways such as rubbish tips, wool scouring plants, fertiliser factories and foundries continue to threaten the river system today through residual contamination.

Often, the legacy of past land management means it is not possible to restore the natural environment back to its original state. Therefore, the focus is on building resilience in the system and preventing the further loss of key natural assets.

#### 2.3.2 Population growth

Perth is the fastest growing city in Australia and is predicted to overtake Brisbane as Australia's third largest city. The current population of the Swan Region is approximately 1.9 million, with an average growth rate of 1.6% per annum. However, the last decade has seen a massive leap in population growth, with the 2011-12 census revealing a 3.6% population growth, largely triggered by the massive growth in the Western Australian resources sector. The variability in population growth rates has made it difficult to reliably predict future population size and appropriately plan for its growth. In 2004, the Australian Bureau of Statistics predicted that Perth's population would reach 2 million by 2030. However, the Perth population is now on the cusp of that prediction fifteen years early. Based on the current level of growth, the Australian Bureau of Statistics estimates Perth's population will approach 5 million by 2055.

## SWAN REGION STRATEGY FOR NRM

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Population growth has not been consistent throughout the Swan Region, with some local areas increasing by more than 19% during 2012-2013 (Australian Bureau of Statistics 2014b). These areas are predominantly in the southern outer suburbs. Forestdale, Harrisdale and Piara Waters are experiencing the fastest population growth and cover a major recharge area for the Jandakot Mound, which, in turn, supports regionally significant Banksia woodlands and wetlands (Department of Environment and Conservation 2010). Population growth in this area poses a significant risk to this recharge area if not appropriately managed.

The projected increase in Perth's population from 1.9 million in 2014 to 5 million in 2055 poses a significant challenge for sustainable development. With a population increase of this magnitude, Perth has reached a critical time in population planning (The Committee for Perth 2012). As the Region's population and ecological footprint increases, current planning strategies need to acknowledge the finite capacity of natural resources to absorb these impacts. Innovative thinking is needed to ensure Perth's development is environmentally, economically and socially sustainable.

### 2.3.3 Land use change and development

Perth's urban planning system has been lagging behind international standards in terms of sustainability and resource use. Car dependent urban planning has led to high rates of vehicle use and an economy overly dependent on fossil fuels. According to the Australian Conservation Foundation's Sustainable Cities Index conducted in 2010, Perth is Australia's most unsustainable city, performing the worst in terms of ecological footprint (total amount of land required to support an average lifestyle), water and transport (641 private vehicles per 1000 people) (Australia Conservation Foundation 2010).

Since 1991, 17,000 hectares of land have been consumed for urban development in the Perth metropolitan area, largely in the form of low-density greenfield projects (Western Australia Planning Commission 2014a). Greenfield development is urban expansion into agricultural land, undeveloped estates or natural areas. For a city of Perth's size it has one of the lowest housing densities in the world, with an average of ten dwellings per urban zoned hectare. This is significantly lower than the target of 15 dwellings per hectare set in Perth's strategic growth plan, Directions 2031. The WA Planning Commission's 2014 Urban Growth Monitor also revealed that the proportion of infill development versus development on Perth's urban fringe dropped from 32% in 2011 to 28% in 2012 which is considerably lower than the 47% infill target set in Directions 2031.

Although infill and high density developments are a logical remedy to combat urban sprawl, these strategies can pose a number of risks to natural assets if not appropriately managed. For example, high density urban, commercial or industrial development often leads to a significant increase in the area of impervious surfaces, which can result in more stormwater runoff and a greater risk of pollution (Swan River Trust 2012). Infill can also mean the removal of vegetation and particularly mature trees, which provide important urban refuges for biodiversity and assist in cooling the built environment.

The Region's 1.9 million people seek a high quality of life, with clean air and water and access to open space and attractive landscapes. The rapid expansion of Perth and the increasing demands on the Region's natural assets pose a significant challenge for sustainable development. Environmentally responsible urban planning will be vital to ensure Perth remains both liveable and sustainable.

### 2.3.4 Invasive plants animals and diseases

Biosecurity threats from plant and animal pests and diseases have had a significant impact on the Swan Region's environment, agriculture and social amenity. The increasing frequency and volume of people and goods entering our Region has increased the risk of introduced pests and diseases invading and becoming established. And once established invasive pests and diseases can be very difficult and costly to eradicate or control.

In Western Australia there are 169 plants and animals that have been declared as pests under the *Biosecurity and Agriculture Management Act 2007*. Feral animals such as foxes, cats, rabbits, pigs and non-native birds such as lorikeets and corellas, pose a serious threat to biodiversity and agricultural production in the region. Pests and feral species can impact natural systems by out-competing and preying on native species. For example, rabbits overgraze areas, reducing food sources for other native fauna and impacting on the functionality of ecosystems. Feral cats and foxes are a significant source of predation, and are thought to be a major contributor to the decline of small native mammals. Feral honeybees are also a major problem, competing with native pollinators for resources and with native hollow-dependent fauna, particularly black cockatoos, through competition for suitable hollows.

Weeds enter natural areas through a number of vectors including wind, water, animals, vehicles and footwear, and are more likely to become established in physically disturbed environments. Once established, weeds can out-compete native plants and reduce the availability of habitats, shelter and food sources for native fauna. As weeds are widespread and well established in the Region, it is not possible to fund the eradication and control of every species. This has meant that invasive species management has either focussed on the eradication, containment or control of high priority weed species, or limited weed control activities to the protection of high value assets. The result is that widespread weeds that are considered a low priority are left largely uncontrolled outside priority areas.

The threat of plant and animal diseases to agricultural production and human health as well as its impact on biodiversity is a significant issue for the management of natural resources in the Region. Phytophthora dieback is a plant disease that poses the most serious threat to the Region's biodiversity. This pathogen has the capacity to substantially change the structure and composition of most of the Region's plant communities which are highly susceptible to the disease, and has the potential to drive susceptible plant species and their dependant fauna to extinction.

The state government takes the lead role in the initial prevention and eradication of new exotic pests and diseases but the responsibility for managing widely established pests and disease rests with the relevant landholders, land managers, industry and the community. This poses a significant challenge for the Region in terms of the funding and coordination of ongoing pest and disease management programs across multiple land tenures.



### 2.3.5 Climate change

Long-term climate variability is affecting the south-west of Western Australia, which is experiencing a trend of increasing temperatures and declining rainfall. The number of days hotter than 40°C has been increasing since the 1990s, and late autumn and winter rainfall has been decreasing (CSIRO and BoM 2012). Rainfall in the south-west of Western Australia has already fallen by 18% since 1970, causing a reduction in mean river flows of 75-80% into dams and a lowering of regional groundwater levels (Water Corporation 2014). This trend is expected to continue over the next 50 years.

Climate change and the effects of a warming and drying climate are likely to:

- Alter hydrological regimes, particularly decreasing water tables and stream flow;
- Increase the risk of both coastal erosion and inundation due to sea level rise;
- Increase the number and severity of weather events such as storms and droughts;
- Increase the incidence and intensity of bushfires; and
- Change the composition of critical habitats, resulting in local extinctions and species migration (generally from north to south).

Climate change entails a wide variety of threats to ecosystems, often exacerbating existing environmental problems. Direct and indirect threats include extended droughts, more prevalent invasive weeds and pests, altered fire regimes, direct temperature effects and changes in water availability. Due to the high levels of biodiversity and endemism in the south-west of Western Australia these areas are expected to be the most severely affected (Productivity Commission 2012).

Decreasing water tables and stream flow is likely to affect the maintenance of critical habitat (such as wetlands) for many plant and animal species of conservation value. It is also likely that climate change will result in the transformation of some farming systems, with others potentially becoming unviable. Whilst there is limited knowledge about the resilience of natural systems to anticipated climate changes, protecting and actively managing natural assets can help to decrease their vulnerability to climate change.

### 2.3.6 Limited knowledge and awareness

Knowledge is a key pillar of natural resource management. Access to good information and knowledge is vital for making sound natural resource management decisions. However, this knowledge is not always available or complete, limiting the ability of natural resource managers to answer major questions about natural systems. For example, the Productivity Commission identified that the provision of research, information and monitoring is a major determinant of effective climate change adaptation (Productivity Commission 2012).

Natural systems are inherently complex, where the inter-relationships among their component parts are non-linear, and largely unpredictable. Such non-linear effects are already being observed as the planet warms under a changing climate. Systems thinking is being increasingly used in natural resource management to build a more holistic understanding of natural systems. It can facilitate the sharing and integration of disparate sources and forms of knowledge (not just technical and scientific), and create a framework for making sense of this knowledge. Although systems thinking offers great promise for natural resource management, it is inherently reliant on the availability of the research and information that underpins it. Without adequate and appropriate information on which to base systems models, unexpected adverse outcomes can occur.

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Another key knowledge gap is the community's level of awareness and understanding of the role of the natural environment in our wellbeing and quality of life. Urbanisation has led to a disconnect from the natural environment, thereby removing environmental issues from the agenda and from our community's hearts and minds. Social researchers have revealed evidence of an "extinction-of-experience" process in cities, whereby people judge biodiversity and aesthetics according to what they have previously experienced, rather than what may be natural, healthy, and/or desirable in a given environment (Schwartz *et al.* 2013). This suggests that as the landscape is further modified over time, people's expectations and aspirations for the natural environment will be lowered accordingly unless they have opportunities to interact with and experience the rich natural heritage of their region.

## 3. The Strategy

### 3.1 The Strategic Framework

The Vision, Aspirational Goals and Action Areas form the Strategic Framework of the Strategy. The Vision describes the ultimate goal for natural resource management in the Swan Region. The eight Aspirational Goals describe what success looks like and the four Action Areas define what needs to happen. The Strategic Framework is focused on the achievement of outcomes for the environment and the broader community.

Vision	
The natural resources of the Swan Region are protected and managed sustainably in their own right and for the enhancement of the quality of life for present and future generations.	
Aspirational Goals	
Perth is an eco-city where natural assets are valued and used sustainably	Water quality (marine and freshwater) is maintained and water resources are used sustainably
Land use and development is sustainable and appropriate to land capability and suitability	Biodiversity and ecosystem function is protected, managed and restored
Residents and visitors value and enjoy access to high quality natural areas	Air is healthy for the community and the environment
Aboriginal cultural heritage values are integral to the way we view and manage the environment	Climate change is addressed to ensure the Swan Region remains liveable and resilient
Action Areas and Strategic Objectives	
<b>1 Leadership, Coordination and Governance</b> <ul style="list-style-type: none"> <li>1.1 Work towards agreed priorities and outcomes</li> <li>1.2 Work collaboratively</li> <li>1.3 Apply environmental accounting approaches</li> <li>1.4 Invest in natural assets</li> <li>1.5 Ensure policies, legislation and standards are effective</li> <li>1.6 Reflect Aboriginal cultural heritage values in policy and practice</li> <li>1.7 Ensure land use planning is environmentally sensitive</li> </ul>	<b>3 Awareness, Participation and Capacity Building</b> <ul style="list-style-type: none"> <li>3.1 Build community awareness and participation</li> <li>3.2 Support environmental community groups</li> <li>3.3 Involve the Aboriginal community</li> <li>3.4 Build the capacity of local government</li> <li>3.5 Enhance the environmental sustainability of businesses and organisations</li> <li>3.6 Support environmental stewardship</li> <li>3.7 Recognise and celebrate achievements</li> </ul>
<b>2 Asset Protection and Sustainable Use</b> <ul style="list-style-type: none"> <li>2.1 Manage assets within a landscape system</li> <li>2.2 Address drivers, risks and threats</li> <li>2.3 Enforce regulations and approval conditions</li> <li>2.4 Support voluntary environmental standards</li> <li>2.5 Transform Perth into an eco-city</li> </ul>	<b>4 Knowledge, Research and Adaptive Management</b> <ul style="list-style-type: none"> <li>4.1 Focus research, development and innovation on critical needs and knowledge gaps</li> <li>4.2 Ensure essential knowledge is accessible to decision-makers</li> <li>4.3 Integrate scientific and traditional ecological knowledge</li> <li>4.4 Monitor and report on resource condition</li> <li>4.5 Monitor and evaluate environmental programs</li> </ul>
Implementation	
Implementation Plan	Monitoring, Evaluation, Reporting and Improvement Plan

### 3.2 The Action Areas

Each of the four Action Areas provides a focal point for organisations to align their skills, knowledge and expertise and form new partnerships. The Strategic Objectives defined under each Action Area describe what is needed to achieve effective natural resource management.

#### 3.2.1 Leadership, Coordination and Governance

##### 1. Leadership, coordination and governance

- 1.1 Key stakeholders are working towards **agreed environmental priorities** and **outcomes** for the Region
- 1.2 Key stakeholders are **working collaboratively** to protect and manage the natural assets of the Swan Region
- 1.3 The protection and management of natural assets is **accounted for in** everyday financial decisions
- 1.4 The protection and management of the Region's natural assets is **adequately resourced**
- 1.5 **Legislation, policies and standards** enable the effective protection and management of natural resources
- 1.6 Aboriginal **cultural heritage values** are integrated into policy, plans, legislation and management practices
- 1.7 Natural resource management is integrated into **land use planning**

##### Overview

Leadership, coordination and governance are fundamental to effective natural resource management. Sustainability of the environment, economy and our society are dependent upon our ability to manage competing priorities and take a holistic and integrated approach to managing our natural resources. To achieve this holistic approach, a high level of coordination and collaboration is needed, guided by leadership at all levels of government, community and industry. By working together to develop shared future directions and priorities for natural resource management in the Region, resources can be leveraged, maximising returns for the environment and the community.

Leadership already exists in the government, business and industry, and community sectors. There is an opportunity to bring key leaders together to build a collective vision for integrated natural resource management and the actions needed to deliver on that vision. In a time of rapid growth and development and changing climate, transformational leadership is needed to advocate for change and a new way forward that is sustainable and environmentally responsible. The successful implementation of this Strategy requires partnerships between government, community, business and industry, and recognition that we all have a part to play in achieving the long term vision.

# SWAN REGION STRATEGY FOR NRM

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## 1.1 Agreed priorities and outcomes

### *The issues*

Natural resource management at the regional scale requires a coordinated and holistic approach to ensure critical threats are addressed and key stakeholders work towards common goals. There are many agencies and organisations responsible for managing natural assets in the Swan Region, with each having their own priority setting processes and strategic goals. Some organisations apply risk-based approaches, while others apply asset-based management frameworks or systems. Although the Strategy does not seek to replace what currently exists, there is a need to develop an overarching framework and methodology for the Region that can align national, state, regional and local priorities and establish a collective set of priorities to focus collaboration and investment.

### *The response*

In order to achieve environmental outcomes, it is important to coordinate action and align programs with strategic priorities. The Strategy does this by articulating the Region's long term vision and strategic objectives, and providing a framework for collaborative action. This will be operationalised through the Strategy's Implementation Plan which will identify high value assets and environmental priorities based on the best available knowledge and analytical tools. Key stakeholders will continue to be engaged in the implementation of the Strategy through the Swan NRM Committee. The key function of the committee is to seek alignment of policies, programs and actions and ensure environmental priorities are reflected in everyday decisions in the Region.

## 1.2 Collaboration coordination and governance

### *The issues*

Natural resource management activities at both the regional and state wide level are not well coordinated. The large number of stakeholders and natural resource management organisations and groups within the Swan Region makes it a complex jurisdictional environment. Regional NRM groups were established by the Commonwealth Government between 2002 and 2004 to coordinate the regional implementation of State and Commonwealth policies and programs under the National Heritage Trust. This was supported by a Bilateral Agreement between the State and Commonwealth Government which committed both levels of government to the regional approach. However, since the discontinuation of the Bilateral Agreement in 2008, this central point of coordination and governance between both levels of government has weakened.

The coordinated management of natural assets across multiple tenures and jurisdictions is inherently complex. In the case of the Swan Canning Riverpark, there are 15 agencies and 21 local governments with a statutory requirement to manage specific aspects of the Riverpark. Despite a strong legislative framework and oversight by the Swan River Trust, coordinated management of the Riverpark has been problematic (Auditor General 2014). In order to effectively manage natural assets at the landscape scale, it is vital that all parties commit to coordination, collaboration and the achievement of common goals.

## SWAN REGION STRATEGY FOR NRM

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### *The response*

Strategic partnerships are needed to achieve effective natural resource management, particularly where the scale of intervention requires cross-tenure or multi-disciplinary action. Networks and strategic alliances are most successful when the sum is greater than the parts.

The Strategy proposes that the Swan NRM Committee be the central body responsible for coordinating the implementation of the Strategy. Implementation will be achieved through the Strategy's Implementation Plan and the Monitoring, Evaluation, Reporting and Improvement (MERI) Plan. The focus of the Implementation Plan will be strategic projects and activities that will deliver natural resource management outcomes in a collaborative and coordinated way across the Region.

Both the Committee members and NRM will actively seek opportunities to establish working groups or other engagement opportunities to build collaboration and partnerships for addressing key issues or priorities for the Region.

### **1.3 Environmental accounting**

#### *The issues*

The link between future prosperity and the functioning of natural systems is not evident in everyday economic decisions (Wentworth Group of Concerned Scientists 2008). Decision-making processes in business and industry continue to rely on traditional financial analysis which does not ascribe monetary value to assets that are external to the project. For example, the costs of polluted waterways or the effects of atmospheric pollution on communities, agriculture and ecosystems are often not taken into account when making economic decisions (Hardisty *et al.* 2013). The focus on short-term financial gain has historically resulted in the overexploitation of many natural assets (Smith *et al.* 2013).

#### *The response*

Environmental accounting can allow for ecosystem goods and services to be quantified in monetary terms as part of a comprehensive cost-benefit analysis. Such approaches can ensure the true costs of environmental degradation to our society and economy are measured and enable ecosystem services such as clean air and cooler microclimates provided by natural vegetation to be quantified. Monetising impacts on environmental assets and including them in the economic analysis, on a full life-cycle basis, can ensure decision-makers not only optimise for profit, but overall human welfare and a multitude of other competing environmental and social issues (Hardisty 2010).

The Water Corporation has been applying Advanced Cost-Benefit Analysis supported by a database of monetised environmental and social values to develop more sustainable water solutions; an approach which is currently being introduced to other Australian water utilities (Hardisty *et al.* 2013). Local government authorities in the Region are also exploring the feasibility of managing mature trees as an infrastructure asset, where the value of that asset is based on the economic and ecological services delivered to the community. This is already occurring in Melbourne where councils use tree valuation programs to place values on street trees, where the removal of trees valued over \$5000 is prohibited (Brown *et al.* 2013). The value of trees and vegetation to the community can also be expressed in the form of property values, with a recent study in Perth showing that a broad-leaved tree on the street verge increases the median property price by more than \$16,000 (Pandit *et al.* 2013).

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An environmental accounting approach could inform the development of incentives and market-based mechanisms to support biodiversity conservation and the delivery of ecosystem services by private landholders. Many Western Countries have developed specific programs that compensate agricultural producers for the production of ecosystem goods and services (other than the production of agricultural commodities) (Gagnon 2005). For example, the 'Upstream Thinking Initiative' in the United Kingdom pays farmers through their capital works programme to make improvements to farm infrastructure to reduce diffuse pollution into the waterways and improve raw water quality (Smith *et al.* 2013).

Although clearly not limited to the regional scale, there is an opportunity for the Strategy to lead some thinking in environmental accounting, particularly to support decision making that affects natural resources.

### 1.4 Investment in natural resource management

#### *The issues*

Funding for natural resource management activities by the State and Commonwealth Governments in Western Australia has been declining over the last thirteen years. The State Government's direct contribution to natural resource management funding through the State NRM Office has dropped from \$40 million dollars per annum in 2002-2009, to \$8 million in 2015. The level of investment in natural resource management is a major limiting factor for the successful protection and management of natural assets. For example, the WA Local Government Association has estimated that the \$72 million currently allocated to the management of the Swan and Canning Riverpark and delivery of the River Protection Strategy each year, is less than half of the \$186 million needed to effectively undertake this work (Auditor General 2014).

The 2004 Strategy was supported by an investment plan which committed funds from both the State and Commonwealth governments to deliver on the natural resource management priorities for the region. With the conclusion of NAP/NHT in 2008, this guaranteed funding ceased and was largely replaced with competitive grants focussed on the delivery of discrete projects rather than supporting regional capacity, collaboration and coordination. This has limited the extent to which regional leadership and coordination has been able to occur and reduced the investment in regional priorities.

#### *The response*

Greater investment in natural resource management is needed to effectively protect and manage our natural assets. A more collaborative funding model can encourage and incentivise lasting, productive partnerships between community groups, local government, state agencies, researchers and industry. There is a need to advocate for greater investment in large scale, long-term collaborative projects that can break down traditional silos and support a broader systems thinking approach to natural resource management. By investing in partnerships and capacity as well as projects, there is a clear recognition that effective environmental management requires more than just the delivery of discrete projects.

The Strategy and Implementation Plan provide a central reference point to coordinate investment and delivery. A key focus of the Implementation Plan will be to explore alternative funding models and approaches for increasing funding for natural resource management activities, and to use environmental accounting approaches can build the business case for investment in natural assets.

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Economic valuation of ecosystem goods and services provides a framework for the voluntary, public and private sectors to work together and can be a powerful mechanism for attracting investment. Direct investment can be partnered with market-based mechanisms that enable environmental values to be reflected in decision-making through incentives and price signals. This can increase the participation of the private sector in environmental management and reduce the need for formal regulation, which can be more cost effective. For example, the Victorian Government's BushBroker program, increases private sector participation by connecting landowners with high value native vegetation with developers who require a matching third party offset site. There is an opportunity to explore the application of market-based approaches to address intractable environmental problems in the Swan Region.

### 1.5 Legislation, policies and standards

#### *The issues*

Western Australia does not have a unified single piece of legislation covering natural resource management. Instead it has a complex and fragmented set of acts. Many of the acts are more than 60 years old (*Rights in Water and Irrigation Act 1914*, *Soil and Land Conservation Act 1945*, *Wildlife Conservation Act 1950*) and reflect natural resource management theory and practice from the last century. Much of the legislation reflects an asset-based approach and does not account for the maintenance of ecological processes that are vital for healthy and functional environments.

Contemporary views are that decision making should be occurring at scales appropriate for the management of ecological processes (often landscape scale) while still protecting specific assets, such as threatened species. A whole of system approach enables natural resource managers to tackle multiple threats and address the cause as well as the symptoms. Existing legislation does not adequately deal with cumulative and long term impacts or complex interactions between impacts. Without a structured framework of environmental legislation, governance and institutional arrangements can be complicated and uncoordinated. This can lead to discrepancies and confusion in accountability and responsibility, a lack of clarity for the judiciary, duplication of legislation and process within institutions, ineffective and bureaucratic processes, unnecessary expenditure and costly delays (Eber 2013).

Along with the need for unified legislation is the need for stronger natural resource management policy coordination at the state level. Unlike other states in Australia, Western Australia's regional NRM groups are non-statutory and regional NRM strategies are not supported by legislation. This places a greater reliance on the state NRM framework to ensure regional and state delivery is aligned. The State NRM Plan currently in development will be important for providing the overarching principles and policy guidance for natural resource management at both the state and regional level.

#### *The response*

Standards represent community values and expectations which can be expressed through legislation, policy, incentive schemes, investment guidelines and codes of conduct. Government has the responsibility to ensure that legislation and policy remains contemporary, effective, and efficient and the best way of achieving the desired outcomes.

This Strategy advocates for regular review and update of the natural resource management legislation, policies and standards in Western Australia, particularly those acts that no longer reflect contemporary natural resource management theory and practice. Legislative review should examine the relevance of legislation; assess whether it addresses stakeholder needs, and how it is applied in practice. This includes whether the current regulations are in fact minimising the threats to natural resource assets.



## SWAN REGION STRATEGY FOR NRM

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Legislative review is already underway for the *Wildlife Conservation Act 1950* with the development of a Biodiversity Conservation Act. The Department of Water is leading the development of a new Water Resources Management Bill that is intended to provide flexible, progressive and modern water legislation for Western Australia. This will consolidate the six existing Acts into one modernised Water Resources Management Act.

Natural resource management can be made more effective and efficient through integrated and holistic policy and legislation. There may be an opportunity to unify existing legislation through a single natural resource management act and establish an integrated environmental regulatory system based on the principles of good governance and ecologically sustainable development. This could be partnered with a unified natural resource management policy framework that can ensure Commonwealth and State investment is focussed on common goals through an effective regional delivery model.

### 1.6 Aboriginal cultural heritage values

#### *The issues*

Non-Aboriginal values form the basis of our laws, policies and approaches to natural resource management. Despite 40,000 years of connection to Country, there is limited recognition of the high standard of custodianship that maintained the natural assets of our Region prior to European settlement. The values and cultural practices that have moulded and shaped our environment are often not recognised and reflected in our approaches to natural resource management.

Increasingly traditional knowledge and management approaches are being integrated with contemporary natural resource management, particularly in relation to fire management in the northern parts of Australia. However, within the Swan Region, the connection between Noongar cultural values and natural resource management is less apparent.

#### *The response*

This Strategy advocates for Aboriginal cultural values and practices to once again play a central role in how the Region's natural assets are managed. A key step towards this will be to incorporate Aboriginal cultural heritage values and traditional ecological knowledge into natural resource management policy, plans, legislation and practices and ensuring that cultural authority is obtained when work on sites of significance is proposed.

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### 1.7 Land use planning

#### *The issues*

Western Australia differs from other states in Australia in that the State government retains a high degree of control over planning, regional NRM groups have no statutory standing and environmental and planning legislation are separate (Western Australian Planning Commission 2011). The separation between land use planning and natural resource management presents a number of challenges for incorporating environmental issues into planning decisions. Key barriers to integration identified in the WAPC's EnviroPlanning project were:

- Natural resource management is just one of many elements that land use planning must consider when seeking sustainable development outcomes;
- The primary focus of the planning system is to coordinate land use and development;
- Land use planning involves a complex and tiered approval process;
- Long time frames are involved with amending the planning framework; and
- There is a reliance on the change of land use to trigger new requirements.

Successful integration relies on a high level of coordination across planning and environmental agencies, with clear roles and responsibilities. The absence of a State NRM plan and strong institutional arrangements for natural resource management at the state and regional level have limited the opportunities to ensure environmental considerations are addressed at a strategic level.

Strategic assessments, such as the one currently being conducted in the Perth and Peel region, offer great promise in terms of delivering an effective long term and strategic response to critical environmental issues. However, the challenge will be to ensure that environmental considerations identified in the strategic assessment are reflected in later stages of planning and that policies are put in place to support this.

#### *The response*

Land use planning is about balancing the built and natural environment, community needs, cultural significance and economic sustainability in an effort to improve our way of life (Western Australian Planning Commission 2011). Good planning is needed to reconcile the needs of the community with the needs of the environment. This includes balancing the community expectations around issues such as bushfire mitigation, mosquito control and visual amenity, with sound environmental planning principles.

In Western Australia, the land use planning system is integral to achieving effective natural resource management outcomes. Land use planning can protect natural assets from incompatible land uses, locate development away from sensitive environments, and require the sustainable use and management of natural resources (Western Australian Planning Commission 2011). The integration of natural resource management into land use planning requires coordination throughout the planning system and a commitment to retaining key natural assets across the development matrix.

The Perth and Peel Strategic Assessment and Subregional Structure Planning seeks to establish a Green Network and ensure natural areas with high biodiversity conservation values are protected and managed. This represents a significant shift towards integration of environmental issues into land use planning and presents an opportunity to address many of the issues identified in the EnviroPlanning project. The challenge will be to ensure they are implemented throughout the different levels of the planning process to ensure environmental considerations are addressed appropriately and in a coordinated fashion.

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WALGA's Perth Biodiversity Project (PBP) and the Perth Biodiversity Framework for Local Biodiversity Conservation has supported the development of Local Biodiversity Strategies by Councils, which can then be incorporated into Local Planning Strategies and reflected in Town Planning Schemes. Although these initiatives have been vital for supporting environmental management at the local level, the Australian and State Governments have discontinued their funding and WALGA are no longer able to deliver this service. Such programs are needed to support local government integration of NRM into local planning strategies, schemes, policies and local structure plans.

# SWAN REGION STRATEGY FOR NRM

## Leadership, Coordination and Governance - Vision of Success

### 1.1 Key stakeholders are working towards agreed environmental priorities and outcomes for the Region

- There is a consistent framework for identifying high value assets and environmental priorities in the Region
- The best available knowledge and analytical tools are used to identify priorities, design programs and make decisions
- Return for natural resource investment is maximised through evidence-based priority setting
- The means of minimising impacts and sustainably managing natural resources are considered in the everyday decisions of government, industry, landholders and the community

### 1.2 Key stakeholders are working collaboratively to protect and manage the natural assets of the Swan Region

- The implementation, review and update of the Strategy is overseen by a steering committee with broad stakeholder representation from across the Swan Region
- The Strategy is supported by an Implementation and Monitoring, Evaluation, Reporting and Improvement Plan (MERI)
- Collaboration and partnerships are supported through regular joint planning events, workshops and communication
- Key assets or threats are managed in a collaborative and coordinated way across the Region

### 1.3 The protection and management of natural assets is accounted for in everyday economic decisions

- There is a system for environmental accounting applied across the Region
- The realistic ongoing cost of managing natural assets is known and applied to decision making
- Ecosystem services are quantified and accounted for in the land use planning system
- Market-based mechanisms are used to support the economic viability of farmers and other private landholders who protect and sustainably manage natural assets on their property

### 1.4 The protection and management of the Region's natural assets is adequately resourced

- The level of investment matches the cost of protecting and maintaining the ecological function of priority natural assets in the Region now and into the future
- The public, private and not for profit sectors are investing in and actively addressing regional NRM priorities
- Agencies and local government are appropriately resourced to monitor and enforce compliance with NRM regulations

### 1.5 Legislation, policies and standards enable the effective protection and management of natural resources

- Policy and legislation is contemporary, holistic and integrated
- Policy and legislation is efficient and based on best practice principles for regulation
- Policy and legislation is regularly reviewed and updated
- Threats to natural resource assets are minimised through appropriate regulation
- There is a consistent set of standards for effective natural resource management

### 1.6 Aboriginal cultural heritage values are integrated into policy, plans, legislation and management practices

- Aboriginal spiritual and cultural practices and values are an integral part of natural resource management activities, policies, plans and legislation
- The need for cultural authority to undertake natural resource management is identified and acted upon through appropriate engagement and consultation

### 1.7 NRM is integrated into land use planning

- NRM is integrated into strategic (eg regional and local planning strategies) and statutory planning (eg regional and local planning schemes and amendments)
- There are clear roles and responsibilities for organisations involved in land-use planning and decision-making that relates to natural assets
- The extent and possible cumulative impacts of planning proposals on natural resources is considered
- The State Planning Framework provides clear and up to date policy guidance for natural resource management issues
- Every local government has a sound environmental strategy incorporated into all planning matters as a priority

## 3.2.2 Asset protection and sustainable use

### 2. Asset protection and sustainable use

- 2.1 Priority natural and cultural heritage assets are protected, managed and restored within a landscape system
- 2.2 Current and emerging drivers, risks and threats are identified and managed
- 2.3 Compliance with regulations and approvals is monitored and enforced
- 2.4 Businesses and organisations are actively managing their environmental impact
- 2.5 Perth is an eco-city where natural resources are used and managed sustainably

### Overview

The Swan Region has a wealth of natural assets that make up our unique identity and sense of place and provide us with the resources we need to live and prosper. Natural assets can be managed for their intrinsic value, their value to society and their contribution to the economy. Whether natural assets are protected within the conservation reserve or used sustainably for farming, forestry or fisheries, natural assets require active management and stewardship. Asset protection and sustainable use is about ensuring our current management practices do not jeopardise the ability of future generations to enjoy and benefit from the Region's natural assets.

### 2.1 Asset protection and management

#### *The issues*

Healthy and diverse ecosystems, established over long periods of time, are often removed without any consideration for both the intrinsic values and ecosystem services they provide. In a highly constructed landscape like Perth, there can be a misconception that natural systems can be replaced, replicated or offset using engineering or technological solutions. For simple systems it may be possible, but the natural ecosystems occurring across the Swan Region have evolved over millions of years; their removal or modification not only represents a significant loss of natural heritage, but can also lead to a loss of vital ecosystem services such as clean water and healthy soils.

Traditionally, natural resource management has tended to focus on protecting and managing individual assets rather than managing whole systems. However, there is a movement around Australia and internationally towards systems thinking that examines the ecological processes that sustain assets and underpins our natural environment. Our knowledge of ecological processes is limited, and our ability to include them in the framing of policy objectives and program practice is poorly developed. There is a need to raise awareness of the fundamental importance of ecological processes, and to create the policy drivers and organisational capacity to bring this into consideration at all levels of natural resource management (Bennett *et al.* 2009). Without a systems thinking approach, cumulative impacts may not be considered and large scale threats such as climate change not adequately addressed.

The value of assets can be driven by the extent to which they are threatened rather than their functional role within an ecosystem or landscape. For example, species and ecosystems listed as threatened or rare under the *Environmental Protection and Biodiversity Conservation Act* (EPBC Act 1999) attract greater investment in their management than more common or lesser known species or ecosystems (i.e. invertebrates). This can often mean that resources are focused on preventing extinctions rather than managing whole systems which are vital for ensuring species persistence in the long term. Another example of this is the management of Aboriginal cultural

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heritage sites. The assessment of cultural heritage focusses on isolated Aboriginal sites or places that are at direct risk of destruction, without taking into consideration archaeological complexes and landscapes that link Aboriginal sites and places together. The cumulative effect is the fragmentation and isolation of once connected cultural heritage sites and places, which can lead to the loss of cultural values and meaning.

### *The response*

The Strategy advocates for natural and cultural heritage assets to be managed within a landscape system to maximise synergies, address cumulative impacts and manage large scale threats such as climate change. A systems approach will provide a clearer understanding of the critical assets and ecological processes that are essential for the overall health and functioning of the Region's natural systems. The Directions 2031 Spatial Framework for Perth and Peel acknowledged the importance of natural infrastructure in the urban landscape with the Green Network, which will be implemented through the sub-regional structure plans (Western Australian Planning Commission 2010).

Key to a landscape approach is a comprehensive, adequate and representative (CAR) conservation reserve network with high value ecological linkages that build landscape resilience and integrity. Initiatives such as the Local Biodiversity Program and Bush Forever have made significant headway in protecting key biodiversity assets in the landscape. These initiatives should be maintained to ensure protection mechanisms are in place and implemented throughout the planning system. For key assets occurring outside protected areas, conservation covenants, voluntary management agreements and incentives are vital for ensuring private landholders have the advice and support to manage natural values within the landscape.

Within a landscape approach, cultural heritage values and practices could be integrated with natural assets to enhance both contemporary and traditional approaches to natural resource management. A more proactive approach to managing significant Aboriginal cultural heritage sites in the Region is needed. This will ensure that impacts to cultural heritage and ethnographic values are considered on a landscape scale rather than based on individual development footprints.

Implementation of the Strategy will work towards identifying high priority natural assets and landscape systems that require concerted and collaborative effort. This will draw on the best available knowledge and analytical tools, along with expert input, and focus on building landscape resilience in the face of a changing climate.

## **2.2 Management of drivers, risks and threats**

### *The issues*

An overview of the key issues and threats identified during the Strategy consultation process are outlined in Section 2.3. Many of these threatening processes are identical to those identified in the 2004 Swan Region Strategy for NRM proving that these problems are not easily managed. Two explanations as to why little progress has been made is that management is often focussed on the symptom rather than the cause, and the level of investment is not adequate to fully tackle the threat. These issues were highlighted in the Auditor General's review of the management of the Swan Canning River System (Auditor-General 2014) and the review of invasive pest management in Western Australia (Auditor-General 2013).

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The effective management of drivers, risks and threats requires an understanding of how the whole system operates. The limited investment in monitoring the condition of natural resources has meant that our knowledge and understanding of the whole system is limited. This has consequences for identifying appropriate management responses and undertaking cost-benefit analyses with all the facts at hand. Often the management of the symptom is considered simpler and cheaper than tackling the cause. However, an informed cost-benefit analysis is likely to reveal inadequacies in this approach if cost is examined over a longer time frame and there is consideration of the flow-on effects. For example, investment in controlling nutrient and non-nutrient contamination of waterways not only protects the health of the Swan Canning River System but also has flow on benefits for the economically important fisheries in the estuaries and embayments (Fletcher and Santoro 2013).

Of all the threats impacting our region's natural ecosystems, climate change is the one that is forcing natural resource managers to completely rethink their approach to the protection and sustainable management of natural assets. With the region's ecosystems already under significant stress, climate change is exacerbating existing threats and creating a new suite of problems. The understanding of how multiple stresses will interact, especially as the magnitude of climate change increases, is limited. Understanding these interactions is critically important in the design of climate adaptation strategies, especially because actions taken by other sectors (eg energy, agriculture, transportation) to address climate change may create new ecosystem stresses. Although a number of organisations in the region are undertaking climate change planning, this is not well coordinated across sectors and levels of government, and the focus has been on adaptation rather than mitigation strategies such as reforestation and the use of renewable energy.

### *The response*

To effectively protect and manage natural assets, threats and risks must be identified and addressed. Across the Swan Region there are a large number of threats and risks. It is not possible to address them all equally, which is why prioritisation must occur to ensure those threats that pose the greatest risk to key assets are given the highest priority.

To be effective, threat and risk management approaches should focus on the whole system, to identify the critical threats that undermine the functioning of that system as well as the resilience of the species that occur within it. Landscape scale approaches, such as the Strategic Assessment of Perth and Peel, are needed to identify and address strategic threats and assess cumulative impacts.

Climate change is a high priority threat that requires holistic thinking and a coordinated response. With continuing uncertainty about the impacts of climate change and the effectiveness of adaptation responses, responding to climate-related risks involves decision making in a changing world. The adaptation and mitigation choices we make now will affect the risks of climate change for the next century. Therefore it is critical that decisions are based on the best available information and policy directions are consistent across sectors and levels of government. At the regional scale, the Australia Government-funded Planning for Climate Change Project has brought together the best available climate science and mapping information for the Swan Region to examine future scenarios, identify risks and develop adaptation strategies. Adaptation strategies focus on building landscape resilience and integrity; whilst mitigation strategies focus on enhanced resource efficiency and biodiverse carbon plantings. Implementation of the Strategy will focus on these strategies, as well as driving greater regional coordination and collaboration through the Swan NRM Committee.

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### 2.3 Enforcement of regulations and approvals

#### *The issues*

There are a number of areas where the current environmental regulations do not adequately protect natural assets. A key area where regulation is weakened is environmental impact assessments. Currently the Environmental Protection Authority (EPA) does not assess the environmental impacts of projects where other agencies have responsibility for managing those impacts under their regulatory frameworks. Several non-government organisations have been advocating for the EPA to assess projects which are likely to have a significant impact on the environment in order to ensure a holistic consideration of the impact of proposals, even where other agencies have regulatory responsibilities.

Where regulations are in place, their effectiveness very much depends on the extent to which they are enforced. For example, the *Environmental Protection (Unauthorised Discharges) Regulations 2004* prohibits the discharge of non-nutrient contamination into the environment, but enforcement has historically focused on licensed businesses managed under license conditions, leaving smaller, unlicensed premises largely unmonitored. Not adequately funding responsible authorities and statutory bodies can limit their capacity to monitor and conduct compliance and follow-up actions to address breaches.

#### *The response*

In order for regulation to be effective, the monitoring and enforcement of regulations and approval conditions needs to be undertaken in a consistent and coordinated manner, particularly across state and local government. The consistent application of enforcement mechanisms not only provides the environment with the level of protection intended under the legislation, but also provides certainty for businesses and members of the community in terms of acceptable practices. Consistent application can also prevent inequity across the community such as where the Unauthorised Discharge Regulations enforcement is focussed on large businesses rather than the whole business community.

Regulations can also be supported by combining them with positive incentives that can drive a shift from resource degradation and exploitation to stewardship. For example, the Busselton Environmental Improvement Initiative combined incentives with enforcement to drive improvements in environmentally sustainable agricultural practices which resulted in a reduction of 73.5 tonnes of nitrogen and 18 tonnes of phosphorus flowing into Geographe Bay each year (Water Corporation 2007).

### 2.4 Responsible environmental management practices

#### *The issues*

Organisations, rural enterprises and even residential home owners each have a role to play as responsible environmental stewards. Environmental management practices can have a significant impact on the health and functioning of the natural environment. For example, phosphorus and nitrogen run off from agricultural and urban areas into the Swan and Canning river system have resulted in eutrophication problems downstream. An audit of 1,800 small to medium sized enterprises in Perth revealed that 28.4% had inappropriate liquid storage and spill management infrastructure, 14.5% had inappropriate disposal of wastewater, and 13.4% were discharging untreated detergents, degreasers or sediments to open ground, septic tank systems or flowing into stormwater systems (Perth NRM 2011).



## SWAN REGION STRATEGY FOR NRM

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There are many different environmental accreditation and certification schemes that can support organisations to adopt environmentally responsible practices. These schemes can complement and support existing government regulation by providing positive incentives for adopting sustainable practices. However, the cost of implementing the operational standards and achieving certification mean that these schemes may be out of reach for small to medium sized enterprises and agricultural producers. Certification schemes also rely on there being enough consumers willing to pay extra for environmentally responsible products in order for the business to be profitable.

### *The response*

Voluntary forms of environmental regulation can be an effective way to embed environmentally responsible practices. Industry-led environmental certification and accreditation schemes are often the most effective at driving sustained change. For example the Green Stamp Program is an environmental initiative first developed by the Motor Trade Association (MTA) in conjunction with the Waste Authority in 1999. Since then, the Green Stamp has been adopted by the printing, sign writing and cleaning industries and has had strong support from both government and industry. In 2012 alone, printing industry Green Stamp members diverted approximately 86,418 m<sup>3</sup> of paper waste from landfill and over 13 million aluminium plates over the last three years.

Environmental Management Systems (EMS) provide a systematic framework and process to assist an organisation to identify and manage significant environmental impacts that may occur as a result of its activities. Organisations that have their EMS independently accredited can be recognised for "environmental friendliness" by markets and local communities alike. EMS certification can deliver financial benefits through greater market access, resources and operational efficiency and reduced legal liability (Department of Agriculture WA 2000). However, smaller operators need access to industry or government incentives and support to overcome the financial barriers to adoption. Support could include marketing campaigns and clear product labelling to increase consumer awareness of environmentally sustainable products.

'Beyond compliance' recognition scheme such as eco-labelling or 'Green Tick' programs can provide businesses and agricultural producers with an incentive to adopt sustainable practices (Environmental Defender's Office 2006). With industry and government working in partnership, there is an opportunity to increase the participation of smaller operators and provide a higher level of protection for the environment. Other options to increase participation could be joint and group certification arrangements to reduce the cost to individual operators (Natural Resource Management Ministerial Council 2002).

## **2.5 An ecologically sustainable city**

### *The issues*

In 2010, Perth was identified by the Australian Conservation Foundation as the least sustainable city in Australia. The key areas where Perth underperformed in the assessment were ecological footprint, water and transport. Ecological footprint is the sum of all the cropland, grazing land, forest and fishing grounds required to produce the food, fibre and timber it consumes, to absorb the wastes emitted when it uses energy and to provide space for infrastructure. Perth has the largest ecological footprint of any city in Australia, with an estimated 7.66 hectares per person per year (Australia Conservation Foundation 2010).

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Despite achieving a reduction in residential water use from 128 kilolitres in 2000/01 to 106 kilolitres in 2008/09, Perth remains one of the highest water using cities in Australia (Water Corporation 2010). Demand for water is estimated to double by 2041, driven by population growth and economic development pressure. It is estimated that by 2060, Perth will require development of an additional major water source to meet this growing demand (Western Australian Planning Commission 2014b). Although this demand could be met through reclaimed wastewater and seawater desalination, the energy required for advanced reverse osmosis-based treatment systems may present a greater risk to sustainability unless renewable energy is part of the solution.

In terms of transport, Perth has the highest level of car ownership in Australia (641 private vehicles per 1000 people) and the 4th highest in the world. This has led to significant congestion issues which have been estimated to cost \$1b per year in lost productivity which is expected to rise to \$2.1 billion by 2020 (Burgess and Woodbridge 2012). Urban sprawl has also led to an over-reliance on cars, which has resulted in an increase in vehicle emissions.

Waste generation is also a major issue, with the national waste data for the year 2008-09 showing that Western Australia had the highest rate of waste generation in the country at approximately 2.6 tonnes per capita (Western Australian Waste Authority 2012).

### *The response*

Perth is a rapidly growing city, grappling with the demand for housing and development on one hand and the need to protect natural assets and essential ecosystem services on the other. Cities around the world faced with the same challenge are adopting an eco-city model; creating or retrofitting their urban settings to improve their environmental sustainability and liveability.

Eco-cities (or ecological cities) “enhance the well-being of citizens and society through integrated urban planning and management that fully harnesses the benefits of ecological systems, and protects and nurtures these assets for future generations” (The World Bank 2010). This can be achieved by using natural resources efficiently, incorporating natural ecosystems into urban areas to host wildlife and enhance amenity, using vegetation to control urban microclimates to stabilise temperature, and applying innovative technologies to improve liveability.

Many of the eco-city principles are already reflected in the Capital City Planning Framework (Western Australia Planning Commission 2013) which has a vision of “a world class liveable central city; green, vibrant, compact and accessible with a unique sense of place.” An eco-city vision is an opportunity to take this one step further and transform Perth into an ecologically responsible city where our unique and internationally renowned natural assets are central to our identity, vibrancy, and prosperity.

In terms of enhancing Perth’s credentials in water management, the Department of Water is working with other state agencies and local governments to advance the concept of ‘water sensitive cities’. Water sensitive cities takes into consideration the total water cycle and encourages all levels of government and industry to adopt water management and urban planning practices that balance the needs of the community, economy and environment. Actions that enhance Perth’s water sensitivity will be an important step towards achieving the eco-city vision.

Achieving an eco-city requires vision, creativity and a collective commitment to ecologically sound economic growth. Many local governments across the region are already leading the charge. For example, the City of Fremantle has been internationally certified as a One Planet Council. Government, industry and community each have a role to play in achieving the eco-city vision; whether that is through simple, everyday actions or advocating for the institutional reform needed to set Perth on an ecologically sustainable and responsible pathway.

# SWAN REGION STRATEGY FOR NRM

## Asset Protection and Sustainable Use - Vision of Success

### 2.1 Priority natural and cultural heritage assets are protected, managed and restored within a landscape system

- Regional natural resource management priorities are being addressed through the Strategy's Implementation Plan
- Natural assets are managed within a landscape system to maximise synergies, address cumulative impacts and climate change and the Region has a network of high value ecological linkages
- Priority natural assets are protected and managed within the conservation reserve network
- Significant cultural heritage sites are protected and actively managed

### 2.2 Current and emerging drivers, risks and threats are identified and managed

- There is a regional approach to identifying and addressing current and emerging drivers, risks and threats
- The management of invasive species, plant diseases and biosecurity risks in the Region is coordinated
- Climate change adaptation is supported through building ecosystem resilience and a network of ecological linkages
- Sea level rise and ocean acidification impacts are minimised
- Fire regimes balance the need to protect life, property, air quality and ecological sustainability
- Best practice approaches are being applied to manage salinity, erosion and soil acidification
- Surface and groundwater resources are used sustainably
- Environmental flows in waterways are maintained
- Nutrient and non-nutrient contaminants are minimised and ameliorated
- Sedimentation from new development sites is minimised
- The impact of land use planning and development on natural assets is minimised

### 2.3 Compliance with regulations and approvals is monitored and enforced

- Government agencies have the capacity to monitor and enforce regulations and policies
- Compliance processes are aligned across State and local government
- Approval conditions are enforced

### 2.4 Businesses and organisations are actively managing their environmental impact

- Businesses, organisations and landholders minimise their environmental impact by adopting best practice standards
- There is an increasing number of organisations and businesses adopting environmental accreditation and certification schemes

### 2.5 Perth is an innovative eco-city where natural resources are used and managed sustainably

- Natural assets are considered a vital part of the city's infrastructure
- Consumers demand environmentally sustainable developments that work in harmony with the unique natural assets of the Region
- Water Sensitive Urban Design (WSUD) principles are incorporated into all new developments and retrofits
- Government, business, industry and the community are using resources efficiently and opting for clean, renewable energy
- Perth is applying innovative solutions to support a healthy and productive society that is in harmony with the natural environment

### 3.2.3 Awareness, participation and capacity building

### 3. Awareness, participation and capacity building

- 3.1. The broader community is aware and actively participating in natural resource management
- 3.2. Environmental managers and community volunteers have the capacity to deliver positive environmental outcomes for the Region
- 3.3. The Aboriginal community is actively involved in managing natural assets
- 3.4. Local governments are community leaders in natural resource management
- 3.5. Business, industry and government organisations are applying sustainable practices
- 3.6. Landholders and managers are environmental stewards
- 3.7. NRM successes are recognised and celebrated

### Overview

The decisions we make at home, at work and for recreation, especially where natural resources are consumed have far reaching consequences for our natural environment. It is important to reveal the consequences of our actions and increase the options available to individuals and organisations to make environmentally-friendly choices. To be effective, actions to manage resources sustainably need to be adopted across the broader community. The task is greater than any one agency or organisation can deliver. As the custodians of our natural assets, we are responsible for their protection and management.

Building awareness, understanding and capacity acknowledges the central role of people in effective natural resource management. By working together towards the same sustainable goals, our actions can change our unsustainable trajectory. From early learning centres through to large corporations, an eco-city approach calls on all sectors and walks of life to take up the challenge of reducing our ecological footprint and design a cleaner, greener future for Perth.

### 3.1 Community awareness and participation

#### *The issues*

The rapid expansion of urbanisation in the last century has created a growing disconnect between people's everyday lives and their environment. Many community members are unaware of the natural assets in their area or the role nature plays in providing essential services such as clean air and water. There is little acknowledgement that human life and the economy are absolutely dependent on a healthy environment. Agricultural producers are acutely aware of this link; but for those in the urbanised environment, the link is less obvious. For example, Australians are more likely to participate in nature conservation activities if they live outside a capital city (Australia Bureau of Statistics 2013). The degrees of separation between people and the source of their clean food, air and water means it is more difficult to see how their everyday decisions impact on the environment and consequently, their wellbeing.

Despite a growing number of environmental problems, the number of Australians concerned about environmental problems has declined from 82% in 2007-08 to 62% in 2011-12. In Western Australia, this downward trend coincided with a decrease in concern about water shortages (Australian Bureau of Statistics 2012a). While more than half of Australians (53%) thought the natural environment in Australia was declining in 2007-08, less than two in five Australians (39%) felt the same in 2011-12. The survey results suggest a gap in awareness and understanding in the general community with regards to the severity of environmental issues and the urgency of action required.

## SWAN REGION STRATEGY FOR NRM

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### *The response*

The decisions we make at home, at work and for recreation, especially where natural resources are consumed or directly impacted, have far reaching consequences for natural ecosystems. An important step in affecting change is to ensure people see the consequences of their actions and provide them with practical information about how they can make a positive difference. The evidence is that simple messages, sustained over time can be effective (sun smart, road safety, etc.) if they connect people with the bigger picture and can be practically applied. For example, the Home River Ocean 'Save the Crabs, Then eat Them' campaign run by the South West Catchment Council delivers a simple message, linking domestic fertiliser use with the health of the iconic Blue Swimmer Crab. Public awareness campaigns are needed to reinforce the community's role as custodians of the land, sea, air and waterways and offer practical steps that can lighten our ecological footprint.

The natural environment is often best appreciated and promoted when people can make direct contact with nature. Programs such as Nearer to Nature are vital for building a familiarity with the natural environment and an appreciation for the unique natural assets in our Region. Citizen science programs such as Dolphin Watch and the Great Cocky Count offer a unique opportunity for the community to contribute to the monitoring of iconic species. The increasing participation rates for such programs demonstrate the community's desire to protect the natural environment. The State Planning Strategy 2050 acknowledges the importance of connecting the community with natural landscapes. One of its strategic goals is to achieve sustainable communities through "Liveability - communities with attractive, liveable environments" and "Connectedness - providing natural and built connections within and between communities" (Western Australian Planning Commission 2014b). It supports the concept of integrating the natural environment with urban settlements to ensure people have the opportunity to connect with nature.

The education system plays a major role in connecting people with the natural world. Sustainability education has come a long way in Australia over recent times. The Australian Sustainable Schools Initiative-WA (AuSSI-WA) is part of a national initiative developed by the Australian Government that provides a whole-school planning framework and a range of tools to build sustainability into the education system. Schools can be engaged in elements of sustainability through such areas as utilities management, bushland and dune protection activities, reconciliation and other social programs. It is important to involve students in local environmental issues and harness energy from experts within the community by inviting landcare groups or agency staff to get involved in teaching and learning. School students are inspired by meaningful projects that build creativity and make them active participants in the future of the planet. A diversity of approaches is needed, such as direct experiences in the bush, and exposure to traditional ecological knowledge and culture.

### **3.2 Support for environmental managers and volunteers**

#### *The issues*

In order to deliver the best possible environmental outcomes it is essential to support those individuals delivering the work on the ground, whether they are community volunteers, landholders or NRM professionals. Training and development is needed to ensure best practice standards are maintained and individuals have the capacity to undertake the work effectively. Without a focus on sector-wide capacity building and support there is the risk of unintended consequences or ineffective management activities.

## SWAN REGION STRATEGY FOR NRM

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Environmental management in the Region is heavily reliant on community stewardship and this contribution is not well recognised or rewarded. This disempowers community groups who end up spending more time disputing and lobbying against government decisions rather than being part of the solution. The contribution of the community sector to natural resource management is also undervalued in terms of the limited investment in the capacity of environmental groups. The 2013 Capacity Assessment of environmental groups in the Swan Region conducted in 2013 revealed that only 20% of respondents received regular sources of income to deliver environmental works (Perth NRM 2014b).

The voluntary workforce for environmental services is ageing. A national survey conducted in 2011-12 found that 57% of people aged 45-74 were engaged in nature conservation activities, compared to only 26% of 18-24 year olds (Australian Bureau of Statistics 2012b). A capacity assessment of environmental volunteers in the Swan Region conducted in 2013 revealed that more than 80% were over the age of 50 (Perth NRM 2014b).

### *The response*

In order to achieve a thriving NRM sector environmental managers and volunteers should be supported through capacity building opportunities, support networks and knowledge sharing. There is a need to advocate for increased investment in training and development and the promotion of best practice approaches for environmental management. Raising the standard of environmental management across the region will deliver enhanced environmental outcomes overall.

The Strategy advocates for greater recognition of the contribution of community groups to natural resource management and increased support through funding and capacity building. Community groups and networks are often the eyes and ears for the natural environment, noticing change and reporting illegal activity. Capacity Assessments for environmental groups in the Swan Region will be vital to identify key capacity gaps. Training programs and other forms of support can then target these key gaps.

The aging voluntary workforce also indicates a need to engage a new generation in environmental volunteering. Approaches that use social media to involve and empower younger generations have been shown to be effective. Opportunities to increase community involvement through empowered decision making are also needed.

## **3.3 Aboriginal participation**

### *The issues*

As a result of historical policies that have disconnected Aboriginal people from the land, the Noongar community do not have the capacity or opportunities to work on Country, participate in natural resource management or maintain cultural practices. The participation of Aboriginal people in natural resource management is essential for connecting and harmonising contemporary management with traditional knowledge and approaches.

The Capacity Assessment of environmental community groups in the Swan Region in 2013 revealed that only 21% of respondents have connections with the Aboriginal community. Many groups find the process of engaging the Aboriginal community complex and time consuming. This highlights the need for more effective ways of connecting the Noongar community with environmental groups who are likely to have very similar beliefs and value systems with regards to caring for the natural environment.

## SWAN REGION STRATEGY FOR NRM

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### *The response*

Currently Aboriginal people are under-represented in land management and protection in the Region. Elders in the Noongar community hold valuable traditional ecological knowledge which could be better utilised to improve and more effectively manage the land and waterways. The Noongar Native Title Settlement offers an opportunity for land to be handed over to the Noongar community for management. This will require a large number of qualified and certified Noongar people to maintain, protect and enhance these lands and waterways. Thus there is currently a need within the Noongar community to build capacity in land management and cultural heritage management. Access to land and capacity building programs will increase natural resource management employment opportunities and support the development of Aboriginal enterprises. More programs like the Department of Parks and Wildlife's Mentored Aboriginal Training and Employment Scheme (MATES) are needed across the NRM sector to provide career pathways for Aboriginal people in natural resource management.

To increase the participation of the Noongar community in environmental management, Perth NRM has developed the Guide to Aboriginal Consultation and Engagement in the Swan Region. Community groups can use the guide to navigate various pathways of consulting with and including the Noongar community in their environmental activities. Dedicated Aboriginal cultural heritage staff within environmental organisations and local government can be a vital contact point for community members to access information and advice for consulting with and involving Aboriginal people in their activities.

### **3.4 Local government capacity**

#### *The issues*

Across local government, the awareness and understanding of natural resource management is varied. With greater devolved responsibilities from the State government for environmental management and monitoring, local governments have limited capacity and funding options to deliver the work. For example the WALGA survey conducted in 2007 found that local governments do not have the resources to adequately manage remnant vegetation on their land (WALGA 2007). The survey also found that key decisions makers such as Councillors, senior management and planners have very limited awareness and understanding of biodiversity and the planning mechanisms that can be used in its protection.

#### *The response*

Local government plays an important role in natural resource management due to their close connection to local communities and networks. Therefore, it is essential that local government staff and elected members have the awareness, understanding and capacity to deliver effective natural resource management at the local level. Capacity building programs, such as the Local Biodiversity Program and New Water Ways are vital for keeping local government abreast of current thinking and best practice in asset management and sustainability. A coordinated approach to capacity building, including support and training is needed in the Region to address key capacity gaps. Local government partnerships and cross-boundary operating structures such as the South West Group, WESROC, EMRC and the Cockburn Sound Coastal Alliance also build the capacity of local government whilst enabling landscape scale management of natural resources.



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### 3.5 Corporate social responsibility

#### *The issues*

To reduce Perth's ecological footprint, there is a need to engage businesses, industry, government agencies and education institutions in sustainable practices. Our ecological footprint is one of the largest in the world and there is significant room for improvement when it comes to more efficiently managing water, waste and the basic raw materials needed to feed our growing development needs. Although the State government is driving new policy directions in sustainable development, it is imperative that organisations and business are supported and rewarded for adopting sustainable practices that can affect real change.

There are a large number of organisations and industry groups who are adopting and championing environmentally sustainable practices. There is a need to recognise and support private sector leadership and also support smaller businesses who have limited capacity to transition to a more environmentally sustainable business model.

#### *The response*

Programs that drive environmentally sustainable design and practices such as the Green Building Council of Australia Green Star Rating and the Urban Development Institute of Australia's EnviroDevelopment can have an enormous impact across sectors if delivered effectively. Best practice approaches should be promoted and extended across the Region and excellence in sustainable practices should be recognised and rewarded. Rewards and recognition can increase uptake by promoting organisations in terms of their corporate social responsibility and demonstrate a commitment to the community and the environment.

Environmental certification and accreditation schemes partnered with incentives and capacity building programs are vital for driving positive change across businesses, industry, government agencies and education institutions. Capacity building and support needs to focus on smaller operators who have limited financial capacity to participate in environmental certification schemes.

### 3.6 Environmental stewardship

#### *The issues*

Private landowners and managers are custodians of environmental assets. Whether they are developers, residential home owners or agricultural producers, they each have a role to play as environmental stewards.

For those land managers deriving an income from the land, there may be limited capacity to adopt sustainable practices and protect the natural environment over and above what is required under legislation. There is increasing recognition that land managers that deliver ecosystem goods and services, such as revegetating waterways to improve water quality, should be compensated for delivering a community benefit.

In the Swan Region there are limited incentives for landholders and land managers to protect and retain natural assets. For example, a 2007 survey conducted by WALGA for the Perth Biodiversity Project found that there is a need for more innovative and extensive use of private landholder conservation incentives to protect remnant vegetation on private land (WALGA 2007). Sustainable land management practices and innovations need to focus on triple bottom line benefits that can support the viability of farmers and businesses whilst also enhancing environmental outcomes.

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### *The response*

There is a need to recognise and reward landholders and land managers who protect and manage natural assets. Incentives and capacity building programs can ensure landholders have the knowledge, skills and resources to fulfil their role as environmental stewards. Initiatives such as the Urban Nature Program and Local Biodiversity Program enhance environmental stewardship and provide a framework and mechanism for driving environmentally sustainable practices. More reward and incentive schemes are needed to overcome the financial barriers to protecting natural assets and transitioning to environmentally sustainable practices.

For agricultural producers, an integrated approach to capacity building based on partnerships between peak industry groups, NRM groups, researchers and government can ensure that high quality information is relevant, reliable and readily available to growers. Information that is 'in my backyard' and generated through local grower group activity is more likely to drive sustainable practice change on-farm.

Landholder capacity building programs such as the Small Landholder Information Service, run by the WA Department of Agriculture and Food, and Heavenly Hectares, run by The Forever Project, offer important sustainable property management information. In the urban environment, community capacity building programs such as Great Gardens, are vital for engaging the community in environmental sustainability and providing simple everyday solutions for responsible resource use in the home and garden. With an expanding urban footprint, there is a need to engage the wider community in the concept of environmental stewardship and acknowledge the important role that all private landholders can have in protecting and managing the Region's natural assets.

### **3.7 Recognising and celebrating success**

#### *The issues*

Recognising and celebrating achievement and leadership in natural resource management and sustainability is an important way of driving positive behaviour across the community. A number of people and organisations are making a significant contribution towards the Region's natural environment but this contribution is not always recognised and acknowledged in the broader community. Many voluntary groups undertake extraordinary efforts on behalf of the environment and our community, often with little recognition or reward other than the satisfaction of 'making a difference'. Leaders and champions in sustainability and environmental management exist across every sector of our community but this network of influencers is not leveraged effectively to support the objectives of natural resource management.

#### *The response*

In order to raise the profile of voluntary groups and encourage volunteerism amongst the community, it is important to publicly recognise and reward the achievements of volunteer groups and individuals. Award programs such as those run by Landcare, the Swan River Trust and the WA Local Government Association are vital to promote environmental excellence, sustainability and best practice and recognise environmental leadership.

There is an opportunity to link environmental awards programs with leadership programs to foster environmental leadership across the community, industry and corporate sectors. Greater support for leaders and champions is needed across different segments of the community to increase the public profile of sustainability and natural resource management and attract volunteers and potential employees to the sector. For example, the Great Gardens initiative identifies and supports 'Great Guardians' who are ambassadors for sustainability, inviting them to present at award events, discussion forums and make guest appearances on TV to inspire and empower the community to become more sustainable.

# SWAN REGION STRATEGY FOR NRM

## Awareness, Participation and Capacity Building - Vision of Success

### 3.1 The broader community is aware and actively participating in natural resource management

- The community values the unique natural assets of the Region and understands their importance to human wellbeing
- The community values Aboriginal cultural heritage and the role of traditional ecological knowledge in the protection and management of natural assets
- The community understands the challenges and opportunities for achieving sustainable development
- The community increases their support for protecting the natural environment and actively advocates for a more sustainable city
- The community have the opportunity to connect with the natural environment and actively participate its protection and management
- The education system reinforces the value of environmental sustainability

### 3.2 Environmental managers and community volunteers have the capacity to deliver positive environmental outcomes for the region

- Environmental managers and community volunteers have the knowledge, skills and resources to protect and manage natural resources
- Environmental managers and community volunteers are collaborating and coordinating their activities
- Community groups understand how and why decisions are made
- Community groups are involved in NRM decision-making and are able to put forward issues and ideas
- Environmental managers and community volunteers are operating to basic standards of project management and natural resource management best practice

### 3.3 The Aboriginal community is actively involved in managing natural assets

- Aboriginal people have the opportunity to work on Country and manage their heritage
- Aboriginal people are actively participating in the protection and management of natural assets
- Aboriginal people and enterprises are actively involved in the natural resource management industry

### 3.4 Local governments are community leaders in natural resource management

- Local Government staff and elected members are aware and actively advocating on behalf of the natural environment and cultural heritage values
- Local Government staff have the knowledge, skills and resources to protect and sustainably manage natural and cultural heritage assets

### 3.5 Business, industry and government organisations are applying sustainable practices

- Business, industry and government organisations have the knowledge, skills and resources to efficiently and sustainably use and manage resources
- Business, industry and government organisations are applying best practice environmental management systems
- Business, industry and government organisations are rewarded and recognised for environmentally sustainable practices

### 3.6 Landholders and managers are environmental stewards

- Landholders and managers have the knowledge, skills and resources to protect and manage natural resources
- Landholders and managers understand their responsibilities as environmental stewards
- Landholders and managers are rewarded for sustainable practices

### 3.7 NRM successes are recognised and celebrated

- The contribution of community and voluntary groups to NRM is recognised and celebrated
- NRM achievements and successes are recognised, shared and rewarded
- Environmental leadership is fostered and supported

### 3.2.4 Knowledge, research and adaptive management

#### 4. Knowledge, research and adaptive management

- 4.1. Research, development and innovation are focussed on critical needs and knowledge gaps
- 4.2. Essential knowledge for protecting and managing natural assets is compiled, accessible and used to make decisions and design programs
- 4.3. Traditional ecological knowledge is recognised and considered alongside contemporary natural resource management knowledge
- 4.4. The condition of natural assets is monitored and reported
- 4.5 The approach to managing natural resources in the Region is being monitored, evaluated, reported on and improved

#### Overview

Timely access to information and analysis relating to natural assets is essential for decision making, program design and implementation. Knowledge management is the process of capturing, storing, and organising information, data and analyses. It ensures that the collective intellectual capital of individuals, organisations and networks can be made available and accessible to decision makers, planners, legislators and investors.

The key holders of knowledge in the Region are state government agencies, Landgate (through the SLIP portal), the WA Local Government Association, local government, non-government organisations, universities and research institutions and a number of community and natural resource management organisations.

There are many public, private and community-based organisations across the Region with a strong history of collecting data and generating knowledge in natural resource management. From universities through to citizen science programs, knowledge can be gathered in a range of different ways.

#### 4.1 Research, development and innovation

##### *The issues*

Currently there is no regional approach to identifying natural resource management research priorities. There is a need to develop a stronger link between research institutions, decisions makers and natural resource managers to ensure that critical gaps are identified and addressed through a regional research program.

A key knowledge gap is the development of functional models of the environment that include water, atmospheric and soil interactions and models of ecological function and health. The response of natural systems to change is not gradual or linear, therefore dramatic thresholds of change are likely. These critical thresholds need to be identified and managed and incorporated into future scenario planning, particularly to address climate change. Appropriate decision making requires an understanding of assets and ecosystem function and how various interventions impact the system. Dedicated research and innovation is needed to develop practical solutions for maintaining natural systems in a growing metropolitan centre.

## SWAN REGION STRATEGY FOR NRM

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### *The response*

There needs to be a regional research plan for identifying and addressing natural resource management knowledge gaps, with research institutions specifically funded to address those gaps. Innovative thinking is needed to shift the paradigm from static asset management to system thinking that considers the whole urban ecosystem to enhance long term sustainability. This will require interdisciplinary capabilities such as ecology, social science, information technology, policy analysis, economics, education and planning. To achieve an integrated and innovative research program for the Region, research collaborations will be vital. These collaborations should not be limited to research institutions but also look at directly linking research with policy makers, planners, business and industry.

To inform the development of an integrated vision for the Region, modelling, mapping and risk assessment capability will be vital. Predictive modelling and scenario planning are essential for making decisions that have far reaching consequences for the future. A partnership approach to developing modelling and risk management systems across organisations can utilise resources and skills more effectively, particularly between research institutions and policy and planning agencies.

## **4.2 Knowledge management**

### *The issues*

There is a lack of coordination and collaboration in the way natural resource management knowledge is managed. The exchange of information between organisations is often ad hoc and at times limited by intellectual property restrictions. This means that knowledge across all natural resources is not readily available to decision makers. To manage natural assets within a landscape system, knowledge across multiple assets is vital.

### *The response*

Good decision making relies on access to accurate and timely information. Access to data, maps and information on resource condition trends, options for investment and likely outcomes for investment are needed to support effective decision making. Such data needs to be available on an open access basis to ensure that land managers and the community understand the risks and consequences for proposed land management practices and development. The WA Local Government Association's Environmental Planning Tool provides a central platform for environmental planning matters that enables local government officers and other land managers to make decisions and provide advice. Decision support tools such as MCAS-S and INFFER are also valuable tools for incorporating the latest information into decision making processes.

The Shared Land Information Platform enabling framework, SLIP Enabler®, is an online mapping tool that allows users to access Western Australia's significant land and geographic information resources over the web. Administered by Landgate, SLIP Enabler provides a virtual single point of access to authoritative location information from a range of government sources, improving the efficiency and effectiveness of the way location information is used and viewed. There is an opportunity to establish an NRM platform on SLIP to facilitate greater sharing of natural resource management information. Future work on an NRM platform should consider the inclusion of raw data sets to enable natural resource managers to interrogate and analyse information.

### 4.3 Traditional ecological knowledge

#### *The issues*

Since European settlement, the traditional ecological knowledge that has been built up by the Noongar people over thousands of years has lost its central place in how the natural landscape is managed. Although there is increasing recognition of the importance of Australia's Indigenous heritage, this heritage is inadequately documented and protected (State of the Environment 2011). Without a way to manage and record traditional ecological knowledge, much of this knowledge is being lost as Noongar Elders pass away.

#### *The response*

Indigenous knowledge in land management practices is an essential ingredient for the integrity and sustainability of natural ecosystems. It is important that traditional ecological knowledge is recognised and considered alongside contemporary natural resource management knowledge. To achieve this, traditional ecological knowledge must be collected, maintained and managed in a culturally sensitive manner.

There have been a number of projects within the Swan Region that have incorporated Aboriginal cultural heritage and traditional ecological knowledge. For example, the Noongar Coastal Trail and the Whadjuk Trail Network provide interpretive signs with Noongar stories, history and language connected to sites of significance. The Swan River Trust's Marli Riverpark Interpretation Plan and Riverpark Trails Project, enhances the sharing and interpretation of the cultural values of the Swan Canning Riverpark. In the greater south west of Western Australian, the Ngadju people worked with the CSIRO, Department of Parks and Wildlife WA and the Terrestrial Ecosystem Research Network to explore traditional knowledge of fire management in the Western Woodlands. The result was a research paper documenting how traditional management regimes ensured wildfires were less severe. The result has been that Elders of the Region are now working with Department of Fire and Emergency Services and Department of Parks and Wildlife to participate and lead on-ground fire management.

A mechanism is needed to connect Noongar Elders and Noongar community leaders with natural resource managers to engage on specific activities and deliver practical management outcomes. Such a mechanism would enhance the sharing of traditional knowledge and identify how scientific theory and traditional ecological can complement one other. This could also have the potential to develop greater Noongar community participation in natural resource management and allow a way for intergenerational transfer of knowledge within the Noongar community.

There is an opportunity enhance the awareness and use of traditional ecological knowledge by incorporating it into the school curriculum. This could include reconnecting Elders with the younger generation through culturally focussed school programs.

### 4.4 Resource condition monitoring

#### *The issues*

While resource condition studies have been conducted they tend to be short term and project specific. This limits the ability to track changes in condition over time. There is a need to understand the status and trends in the condition of natural assets through time and space for effective protection and management. The State of the Environment Report fulfilled this gap to some extent but a report has not been produced since 2007, limiting our overall understanding of resource condition in the state. Without baseline data and long-term resource condition monitoring, it is not possible to know which management approaches have been the most effective.

Funding for natural resource management is increasingly being directed towards on-ground activities rather than monitoring the condition of assets. This means that the collection of resource condition information is often opportunistic and at a small scale, reducing the capacity to obtain a holistic view of resource condition over time and our ability to detect critical threats.

#### *The response*

Access to resource condition information is vital for understanding what is or isn't working and what the critical needs are in the Swan Region. Ongoing funding is needed to undertake systematic monitoring of resource condition to understand the status of natural resources and identify areas particularly under threat. Non-government and community groups could be involved in 'citizen science' data collection, supplemented by professional monitoring and analysis, as occurs with the annual Great Cocky Count and the monitoring of Marri canker. Given the size of the task it may be necessary to identify indicator species or surrogates to measure changes in natural systems over time. What is needed is an ongoing commitment to understanding and responding to the condition of our natural assets.

### 4.5 Monitoring and evaluation

#### *The issues*

Other than independent reviews conducted by the Auditor-General, very few natural resource management programs and approaches are routinely reviewed and evaluated in terms of their effectiveness, efficiency, appropriateness and impact. The risk is that significant public investment is directed towards initiatives that do not equate to a net benefit for the environment. For example, the absence of an ongoing auditing process for Bush Forever means that we do not know what has been achieved at each site or the extent to which the policy objectives have been achieved.

#### *The response*

The Strategy advocates for a culture of evaluation to ensure the value of projects, programs and investments are assessed and measured. The Strategy's monitoring, evaluation, reporting and improvement (MERI) plan will facilitate coordinated data collection and storage and identify key knowledge gaps and opportunities at the regional scale. Outcomes will be measured and reported in a transparent way so that both stakeholders and the community can see what has been achieved.



## Knowledge, research and adaptive management - Vision of Success

### 4.1 Research, development and innovation are focussed on critical needs and knowledge gaps

- There is a regional research plan for identifying and addressing agreed natural resource management priorities
- Research institutions are funded to address key knowledge gaps in natural resource management
- Effective collaborations are established to address research priorities
- Innovative thinking, approaches and technologies are fostered and supported to drive improvements in natural resource management
- Increased modelling, mapping and risk assessment capability

### 4.2 Essential knowledge for protecting and managing natural assets is compiled, accessible and used to make decisions and design programs

- The management of natural asset knowledge is coordinated across the Region to enhance accessibility and useability
- Natural resource managers and decision makers have access to essential knowledge and sophisticated support tools and analyses
- Scientific and traditional ecological knowledge is integrated and made available to decision makers
- The value of natural and cultural heritage assets to the Aboriginal and non-Aboriginal community is known and considered in decision making

### 4.3 Traditional ecological knowledge is recognised and considered alongside contemporary natural resource management knowledge

- Traditional ecological knowledge is collected, maintained and is accessible
- Traditional ecological knowledge is managed in a culturally sensitive manner

### 4.4 The condition of natural assets is monitored and reported

- The condition of natural and cultural assets is monitored
- Information on the condition of natural assets is readily available

### 4.5 The approach to managing natural resources in the Region is being monitored, evaluated, reported on and improved

- A monitoring, evaluation, reporting and improvement framework for the Region is guiding the review and improvement of environmental programs and activities
- Environmental programs, policies and plans are regularly reviewed and improved
- The efficiency, effectiveness, appropriateness and impact of natural resource management programs and interventions is evaluated
- Evaluation findings and recommendations are used to improve and adapt programs and are made publicly available

### 4. Implementing the Strategy

#### 4.1 A Collaborative Responsibility

Partnerships and collaboration are essential for effective natural resource management, particularly in a stakeholder rich environment such as the Perth Metropolitan area. The challenges are large, but so are the opportunities if we can apply our collective intelligences and experience. Central to the successful implementation of the Strategy are the stakeholders of the Region; government, community, business and industry, and education, training and research providers.

The Swan NRM Committee will continue to have a key role in overseeing the delivery of the Strategy and building partnerships to support implementation. The Committee has two key functions:

- Monitor progress against the Strategy and identify opportunities for refinement; and
- Identify partnership opportunities, pursue mutual activities and explore new ideas that can deliver maximum benefit for our Region's natural assets.

Working Groups will be established to bring together the relevant organisations where specific opportunities or issues are identified. Perth NRM will continue to provide executive support for the Committee and the Working Groups.

##### 4.1.1 Government

All three levels of government (local, state and federal) play a critical role in the management of natural resources at the regional level.

Local government are the closest level of government to the community and have a key role in identifying and addressing local natural resource management issues and engaging the community. Local government delivers natural resource management priorities through the management of land uses, zoning, development approvals, and of lands vested in it. They are also responsible for the wise use of natural resources through the conduct of municipal activities and the provision of infrastructure. Many local governments also provide support for friends groups and community planting events.

The role of the state government is to provide leadership on natural resource matters at a State level. It is responsible for the development and implementation of plans, policies and legislation for the sustainable use of the State's natural resources. State Government is also responsible for monitoring and evaluation of these plans, policies and legislation, including ongoing resource condition monitoring. State Government are partners in the Strategy, and deliver important natural resource management programs that support the protection and management of key natural assets in the Region.

The Australian Government provides leadership on natural resource management matters at a National level. They ensure the protection of areas of national significance, administer national environment legislation and allocate funding through major initiatives such as the National Landcare Programme.

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### 4.1.2 Community

For the purpose of this Strategy, the community are comprised of two distinct segments – natural resource management groups and the general public.

Natural resource management groups such as NRM regional bodies, Landcare and Friends groups play a vital role in the protection and management of natural assets across the Swan Region. They coordinate on-ground action and community involvement at the local level and also act as the community voice for the environment.

The general public can contribute to natural resource management through their everyday decisions and actions. Many of the actions identified in this Strategy are designed to raise the public's awareness of the significance of the Region's natural resources and the practical actions that can be implemented to preserve these assets.

### 4.1.3 Business and Industry

There are a significant number of business and industry organisations that have a major stake in the management of the natural resources in the Region. The prosperity of industries such as agriculture, fisheries, forestry and tourism are highly dependent on the condition and availability of natural resources.

To create a sustainable balance between business, industry and the natural environment, the Strategy advocates for new partnerships and innovative approaches. For Perth to be an eco-city, a triple bottom line approach is needed, that values and seeks to enhance the environment, society and the economy in the Region. The private sector can be visionary leaders of change and drive sustainability through private investment, operating procedures, codes of practice and accreditation systems. Public – private partnerships can also deliver significant natural resource management outcomes.

### 4.1.4 Education, Training and Research

Primary and secondary schools provide an opportunity to reconnect young people with our natural assets and ecosystem services. They provide a vital conduit to build community understanding and appreciation of the natural environment. Schools can inspire youth to engage with their environmental heritage and provide capacity to illustrate learning in any number of disciplines be it social science, biology or economics.

Tertiary and research institutions are centres of innovation and critical thinking, and can approach issues from well-established concepts, whilst also investigating and testing new ones. They also provide multidisciplinary approaches to learning and research, allowing a deeper investigation of the complex nature of natural systems.

### 4.2 Implementation Plan

The Strategy's Implementation Plan is developed in collaboration with Swan NRM Committee members and other key stakeholders. The plan includes projects and activities currently being delivered by organisations and groups in the region that address the Strategic Objectives, and identifies 'priorities for action' where new investment, ideas or actions are needed. Delivery partners in the Implementation Plan will report on progress and achievements as part of the Monitoring, Evaluation, Reporting and Improvement process.

### 4.3 Monitoring, Evaluation, Reporting and Improvement Plan

Implementation of the Strategy is supported by a Monitoring, Evaluation, Reporting and Improvement (MERI) Plan. This enables implementation of the Strategy to be monitored and measured over time and informs adaptive management opportunities. To gather information against the implementation actions and key evaluation questions, Perth NRM will lead a streamlined annual reporting cycle.

### 5. Appendices

#### 5.1 Stakeholders engaged in the review process

1. Air Quality Coordinating Committee
2. Australian Sustainable Development Institute
3. Birdlife Australia
4. Botanical Gardens and Parks Authority
5. Chamber of Commerce and Industry (WA)
6. City of Armadale
7. City of Belmont
8. City of Canning
9. City of Cockburn
10. City of Gosnells
11. City of Joondalup
12. City of Kwinana
13. City of Melville
14. City of Nedlands
15. City of Perth
16. City of Rockingham
17. City of South Perth
18. City of Stirling
19. City of Subiaco
20. City of Swan
21. City of Wanneroo
22. Clear Horizon
23. Cockburn Sound Coastal Alliance
24. CSIRO
25. Conservation Council WA
26. Curtin University
27. Department of Aboriginal Affairs
28. Department of Agriculture (Commonwealth)
29. Department of Agriculture and Food
30. Department of Environment Regulation
31. Department of Fisheries
32. Department of Health
33. Department of Local Government and Communities
34. Department of Parks and Wildlife
35. Department of Planning
36. Department of Premier and Cabinet
37. Department of Prime Minister and Cabinet
38. Department of Regional Development
39. Department of the Environment (Cwlth)
40. Department of Water
41. Dieback Working Group
42. Eastern Metropolitan Regional Council
43. Edith Cowan University
44. Ellen Brockman Integrated Catchment Group
45. Environmental Weeds Action Network (WA)
46. Evergreen Farming
47. Friends of Forrestdale Lake
48. Friends of Lake Claremont
49. Friends of Lightning Swamp
50. Grape Growers
51. Greening Australia (WA)
52. International Council for Local Environmental Initiatives (ICLEI)
53. Noongar Elders and community members
54. Murdoch University
55. Northern Agriculture Catchment Council
56. Nursery and Garden Industry (WA)
57. Regional Development Australia
58. Rottnest Island Authority
59. Shire of Chittering
60. Shire of Kalamunda
61. Shire of Mundaring
62. Shire of Serpentine-Jarrahdale
63. Shire of Toodyay
64. Shire of York
65. South East Regional Centre of Urban Landcare
66. South West Aboriginal Land and Sea Council
67. South West Group
68. State NRM Office
69. Swan River Trust
70. The Claise Brook Catchment Group
71. Town of Claremont
72. Town of Nedlands
73. Two Rivers Catchment Group Inc
74. University of Western Australia
75. Urban Bushland Council of WA
76. Urban Development Institute of Australia (WA)
77. Waste Management Association of Australia
78. Water Corporation
79. West Australian Planning Commission
80. Western Australian Fishing Industry Council
81. Western Suburbs Regional Organisation of Councils
82. Wheatbelt NRM
83. Wildflower Society of WA
84. Wines of WA
85. World Wildlife Fund

## SWAN REGION STRATEGY FOR NRM

### 5.2 Swan NRM Committee members (as at December 2014)

Representative	Organisation
Barbara Cook	University of Western Australia
Belinda Robson	Murdoch University
Don Cummins	Department of Water
Garry English	Chair, Swan NRM Committee
John Brinkman	Department of Aboriginal Affairs
John Holley	State NRM Office
Julia Beijeman	WA Local Government Association
Julie Robert	South East Regional Centre of Urban Landcare
Karen Warner	Eastern Metropolitan Regional Council
Lisa Potter	Perth NRM
Mark Cugley	Swan River Trust
Marko Pasalich	Department of Environment Regulation
*Michael Grasby	Department of Agriculture (Commonwealth)
Mike Burbridge	Curtin University
Neil Riches	Department of the Environment (Commonwealth)
Nick Abraham	South West Aboriginal Land and Sea Council
*Paul Bowers	Department of Prime Minister and Cabinet
Peter Nash	South West Group
Peter Neville	Department of Health
Phil Shaw	Department of Fisheries
Ray Froend	Edith Cowan University
Rod Safstrom	Department of Agriculture and Food WA
Rosanna Hindmarsh	Ellen-Brockman Integrated Catchment Group
Simon Taylor	Department of Premier and Cabinet
Stefan de Haan	Department of Parks and Wildlife
Steve Dorricott	Water Corporation
Thomas Wilson	Urban Development Institute of Australia (WA)
Vivienne Panizza	Department of Planning

\*Members who have since retired from their organisations and the Swan NRM committee

### 5.3 Summary of Public Submissions

#### 5.3.1 Introduction

On the 5th of December 2014, Perth Region NRM released the Consultation Draft for the Swan Region Strategy for Natural Resource Management ('the Strategy'). Community groups, organisations and individuals were invited to make submissions on the draft Strategy, which was published on the Swan Region Strategy webpage, along with the draft Monitoring, Evaluation, Reporting and Improvement (MERI) Plan. Submissions were able to made either online, via the strategy email address or by post. The closing date for submissions was the 6th of February 2015.

To support the public comment period two community information sessions and one local government forum were held in early December. The sessions were an opportunity for community members and key stakeholders to find out more about the Draft Strategy and also provide initial feedback. A total of 45 community members attended the community sessions and 18 local government staff attended the local government session.

#### 5.3.2 Submissions received

A total of 41 submissions were received during the public comment period, either as formal submissions, letters of support or informal feedback and comments. All feedback provided during the public comment period has been included in the summary of responses below.

Organisation/Individual	Number of Submissions
Private Submission	5
Local Government	11
Regional/voluntary council organisation	2
State Government agency or organisation	14
Industry/Professional	3
Community Group	2
State Government Minister	4
<b>Total</b>	<b>41</b>

Table 1: Submissions received by Perth NRM

#### 5.3.3 Feedback Summary

The majority of submissions expressed their support for the Strategy and the framework presented.

*"The document captures the complexity of NRM in the Swan Region, the aspirations of its people and industries, and the actions required to address the issues that threaten the health and integrity of the region's natural assets".*

*"The strategy provides a comprehensive framework to support integrated and coordinated planning and delivery of natural resource management activities in the Perth region".*



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### 5.3.4 Aspects of the Strategy that are supported

The key aspects of the Strategy that received the most support are:

- the change from an asset-based approach to an integrated, systems approach;
- the comprehensive analysis of the key issues and challenges for NRM in the Swan Region;
- the strategic framework and the vision, goals and aspirations for the region;
- the promotion of environmental accounting methods; and
- the eco-city concept.

### 5.3.5 Recommended changes to the strategy

The aspects of the Strategy that respondents felt needed further definition and elaboration were related to governance and implementation. For the community and local government, certainty around the funding for NRM activity in the region was a priority. For organisations and groups involved in the Swan NRM Committee, it was certainty around the role of the committee into the future and how this relates and interacts with the broader State NRM framework.

There is broad support for the eco-city concept but there is a sense that the vision of success needs to be more clearly articulated and effectively weave together environment, economy, society and culture (including Aboriginal cultural heritage). There is also a need to include a clear definition of sustainability and ensure there is a focus on native biodiversity when looking at green infrastructure in the urban landscape.

Theme	Recommended Changes
1. Funding	<ul style="list-style-type: none"><li>• Propose a funding model that can ensure the Strategy is implemented.</li><li>• Identify strategies for attracting more funding for NRM, particularly from State and Federal Government.</li><li>• Include the need for advocacy to secure sustainable Federal and State Government funding and other financial initiatives for environmental programs such as crowd funding, business partnerships and incentives.</li><li>• Clearly communicate the declining trend in NRM funding and what the implications and risks are (eg loss of Perth Biodiversity Project)</li><li>• Seek a substantial State Government commitment to a funding program.</li></ul>
2. Implementation	<ul style="list-style-type: none"><li>• Identify and address the possible barriers to implementation.</li><li>• Address potential implications of local government reform.</li><li>• Outline the approach to ensuring the Strategy will become a priority for all levels of government</li><li>• Encourage stakeholders to actively participate in undertaking agreed responsibilities and actions identified in the Implementation Plan</li><li>• Ensure that the identification of high value assets/environmental priorities includes consultation with the community.</li><li>• Include a stronger communication element in the Strategy that goes beyond reporting and seeks to encourage and enthuse.</li></ul>

Table 2: Summary of the changes to the Strategy recommended by respondents

## SWAN REGION STRATEGY FOR NRM

Theme	Recommended Changes
3. Endorsement ownership and commitment	<ul style="list-style-type: none"> <li>Secure State Government support, participation and endorsement of Strategy and agreed action.</li> <li>Include actions for enhancing the State NRM framework and ensure better organisational alignment.</li> <li>Seek recognition of the Strategy in the State NRM Plan.</li> <li>Enhance the role of the Swan NRM Committee. Review its terms of reference, membership and representation to ensure that it maximises its capacity to support the collaborative and coordinated implementation of the Swan Region NRM Strategy.</li> </ul>
4. Eco-city	<ul style="list-style-type: none"> <li>Ensure reference to eco-city refers to the environment, economy and society equally and as a holistic concept.</li> <li>Create an inspirational and tangible vision of the Strategy that the community can engage with.</li> <li>Incorporate an indigenous element into the eco-city approach to ensure that the design outcome includes native species.</li> <li>Incorporate water sensitive cities into the eco-city vision.</li> <li>Convey the fact that Perth has come a long way in terms of water sensitive urban design and the reduction of domestic use.</li> </ul>
5. Land use planning	<ul style="list-style-type: none"> <li>Highlight the urgent need to address land use planning issues and the extent to which it can make or break effective NRM.</li> <li>Highlight the risk of inappropriate development along foreshore areas that are natural mosquito breeding grounds and how this needs to be addressed in land use planning.</li> <li>Highlight the need for greater support from State Government to enable local government to manage development proposals.</li> </ul>
6. Climate Change	<ul style="list-style-type: none"> <li>Make reference to the extensive work that DoW are doing in this area.</li> <li>Make reference to the fact that climate change causes coastal erosion as well as inundation, and that it can slower the expression of salinity.</li> <li>Include a summary of the climate change risk assessment.</li> </ul>
7. History and context	<ul style="list-style-type: none"> <li>Outline the current situation with NRM, what worked with the 2004 Strategy, what didn't and how this will be addressed in the new Strategy.</li> <li>Provide a sense of the long history of NRM in the region and what the achievements and significant environmental events have been.</li> </ul>
8. Environmental accounting	<ul style="list-style-type: none"> <li>Describe how you might widely implement adding a dollar value to the environment in Perth.</li> </ul>

Table 2: Summary of the changes to the Strategy recommended by respondents

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Theme	Recommended Changes
9. Drainage and water quality	<ul style="list-style-type: none"> <li>• Include more information about the identification and improvement of drainage networks throughout the region. Highlight urban waterway renewal and drainage nutrient intervention concepts and discuss how these could be resourced in consideration of limited funding opportunities. Ensure these link to the Healthy Rivers Action Plan and the Swan Canning Water Quality Improvement Plan</li> </ul>
10. Enforcement and regulations	<ul style="list-style-type: none"> <li>• Add that DER is the lead agency for enforcing the Unauthorised Discharge Regulations (UDR) and that UDR are more useful as an infringement tool rather than a pollution prevention method.</li> </ul>
11. Legislation	<ul style="list-style-type: none"> <li>• Highlight that some areas completely lack specific legislation.</li> </ul>
12. High quality agricultural land (HQAL)	<ul style="list-style-type: none"> <li>• Include reference to the SPP2.5 which allows for the protection of HQAL from urban development, and applies to rural zoned land within the Perth region.</li> <li>• Clearly distinguish between land that has been identified as HQAL and other agricultural land.</li> </ul>
13. Nutrient export	<ul style="list-style-type: none"> <li>• More clearly articulate the link between export of nutrients on agricultural land and water quality, and the fact that urban sprawl impinging on HQAL means that farming is occurring on low fertile areas where more fertilisers are needed.</li> </ul>
14. Wetlands and environmental flows	<ul style="list-style-type: none"> <li>• Include the work that Water Corp is doing to provide water for the environment through riparian release to replenish wetlands and maintain river flows.</li> <li>• Include description of Conservation Category wetlands.</li> </ul>

Table 2: Summary of the changes to the Strategy recommended by respondents

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### 5.4 English translations of Noongar place names

Aboriginal Place Name	Meaning	Non-Aboriginal Place Name
Beeragunning	An area for hunting Yakkan (turtle)	Soldier Swamp South Guilford
Chittering	The Place of Djidi djidi (the Willy-Wag Tail)	Chittering
Derbal Yaragan	A main fishing area	Swan River Estuary
Djarlgarra Bilya	Djarlgarra River	Canning River
Gabbiljee	The watery place at the end of the River	Bull Creek
Gabee warden Kuranup	The Water (the sea)	Indian Ocean
Gargangara	Uncertain	Northern Armadale Area
Gnangarra	Spring or stream*	Gnangarra Water Mound
Goodinup	An area for good camping	Perth City - west end
Goolamrup	A place of young man	Kelmscott area
Gyunning	Uncertain	Ellen Brook
Jandakot	Place of whistling eagle*	Jandakot Water Mound
Karbomunup	Black Hill	Mount Claremont
Mandalup	The Place of Small Marsupials	Claire Brook
Mandoon	A place of many trees	Guildford section of the Helena Valley
Munjallina	A place of moyootj (swamp pools)	Mundaring
Ngooloormayup	Place of little brother*	Carnac Island
Wajemup	The place across the water	Rottne Island
Wallyalup	The Place of Waalitj (the Eagle)	Inland Fremantle
Walyubup	The Place of the Woyli (kangaroo rat)	Willis Point
Walyunga	Uncertain	Walyunga
Wurdaatjus	A place of djanak (bad spirits)	Jane Brook
Wurerup	Uncertain	Upper Swan
Yorgarin	The Place of Djirridj (zambia plants). A hunting area for Yonga (kangaroo).	Kings Park

[Source: Swan River Trust (2010) Indigenous history of the Swan and Canning rivers]

[Source: South West Aboriginal Land and Sea Council (2011) Noongar Wangkinyiny]

### 6. Glossary

**Air** - the surrounding outside air that is found within the Region.

**Air quality** - the condition of the air we breathe compared to measured acceptable guidelines such as the National Environmental Protection Measure (NEPM) guidelines.

**Amenity** - a concept expressing those natural or man-made qualities of the environment from which pleasure, enrichment and satisfaction is derived.

**Aquifer** - porous soil or geological formation capable of being permeated by water, which holds and yields groundwater.

**Asset-based approach** - the identification of values, threats and condition of the assets to enable management activities to be focused on the protection of high value natural resource assets.

**Best Management Practice (BMP)** - the best practicable methods of meeting natural resource management objectives.

**Biodiversity** - the variety of all life forms including the different plants, animals and micro-organisms and the genes they contain, and the ecosystems of which they form a part.

**Biodiversity Hotspot** - where exceptional concentrations of endemic species are undergoing exceptional loss of habitat.

**Biosecurity** - refers to a set of measures designed to protect the land from harmful pests, diseases, weeds and unwanted animals.

**Capacity Assessment** - an assessment (usually via questionnaire) of human, social, financial and organisational capital to determine an individual or group's capacity to undertake natural resource management.

**Coastcare** - a national network of community environmental 'care' groups that focus on coastal environments.

**Cultural heritage** - in relation to a place, the relative value which that place has in term of its aesthetic, historic, scientific or social significance, for the present community and future generations.

**Degradation** - any decline in the quality of natural resources commonly caused by human activities.

**Eco-city** - (ecological) cities that enhance the well-being of citizens and society through integrated urban planning and management that fully harnesses the benefits of ecological systems, and protects and nurtures these assets for future generations.

**Ecological footprint** - the ecological impact of cities, including the direct local effects and the indirect regional and global effects due to the resources they use and the wastes they produce.

**Ecologically sustainable development (ESD)** - using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and into the future, can be increased.

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**Ecosystem** - unit including a community of organisms, the physical and chemical environment of that community, and all the interactions among those organisms and between the organisms and their environment.

**Ecosystem services** - the benefits provided to humans through the transformation of resources (or environmental assets, including land, water, vegetation and atmosphere) into a flow of essential goods and services e.g. clean air, water, and food.

**Endangered species** - those species likely to become extinct unless actions are taken to remove the factors that threaten their survival.

**Endemic** - originating in a given area and confined to that area.

**Endemism** - native species that are distributed within a limited geographical range.

**Erosion** – the process by which soil particles are detached and transported to other locations by water, wind or waves. Erosion is a natural process but is often intensified by human land use practices.

**Eutrophication** - an increase in the rate of supply of organic matter to an ecosystem caused by unnaturally high loads of nutrients to that ecosystem.

**Evaluation** – the systematic review of a program, project, strategy or other activity to determine its effectiveness, efficiency, appropriateness and impact. Evaluation involves collecting and analysing information to make judgements and recommendations for future action.

**Exotic plants and animals** - introduced plants or animals not indigenous to the natural environment.

**Extinct** - species no longer in existence or not located in the wild during the past 50 years.

**Fauna** - the animals inhabiting an area; including mammals, birds, reptiles, amphibians and invertebrates (such as insects, spiders and crustaceans).

**Flora** - the plants growing in an area, including flowering and non-flowering plants, ferns and mosses. Usually restricted to species occurring naturally and excluding weeds.

**Groundwater** - water which occupies the pores and crevices of rock or soil.

**Habitat** - the environment or place where a plant or animal grows or lives (includes soil, climate, other organisms and communities).

**Hydrological cycle** – a bio-geochemical cycle that collects, purifies and distributes the Earth's fixed supply of water from the environment to living organisms, and then back to the environment.

**Indicator** – a measurement that can be repeated over time to track changes in the condition of a resource or environmental asset, a management practice or a social or economic process.

**Integrated natural resource management** – a process of managing natural resources in a systematic and holistic way, with coordination across different agencies and organisations, and across different land tenures and geographical boundaries.

**Land capability** - the ability to sustain a particular land use without the land suffering long-term damage.

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**Land suitability** - the potential uses of the land based upon consideration of prevailing physical, technical and socio-economic conditions.

**Land use** – describes the activities that occur on land, such as agriculture, energy production, human settlements, transport, forestry, mining and conservation.

**Landscape** - all the natural features of land or territory encompassed in a single view (e.g. fields, hills, forests and water), which distinguish one part of the Earth's surface from another.

**Landcare** - a national network of community environmental 'care' groups.

**Leeuwin current** - tropical warm waters moving in a southerly direction from Indonesia-New Guinea down the coast of Western Australia.

**Market-based mechanisms** - Instruments or regulations that encourage behaviour through market signals rather than through explicit directives.

**Micro-organisms** - microscopic organisms that cannot be considered to be plants or animals, including most fungi species, bacteria, algae, water moulds and most lichen species.

**Monitoring** – the regular gathering of information in a consistent manner to track progress or changes over time.

**Natural resources** – the land, water, air, natural diversity (physical and biological) and the systems they form.

**Natural resource management** – the management of any activity that uses, develops or conserves natural resources.

**Nitrogen dioxide (NO<sub>2</sub>)** - a gas and air pollutant; motor vehicles are the main source in metropolitan areas.

**Offset** – in this Strategy the term offset refers to measures that are taken, usually as a requirement under planning or conservation law, to compensate for the environmental impacts of a development or other land use action.

**Particulate matter** - solid particles or liquid droplets suspended or carried in the air.

**Photochemical smog** - smog forming in the lower atmosphere through the action of sunlight on the pollutants oxides of nitrogen and hydrocarbons.

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

**Renewable energy** – any source of energy that can be used without depleting its reserves.

**Reserves** – areas of protected landscapes or ecosystems. Reserves can be marine or terrestrial and informal or formal (statutory reserves).

**Resilience** – the ability to absorb disturbances, or the ability to recover from or adjust easily to misfortune or change. Resilience can refer to natural systems (i.e. species or ecosystems) and human social systems.



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**Resource Condition** - the current status of a particular habitat or environment, in reference to the “health” of that system, and the ability of that system to tolerate impacts without significantly altering the system.

**Riparian vegetation** - vegetation situated on or belonging to a river or stream bank.

**Salinity** - the accumulation of excessive salts in land and water at sufficient levels to have an impact on human and natural resources (plants, animals, aquatic ecosystems, water supplies, agriculture or infrastructure).

**Sector** - a specific section of the community, such as state government, local government, industry, public land managers, the ‘care’ community, the Aboriginal community.

**Sedimentation** - material of varying size, both mineral and organic, deposited away from its site of origin by the action of water, wind gravity or ice.

**Soil acidification** - a gradual increase in the acidity of a soil as a consequence of a variety of natural processes and management actions.

**Swan Region (the ‘Region’)** – the area of southern Western Australia that includes the Perth Metropolitan area, the Swan and Canning river catchments and extends three nautical miles offshore.

**Stakeholders** – agencies, organisations and individuals responsible for managing the Region’s natural resources.

**Strategic Assessment** - Strategic assessments are landscape scale environmental assessments and unlike project-by-project assessments, which look at individual actions (such as construction and operation of a pipeline or wind farm), they can consider a much broader set of actions. For example, a large urban growth area that will be developed over many years, or a fire management policy across a broad landscape.

**Systems thinking** - is the process of understanding how things influence one another within a whole.

**Threatened species or ecological communities** – species or communities listed under state or Commonwealth legislation that need to be specially protected because they are under identifiable threat of extinction, are rare, or otherwise in need of special protection.

**Water abstraction** - the removal of water from a natural water body for human use.

**Water quality** - the physical, chemical and biological measures of water.

**Water resources** - includes all wetlands, waterways and groundwater resources in the Region. Includes reference to water supply, habitat and biophysical processes, and includes the biotic and abiotic elements of waterways, wetlands and groundwater.

**Waterways** - all streams, creeks, rivers, estuaries, coastal lagoons, inlets and harbours.

**Wetland** - areas that are permanently, seasonally or intermittently waterlogged or flooded.

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