OCTOBER 2005

FINAL REPORT

Busselton WetLands

CONSERVATION STRATEGY

GOVERNMENT OF WESTERN AUSTRALIA

Western Australian Planning Commission
50 years spatial planning

Busselton wetLands

CONSERVATION STRATEGY

Final

OCTOBER 2005

Prepared by

Western Australian Planning Commission
in association with

Department of Conservation and Land Management
Department of Environment
Department of Agriculture
Water Corporation
Shire of Busselton
GeoCatch

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50 years spatial planning

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Minister's foreword

Judy Edwards

Alannah MacTiernan

The Busselton Wetlands are a chain of coastal wetlands of local, regional and international significance that is reflected in the listing of a large portion of the wetlands under the Ramsar Convention.

Possessing important conservation, landscape, agricultural, heritage and amenity values the Busselton Wetlands provide unique and diverse habitats of flora and fauna.

The Busselton Wetlands Conservation Strategy is a balanced and integrated approach that will guide land use planning and management in the study area to sustain and enhance their conservation values.

The strategy will also ensure the wetlands are suitably protected from urban expansion pressures and inappropriate agricultural practices.

Containing objectives, strategies and implementation recommendations the strategy provides guidance for the sustainable land use and wise management of the area's resources and biodiversity.

Additionally, the strategy provides a framework for future management planning of the publicly owned wetlands, and land to be vested in the Conservation Commission.

The strategy will help fulfil environmental conditions associated with the Port Geographe project and help meet international obligations under the Ramsar Convention while promoting sustainable conservation and land use for the benefit of the environment and current and future generations.

An historic relationship exists between the wetlands and broad-acre grazing land. The importance of the past and ongoing contributions of rural landowners in maintaining and enhancing the conservation values of the wetlands is recognised in the strategy.

Integrated catchment management planning for the Geographe Bay catchment that addresses land use and land management challenges is being coordinated by GeoCatch and implemented through the Geographe Catchment Management Strategy. The Busselton Wetlands Conservation Strategy complements this catchment management strategy.

Our thanks are extended to the many people who have contributed to development of this important strategy including landowners, community members, the steering committee and the technical working group.

Judy Edwards

Hon Dr Judy Edwards MLA
Minister for the Environment

Alannah MacTiernan

Hon Alannah MacTiernan MLA
Minister for Planning and Infrastructure

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Summary

In granting approval to the Port Geographe project in 1990 the then Minister for the Environment required the preparation of a conservation strategy. Subsequently, it was agreed that the Western Australian Planning Commission would prepare the conservation strategy in conjunction with the Department of Conservation and Land Management, together with other key agencies, the Shire of Busselton, community groups and land owners. The Busselton Wetlands Steering Committee has overseen the preparation of the Strategy, assisted by a Technical Working Group.

In addition, the Geographe Catchment Council (GeoCatch) has provided significant support and assistance. In particular, GeoCatch has added local knowledge and expertise, and financially contributed to community consultation.

Purpose

The purpose of the Strategy is to provide a framework to guide sustainable land use and wise management of the biodiversity and environmental values of the Busselton Wetlands area. The Strategy will also guide management planning for the publicly owned wetlands area to be vested in the Conservation Commission.

Study Area and Planning Context

The study area extends approximately 25 kilometres behind the narrow coastal dunes running along Geographe Bay and includes the Vasse-Wonnerup estuaries and the New River and Broadwater wetlands (see figure 2).

The wetlands are of local, regional and international significance for waterbirds. Each year some 90 species of birds — 30,000 in number — nest in or visit this area. A large portion of the Vasse-Wonnerup estuaries is listed under the Ramsar Convention, which is an intergovernmental treaty aimed at the conservation of wetlands of international significance and the wise use of wetlands generally. The Ramsar Convention and the Ramsar principles of wise use of wetlands strongly influence this Strategy.

The concept of 'sustainability' is central to the Strategy. The concept, as established in the *State Planning Strategy,* provides direction for State strategies regarding balance between economic growth and the conservation and enhancement of our natural environment to provide a better quality of life for present and future generations. The conservation of biological diversity is paramount in the drive for sustainability.

The Busselton Wetlands lie within the Geographe Bay catchment. An integrated catchment management strategy has been prepared for this catchment: the *Geographe Catchment Management Strategy*. The significant biodiversity and environmental values of the Busselton Wetlands have been established and the need for a conservation strategy recognised.

Also, the wetlands lie close to the Busselton townsite, which is one of Australia's fastest growing centres and the 'gateway' to the South-West Region. The study area is subject to development pressures. Extensive areas around the wetlands have been cleared for agriculture and form a scenic rural landscape backdrop to Busselton's urbanised areas.

Key Issues

The key issues identified during community consultation conducted as part of the preparation of the Strategy are as follows:

- ***Water-Levels and Water Quality:*** The need to optimise management of water-levels, in particular management of drainage and the floodgates, and the management of water quality regimes and the fringing margins of the wetlands to ensure that biodiversity and health of the wetland system is maintained or enhanced.
- ***Agricultural Land Use and Land Management:*** The continuity of broad-acre farming near the wetlands and the need to promote sustainable agricultural land use which has acceptable or beneficial impacts on the wetlands and which enables conservation of the biodiversity and environmental values of the wetlands area.
- ***Urban:*** Land use competition between the pressures of urban expansion and existing agricultural land uses, and the need to address issues associated with the impacts of urban and industrial activities on the wetlands are a concern. This issue relates to the control of land use and development around the wetlands to ensure the conservation of the biodiversity and environmental values.
- ***Heritage, Education and Ecotourism:*** The Busselton Wetlands is a wonderful heritage, education and ecotourism asset in the region. Issues relate to the need to recognise Aboriginal and non-Aboriginal heritage values, the need for controlled public access to specific wetland sites, the management of those sites to avoid unacceptable impacts on waterbird nesting and breeding areas, and the need to raise awareness of the natural values and attributes of the wetlands.
- ***Amenity:*** Amenity issues that were raised overlap with the issues above. Specific amenity issues relate to maintaining or enhancing the visual landscape character of the wetlands; to concerns about seasonal drying out of the wetlands and the resultant odour problems; and to seasonal excessive mosquito and midge numbers.

Implementation

The success of the Strategy's implementation lies in its acceptance by the local community and a structured decision-making process. The preferred method of Strategy implementation is as follows:

Government Agencies

Implementation will be largely effected through the agencies listed as having carriage of each of the recommended Guidelines and Actions (see Sections 2.3 and 2.4). These agencies have various roles to play in planning for the environmental, social and economic sustainability of the area.

Landowners

The Strategy recognises the past and ongoing contribution of rural landholders in maintaining the conservation values of the wetlands. The Strategy acknowledges and encourages the voluntary work that landowners do in relation to conserving and enhancing wetland values.

Community Groups

The Strategy also acknowledges and encourages the voluntary work that community members do in relation to conserving and enhancing wetland values. In addition, it is recommended that the Strategy supports the establishment of Friends of the Busselton Wetlands Groups to assist in this work through co-ordination and promotion of positive actions, and access to funds for such.

Statement of Planning Policy

Notwithstanding the role that individual agencies, landowners and community groups may play in implementing the recommended strategies, guidelines and actions contained in Sections 2.3 and 2.4, it is recommended that a Statement of Planning Policy (SPP) under Section 5AA of the *Town Planning and Development Act 1928* be prepared in consultation with landowners, community groups and relevant agencies. An SPP can provide a statutory basis for implementation of the Strategy. However, an SPP should be supported by the actions of relevant agencies, landowners and community groups.

Busselton Wetlands Conservation Strategy Implementation Committee

An implementation committee should be formed to oversee the implementation of the Strategy, including co-ordination between all affected parties. The committee could set priorities and report annually to relevant agencies, landowners and the community.

Technical Advisory Group

A Technical Advisory Group (TAG) consisting of a group of technical officers should be convened as appropriate to consider specific contentious proposals to ensure that all relevant agency groups are brought together to consider such in a timely way and to assist the Shires of Busselton and Capel regarding the technical resources burden. This group could also consider issues or implementation difficulties that may arise and report its findings to relevant agencies or authorities as appropriate.

Co-ordination Officer

It is recommended that an officer be appointed to a relevant agency with prime responsibility for co-ordinating the implementation of the Strategy and disseminating scientific information regarding the Busselton Wetlands. Although lead agencies have been nominated for the majority of the guidelines and actions, successful implementation will be facilitated by such an officer, appointed on a full-time, two-year limited tenure basis.

Monitoring and Review

The Strategy should be the subject of ongoing monitoring and amended as required. To maintain the relevance of the Strategy, it should be reviewed every five years.

Additionally, an evaluation or measure of the success of implementation should be reported annually to relevant agencies and the community.

The information gaps and further research needs identified in the report should be rigorously pursued and incorporated in the Strategy where appropriate.

How to Read the Strategy

The key chapter in this document is Chapter 2. This chapter addresses the issues and aims to present a balanced and integrated strategy to guide land use planning and management in the study area, consistent with responsible management of the natural environment. Chapter 2 should be read in conjunction with Figure 1 - 'Strategy Land Use Plan' and the format and components of the Chapter are outlined below.

Chapter 3 describes the natural and cultural landscape.

Chapter 4 describes the existing planning context. This chapter highlights the national, State and local non-statutory and statutory background which has planning and environmental implications for the Strategy area.

Chapter 5 describes the issues and actions raised in community consultation (see 'Key Issues' above). The issues and actions were categorised and the same categories were used in Chapter 2 to facilitate cross-referencing between these chapters.

Chapter 2: The Stategy

The format and components of Chapter 2 include the following:

- Vision Statement;
- Overall Objectives;
- Statement of Intent for each key issue, which provides the guiding intention and direction for the General Strategies;
- General Strategies, which respond to the key issues affecting the study area;
- Precinct Strategies, which provide additional strategies for distinct portions of the study area;
- Guidelines and Actions, which provide implementation recommendations; and
- Planning and Environmental considerations, which should be considered by proponents of subdivision, development or change of land use within the study area and in the assessment of such proposals.

These components should be read together with the Strategy Land Use Plan.
An example of this format is provided in Table 1 (see page xv).

Vision Statement

The Vision is to achieve:

> *Ecologically sustainable land use activities and wise management of the natural resources of the area to maintain and enhance conservation of the biodiversity, environmental and landscape values of the Busselton Wetlands area, both now and in the future.*

Overall Objectives

The overall objectives of the Strategy, largely derived from community consultation, are listed below (not ranked in order of importance) to:

- Provide a framework for the conservation of the environmental, ecological, recreational, productive and landscape values of the wetlands to complement a CALM management plan for the proposed wetlands reserve.
- Provide for the protection and enhancement of flora and fauna habitat, particularly for waterbirds.

- Reflect broad community attitudes and aspirations for the future of the wetlands environment.
- Encourage implementation of new recommendations on the optimal water-levels and water quality regimes for the wetland system.
- Encourage and promote management of weeds, feral animals and nuisance insects within the wetlands environment.
- Establish a broad land use planning and land management framework to enhance the wetlands environment.
- Provide an acceptable balance between conservation objectives and the aspirations of landholders, including ongoing productive agricultural uses.
- Promote awareness and understanding of the ecology and nature conservation values of the wetland system.

Overview of Strategy Recommendations

The Strategy aims to address the issues raised in community consultation and aims to present a balanced and integrated strategy to guide land use planning and management in the study area, consistent with responsible management of the natural environment.

The Strategy provides ***General Strategies*** which respond to the key issues. For convenience, the issues have been categorised into the following topic headings:

- water-levels and water quality regimes
- agricultural land
- urban and rural residential land
- heritage, education and ecotourism
- amenity.

In addressing the above issues, the Strategy provides strategies applicable to the study area, coupled with guidelines and actions to ensure conservation of the biodiversity and environmental values of private land and Crown land adjoining the wetlands. Also, the Strategy provides a framework for the preparation of management plan(s) for reserves adjoining or near the wetlands.

In addition, the Strategy responds to the need for specific strategies to address issues for distinct portions of the study area. The study area has been divided into six precincts. Each precinct is further divided into areas where the General Strategies need to be supplemented with more precise land use strategies and actions to address particular issues. The precincts are:

- *Wonnerup Estuary*
- *Vasse Estuary*
- *Coastal*
- *Town*
- *New River*
- *Broadwater*

Table 1: How to read the Strategy Framework

The following example of the strategy framework is for General Strategies 'Water-levels and Water Quality Regimes' which should be read in conjunction with the Vision Statement, Overall Objectives, and Guidelines and Actions:

General Strategies (examples)	Planning and Environmental Considerations (examples)	Guidelines and Actions (examples)
This Strategy supports management of the water-levels and water quality of the Busselton Wetlands which conserve and enhance the biodiversity and ecosystem functions of the wetlands. This Strategy supports the creation of environmental buffers of locally indigenous native vegetation in fringing areas of the Busselton Wetlands and associated watercourses. Proposals for subdivision and development adjacent to, or in the vicinity of, the wetlands should be assessed for their compatibility with wetland conservation.	Ramsar Convention. EPA *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992.* EPA *draft Environmental Protection (Swan Coastal Plain Wetlands) Policy 2004.* *Geographe Catchment Management Strategy, 2000.* Community and scientific expertise on appropriate water-levels and water quality regimes of the wetlands. DoE water quality information. Impacts of high and low water-levels on fringing vegetation and wildlife. Conservation of wetland habitat and fringing remnant vegetation. Relationship between water-levels and water quality regimes, development and nuisance insects. Flood mitigation, drainage management, existing drains and the floodgates (operation and upgrading). Effect of land use activities in the upper catchment e.g. clearing, run-off of excess nutrients and storm water management. The impacts of increased salinity. The effects of water pollutants e.g. petrol, oil and industrial wastes.	DoE, in conjunction with CALM, WC and the local government should establish environmental 'targets' for 'optimal' water-level and water quality regimes. The WC, in consultation with relevant agencies and the local community, will: operate and manage the floodgates to maintain the existing salinity regime (fresh-brackish) of the Vasse-Wonnerup estuaries; and operate and manage the diversion drains to ensure adequate flood protection for Busselton's urban areas and to ensure the water-levels and water quality regimes of the wetlands conserve and enhance the biodiversity and environmental functions of the Busselton Wetlands **(ST)**. CALM, in conjunction with relevant agencies, and in consultation with community groups, will prepare and implement a management plan to protect habitats for those wetlands to be vested in the Conservation Commission in accordance with the *Conservation and Land Management Act 1984 as amended.* The management program should be reviewed every ten years. **(MT)** The Shires of Busselton and Capel, WC, CALM, DPI and other relevant agencies are requested to integrate sustainability principles and the Ramsar principles of 'wise use' in relation to maintaining and enhancing the biodiversity, environmental and landscape values of the Busselton Wetlands area into their maintenance, operational and capital works programs. **(ST)** Land Conservation District Committees (LCDCs), other community groups including school groups, GeoCatch and relevant agencies should foster collaborative partnerships to lift awareness of and provide access to relevant wetland information and activities to facilitate the conservation of flora, fauna and habitat values. **(ST)**

Note: **(ST)** = Short Term 0 – 2 yrs
(MT) = Medium Term 3 – 10 yrs

Introduction 1

Photo courtesy: Jim Lane, Department of Conservation and Land Management

Busselton Wetlands looking west towards the townsite.

Introduction 1

Preamble

The Vasse-Wonnerup estuaries, the Broadwater and New River wetlands are located near the township of Busselton, in the South-West Region of Western Australia (see Figures 2 and 3). The wetlands are predominantly in the Shire of Busselton with the northern portion extending into the Shire of Capel. These wetlands form the focus for the Busselton Wetlands Conservation Strategy ('the Strategy').

The coastal chain of wetlands is of local, regional and international significance for waterbirds, as reflected by the listing of a large portion of the wetlands under the Ramsar Convention (see Section 1.3 and Appendix 3). The area features tens of thousands of resident and migrant waterbirds of a wide variety of species and the largest breeding colony of Black Swan in South-Western Australia.

Located within the Geographe Bay catchment (see Section 3.1 and Figure 4), the wetland system forms an extensive, shallow, nutrient-enriched system with widely varying salinities. Historically, the wetlands received considerable flows from the catchment. However, extensive modification to the natural pattern of drainage has reduced flows (see Section 3.9).

The wetlands and the adjoining farmland provide a scenic backdrop to the urbanised area of Busselton. The study area possesses significant heritage and landscape values and presents a range of issues and opportunities to conserve and enhance these values, in balance with the social and economic goals of the community. The wetlands provide vital and unique habitats to local flora and fauna; a hydrological function in collecting water during storm events; flood protection; opportunities for biodiversity conservation, for sustainable land use; and for wise management of resources, recreation, education, ecotourism and landscape amenity protection.

In granting approval to the Port Geographe project in 1990, the (then) Minister for the Environment required that a conservation strategy be prepared for the Vasse estuary. Subsequently, it was agreed that a Strategy would be prepared by the Western Australian Planning Commission (WAPC) in a co-operative arrangement with the Department of Conservation and Land Management (CALM), together with key agencies (represented in the Technical Working Group), and in consultation with the Shire of Capel, landowners and community groups. The Busselton Wetlands Steering Committee is overseeing its preparation and, with assistance from the Technical Working Group, and will oversee its finalisation, including reviewing public submissions, (see Section 1.4).

1.2 Purpose of the Strategy

The Strategy provides direction for sustainable land use and wise management of the natural resources, including biodiversity of the Strategy area. Subsequently, management planning will be undertaken for the publicly owned wetlands area to be vested in the Conservation Commission (in accordance with the *Conservation and Land Management Act 1984*, as amended). The management plan(s) should complement the Strategy and address issues affecting areas where the Department of Conservation and Land Management has authority.

The driving focus of responsible planning is to provide for a sustainable future which ensures the conservation of our environmental assets and the wise management of our resources, while encouraging ecologically sustainable development.

The concept of 'sustainability,' as established in the *State Planning Strategy* (see Section 4.2.1) and WA State Sustainability Strategy (see Section 4.2.2), central to the Busselton Wetlands Conservation Strategy, relates to the wise management of our natural environment and resources. The *State Planning Strategy* provides strategies that ensure a balance between economic growth and the conservation and enhancement of our natural environment to provide a better quality of life for present and future generations. Necessary, in the drive for sustainability, is the conservation of biodiversity. Biodiversity underpins ecological processes which are essential for soil fertility and clean, fresh water and air. Biodiversity is also fundamental to the quality and character of the

landscape and in providing recreational opportunities and cultural identity. These principles are also reflected in the WAPC Environment and Natural Resources Statement of Planning Policy (see Section 4.2.3).

The Strategy recognises the past and ongoing contribution of rural landholders in maintaining the conservation values of the wetlands. It also recognises existing statutory and non-statutory policies, strategies and plans that affect the wetlands. These are considered (see Chapter 4) and have influenced the Strategy (see Chapter 2).

1.3 The Study Area

1.3.1 Location

The study area is located in the South-West Region of Western Australia. It lies on the Swan Coastal Plain and within the Geographe Bay catchment (see Figures 2 and 4, and Sections 3.1 and 3.2). The study area includes the Busselton Wetlands and the adjoining 'Agriculture', 'Rural Residential' and 'Conservation' zoned land (see Figure 9). Part of the Busselton urban area adjoins the study area.

The study area is bounded by:

- The Shire of Busselton 'Landscape Value Area Line' to the north of the Broadwater nature Reserve;
- Buayanyup Drain to the west, where it trends towards Margaret River, the bypass road and Bussell Highway to the south;
- Forrest Road to the east; and
- Layman Road and the coast to the north.

1.3.2 Description of the Wetlands

Within the study area, the wetland system is approximately 1.5 kilometres wide, extending approximately 25 kilometres behind the narrow coastal dunes running along Geographe Bay (see Figure 2). The overall area is approximately 2,500 hectares and includes those areas that contain natural vegetation fringing the wetlands. The core wetland area is located within the 1:100 year floodline. The wetlands, shown in blue in Figure 2, approximate the annually inundated open water area.

The Vasse, Wonnerup, New River and Broadwater wetlands are the main waterbody features in the study area. Extensive clearing of the surrounds of the wetlands has occurred. The natural hydrology of the wetlands has been altered by, for example, modification of the natural drainage network in the catchment, primarily by the construction of drains that divert water away from the estuaries and by the construction of the 'floodgates', which has significantly altered the Vasse-Wonnerup estuaries (see Sections 3.9 and 5.1).

The Ramsar listed Vasse - Wannerup Wetland

The ***Vasse-Wonnerup*** is a very large, elongated and shallow waterbody, separated from the ocean by beach ridges (Pen, 1997). Fringing the Vasse-Wonnerup is estuarine marshland and tidal floodplain, mainly on private land. Some saline samphire marshes and stands of remnant estuarine forest trees remain in places, including small CALM managed reserves on the Vasse estuary (see Section 3.4). The Vasse-Wonnerup wetlands are unique in Western Australia as an example of formerly estuarine basins which, since the installation of the floodgates in 1908

(see Section 3.9.2), have functioned as low-salinity lagoons. Since 1988, increasing amounts of seawater had been allowed back into the Vasse Estuary during summer and autumn, inundating its broad expanses with saline to hypersaline water for up to five months each year (Lane, Hardcastle, Tregonning and Holtfreter, 1997) and agreed by the Vasse Estuary Technical Working Group.

The ***New River*** area is low-lying and floodprone land which is seasonally inundated, although in recent years it has not dried up in summer. The section of the New River east of the Vasse River Diversion drains into the Lower Vasse River. Adjoining is a large area of consolidated intact natural vegetation. The surrounding land is mainly urban, and contains one primary and two secondary schools adjoining the wetlands.

New River

The ***Broadwater*** is mostly contained in a conservation reserve, but the adjoining area is mainly cleared pastureland. It is a large area of floodplain and shallow lagoon on the modified Vasse and Buayanyup Rivers. Remnant vegetation near the Broadwater consists of wetland vegetation on the northern margins and a paperbark forest on the southern and eastern margins (Pen, 1997). The Broadwater margins also contain the rare aquatic herb *Villarsia submersa*. Although the wetland is in poor condition, it is an important waterbird habitat (Jaensch *et al* 1988).

1.3.3 The Ramsar Convention

The Convention on Wetlands is an inter-governmental treaty aimed at the conservation of wetlands of international significance and the wise use of wetlands generally (Appendix 2). The Convention was adopted in 1971 at a meeting of international delegates in the Iranian city of Ramsar; hence, it is commonly referred to as the 'Ramsar Convention'.

The Ramsar Convention defines wetlands as:

> *areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres.*

The Convention established a List of Wetlands of International Importance. Wetlands are selected for the List on the basis of their international importance in terms of ecology, botany, zoology or hydrology (see Appendix 3). In 1990, the Government of Western Australia nominated the Vasse-Wonnerup wetlands and eight other wetland systems (i.e. the Ord River Floodplain, Lakes Argyle and Kununurra, Roebuck Bay, Eighty Mile Beach, Forrestdale and Thomsons Lakes, the Peel-Yalgorup System, Toolibin Lake and Lake Warden System) for inclusion on the List. The Ramsar Bureau formally listed these in June 1990. Subsequently, the Western Australian Government nominated three new sites and extensions to four existing sites, including the Vasse-Wonnerup. The current Ramsar boundaries of the Busselton Wetlands are shown in Figure 2.

By joining the Convention, Australia and more than 120 other nations have made a number of commitments regarding their Wetlands of International Importance. Foremost among these are undertakings to 'formulate and implement their planning so as to promote conservation of the wetlands included in the List', to 'promote the conservation of wetlands and waterfowl by establishing nature reserves on wetlands', and 'to

provide adequately for their wardening [management]'.

Ramsar and the Busselton Wetlands

The Busselton wetlands provides habitats for more than 30,000 waterbirds. It is one of the most important waterbird habitats in Western Australia. Almost ninety species of waterbirds have been recorded, several of them rare or uncommon visitors.

The Vasse-Wonnerup Ramsar Site, which is approximately 1,115 hectares and a core component of the Busselton Wetlands, satisfies two Criteria for Ramsar Listing . (Note: only one criteria needs to be met in order to qualify). These are:

'regularly supports 20,000 or more waterbirds' (Vasse-Wonnerup supports more than 30,000 waterbirds each year); and

'regularly supports 1% of the individuals in a population of one species or subspecies of waterbird' (Vasse-Wonnerup supports at least 1% of the Australian populations of Black-winged Stilt and Red-necked Avocet).

The Vasse-Wonnerup Ramsar Site was originally nominated in 1990 and consisted of non-freehold wetland (including the Vasse Estuary portion of Reserve 31188) within the boundaries of the Vasse and Wonnerup estuaries and Wonnerup Inlet, and an adjoining area of non-freehold wetland (formerly part of Wonnerup estuary) between Wonnerup Estuary and Forrest Beach Road). Recently, the Site was extended to include a part of the Sabina River, parts of the Tuart Forest National Park (Reserve 40250) between the original Vasse-Wonnerup Ramsar Site and a length of the Abba River and Nature Reserve 41568 which includes a substantial portion of the northern shore of Vasse Estuary (see Figure 2). The Vasse, Sabina, Abba and Ludlow Rivers and the Deadwater were not included in the Site. Dryland parts of the Sabina Nature Reserve (Res. 31188) and dryland parts of Unallocated Crown Lands that extended into the estuaries were also not included. (WA Government, Wetlands nominated by the Government of Western Australia for inclusion on the *List of Wetlands of International Importance Ramsar Convention, November 2000.)*

Formation of the Busselton Wetlands Steering Committee and Technical Working Group

Consultation with affected landowners, adjoining landowners and wider community

- community workshops;
- formation of landowner representative groups;
- preparation of report: *Outcomes of Landowner Consultations and Community Workshops*;
- consultation with individual landowners regarding best management practices and preparation of land use guidelines: *Guidelines for the Management of Farmland Adjacent to the Busselton Wetlands;*
- preparation and circulation of the *Busselton Wetlands Conservation Strategy Discussion Paper*; and
- assessment of community comment.

Related Studies

Completion of related studies of the area: Department of Environment *Busselton Regional Flood Study*; vegetation and wildlife reports; Department of Agriculture *Guidelines for the Management of Farmland Adjacent to the Busselton Wetlands*.

Conservation Strategy

- preparation and advertising of the draft Strategy;
- assessment of public submissions and review of the draft Strategy; and
- finalisation, approval and adoption of the Strategy.

1.4 The Study Process

The formal planning process commenced in 1999 with the formation of the Busselton Wetlands Steering Committee (see Appendix 1) to guide the development of the Conservation Strategy; to provide direction and guidance to the Technical Working Group; and to oversee community consultation. The Technical Working Group was formed to assist the Steering Committee and to ensure community consultation.

In addition, the Geographe Catchment Council (GeoCatch) has provided significant support and assistance throughout the preparation of the Strategy. In particular, GeoCatch has provided relevant local knowledge and expertise plus financial assistance with landowner consultation. It is recognised that the key to successful implementation of the Strategy lies in the sense of 'ownership' of the Strategy by the affected landowners, the broader community and relevant agencies.

The following outlines the preparation stages of the Strategy:

Community consultation, including individual on-site consultations and workshops, has occurred with the major rural landowners and rural-residential landowners whose land abuts or extends into the wetlands area and the wider community. The workshops provided an opportunity to outline the study process, the objectives and anticipated outcomes; to promote a good working relationship; and to get important landowner feedback.

Community consultation identified a number of issues and opportunities and these are summarised in the *Busselton Wetlands Conservation Strategy Discussion Paper*. The discussion paper was designed to assist the Busselton community focus on the important land use planning and development issues, possible actions related to the wetlands and to stimulate additional ideas for consideration in the preparation of the Conservation Strategy.

Community consultation also identified many common themes and observations (see chapter 5) which, in summary, reflect general support for a strategy that aims to:

- conserve, preserve and enhance the wetland system, its water quality, birdlife and biodiversity;
- manage water-levels and flood control;
- maintain current land uses and private ownership;
- maintain 'low-key' development;
- recognise its education, ecotourism and heritage values;
- pay attention to the impacts of urban, industrial and special development; and
- support improved land management practices and involve landowners in management.

The Strategy 2

2 The Strategy

The purpose of this chapter is to provide strategies, guidelines and actions to address the issues that have been raised (see chapter 5). This chapter presents a balanced and integrated strategy to guide land use planning and management in the study area, consistent with responsible management of the natural environment.

In this chapter there are five components which should be read together. They are:

- Vision
- Objectives
- General Strategies
- Precinct Strategies
- Guidelines and Actions (implementation)

The intent of the **Vision** and **Objectives** is reflected in the **General Strategies**, which respond to the key issues affecting the entire Strategy area (see Chapter 5), whereas the Precinct Strategies respond to the need to address specific issues for distinct portions of the study area. Six precincts have been identified (Figure 5), which are areas characterised by common landscape and drainage features. Additionally, implementation will be largely effected through the agencies listed as having carriage of each of the recommended **Guidelines and Actions.**

The above components should also be read together with the *Strategy Land Use Plan* ('the Strategy Plan'), (Figure 1). The Strategy Plan identifies different categories of preferred land use throughout the Strategy area.

The vision, objectives, recommended strategies, and guidelines and actions are based on consideration of the following:

- issues raised during community consultation and community aspirations, including the interests of the private land owners, for the wetlands;
- suitable water-levels and water quality regimes for maintaining and enhancing the present diversity of species and numbers of waterbirds and fish;
- the natural environment and existing land uses; and
- the existing planning and environmental statutory and non-statutory context including previous studies (see Chapter 4).

2.1 Vision Statement

The **vision statement** for the Strategy area is:

Ecologically sustainable land use activities and wise management of the natural resources of the area to maintain and enhance conservation of the biodiversity, environmental and landscape values of the Busselton Wetlands area, both now and in the future.

2.2 Strategy Objectives

The overall objectives of the Strategy, largely derived from community consultation, are listed below, not ranked in any order.

- Establish a land use and land management framework to conserve and enhance the ecological, productive, landscape and social values of the wetlands and complement CALM management plans for wetland reserves.
- Provide for the protection and enhancement of flora and fauna, particularly for waterbirds.
- Reflect broad community attitudes and aspirations for the future of the wetlands environment.
- Encourage implementation of new recommendations on optimal water-levels and water quality regimes for the wetland system.
- Manage weeds, feral animals and nuisance insects within the wetlands environment.
- Provide an acceptable balance between conservation objectives and the aspirations of landholders, including ongoing productive agricultural uses.
- Promote awareness and understanding of the environmental and nature conservation values of the wetland system.

2.3 General Strategies

This section responds to the key issues identified during community consultation conducted as part of the preparation of the Strategy (also see Chapter 5). For convenience, the issues have been categorised into the following topic headings:

- water-levels and water quality regimes
- agricultural land
- urban and rural residential land
- heritage, education and ecotourism
- amenity.

Each of the above topics is presented with an **Overview** leading into the **Statement of Intent.** The Statement of Intent provides the guiding intention and direction for the General Strategies. The **General Strategies** are provided in table format and reflect the **Vision Statement** and **Objectives** of the Strategy. These are not ranked in any order.

Specific **Planning and Environmental Considerations** are listed and should be considered by proponents of subdivision, development and changes of land use, and in the assessment of such proposals.

Implementation of the strategies is recommended in the **Guidelines and Actions**. The lead or co-ordinating agencies are indicated. A time frame for each strategy is indicated as short term (i.e. 0 – 2 years: **ST**), medium term (i.e. 3 – 10 years: **MT**) and long term (i.e. greater that 10 years: **LT**).

Overall Planning and Environmental Considerations

The planning and environmental considerations listed below (not ranked in any order) have general bearing on all the issues. Due regard should be given to the principles and issues in the policies and strategies listed below:

- Ramsar Convention and the Ramsar principles of Wise Use of wetlands, and sustainability principles;
- *National Strategy for Ecologically Sustainable Development 1992;*
- *National Strategy for Conservation of Australia's Biological Diversity 1996;*
- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999;*
- WA *Environmental Protection Act 1986;*
- WA *Aboriginal Heritage Act (1972 – 1980)*;
- WA *Soil and Land Conservation Act, 1945*;
- WA *Conservation and Land Management Act 1984;*
- WA Government *Western Australian Sustainability Strategy, Hope for the Future* September 2003*;*
- EPA *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992;*
- Draft *EPA Environmental Protection (Swan Coastal Plain Wetlands) Policy 2004;*
- EPA System 1 recommendations;
- WAPC *State Planning Strategy;*
- Shire of Busselton District Town Planning Scheme (DTPS) No. 20 and Shire of Capel District Planning Scheme (DPS) No. 7;
- WAPC *Statements of Planning Policy*
  - *SPP 2.5 Agriculture and Rural Land Use Planning*;
  - *SPP 2 Environment and Natural Resources Policy*;
  - *SPP 2.6 State Coastal Planning Policy*;
  - *SPP 2.9 Draft Water Resources*; and
  - *SPP 3 Urban Growth and Settlement (draft).*
- WAPC *Planning for Bushfire Protection 2001;*
- Local government planning policies and strategies, including local structure plans, the local Rural Strategy; heritage places listed under the Municipal Inventory of Heritage Places; the *Busselton Urban Growth Strategy 1999* and the Shire of Busselton *Biodiversity Incentive Strategy for Private Land in the Busselton Shire;*
- WA Government *Wetlands Conservation Policy 1997 for Western Australia;*

- the DoE *Busselton Regional Flood Study*;
- GeoCatch *Geographe Catchment Management Strategy, 2000*, in particular those strategies that:
  - promote the reduction of excess nutrients entering the wetlands;
  - promote drainage management in the upper catchment;
  - encourage the retention and management of remnant vegetation on private land;
  - promote community understandings about the need for reduced run-off of excess nutrients into the wetlands system;
  - promote community awareness that the biodiversity and habitat of the wetlands are placed under great pressure from clearing and development in the catchment;
  - promote community involvement in integrated catchment management;
  - foster and support alliances/networks between land owners, landcare and community groups, local government and relevant agencies; and
  - encourage community understandings and measures that reduce polluting materials such as urban and industrial wastes and pesticides entering the wetlands system.
- Report of the Vasse Estuary Technical Working Group, 1997 *Management of the Vasse-Wonnerup Wetland System in Relation to Sudden, Mass Fish Deaths*.
- Western Australian Planning Commission *Leeuwin-Naturaliste Region Plan – Stage One Final, 1988*; and
- Department of Agriculture Western Australia *Guidelines for the Management of Farmland Adjacent to the Busselton Wetlands, 2002*.
- Water and Rivers Commission Geomorphic Wetland Mapping. This dataset includes the evaluation of wetlands based on ecological attributes and functions and identifies priority wetlands for management.
- Water and Rivers Commission Position Statement: Wetlands. This position statement regarding Swan Coastal Plain wetlands should be used in conjunction with the Water and Rivers Commission Geomorphic Wetland Mapping.

2.3.1 Water-Levels and Water Quality Regimes

Overview

Community consultation confirmed the importance of issues related to water-levels and water quality regimes, and the fringing vegetation of the Busselton Wetlands. Activities in the broader Geographe Bay catchment also affects these regimes. Agricultural activities in the upper catchment influences water quality in the Busselton Wetlands.

The conservation of the biodiversity, recreational, productive and landscape values of the wetlands strongly relates to management of the water-levels and water quality regimes, having due regard to sustainability and Ramsar wise use principles. This Strategy recognises that these regimes can be controlled through the:

- management and operation of the Vasse Floodgates and Wonnerup Floodgates;
- drainage management in the upper catchment;
- management of the diversion drains;
- seasonal openings of the Wonnerup Inlet sand bar;
- drainage management in urban and industrial areas; and
- best management practice of the adjoining land (see Section 2.3.3).

Best management practices should also be applied in areas designated for future urban subdivision and development; for example, incorporate water sensitive urban design principles and *Liveable Neighbourhood* planning principles (see Section 2.3.3).

This Strategy encourages the Shires of Busselton and Capel, relevant State government agencies, community groups and local land owners to work together to implement the relevant strategies adopted by GeoCatch as per the

Geographe Catchment Management Strategy, 2000. Agencies, community groups and owners of adjoining land should be encouraged to manage the land, particularly the margins of the wetlands, for its conservation and landscape values. Also important is the need to raise awareness of the conservation values of the wetlands and their fringing vegetation.

Statement of Intent

The water-levels and water quality regimes of the Busselton Wetlands will be managed and monitored to:

- conserve and enhance the biodiversity and ecosystem functions of the Busselton Wetlands;
- meet Australia's international obligations under the Ramsar Convention and meet 'sustainability' principles;
- ensure the water quality regime of the Busselton Wetlands is maintained as fresh-brackish and is suitable for maintaining and enhancing the present diversity of species and numbers of waterbirds and fish; and
- provide an acceptable balance between conservation objectives and the social and economic aspirations of the community.

Water-Levels and Water Quality Regimes

General Strategies

- This Strategy supports management of water-levels and water quality regimes of the Busselton Wetlands which conserve and enhance the biodiversity and environmental functions of the wetlands.
- This Strategy supports the creation of 'buffers' of locally indigenous native vegetation in fringing areas of the Busselton Wetlands and associated watercourses.
- Proposals for subdivision and development adjacent to or near the wetlands should be assessed to ensure that they are compatible with wetland conservation.
- Development should not adversely impact on the quality and quantity of water and the conservation of natural environmental values.
- Proposals for subdivision and development in the Strategy area should conform to the DoE water-sensitive design principles.
- This Strategy supports integrated catchment management and the implementation of the strategies in the *Geographe Catchment Management Strategy* that are relevant to its objectives.

Water-Levels and Water Quality Regimes

Planning and Environmental Considerations (also see the Overall Planning and Environmental Considerations listed above)

- The Ramsar-listed portion of the Busselton Wetlands;
- *Environmental Protection Act 1986*;
- Community and scientific expertise on appropriate water-levels and water quality regimes of the Busselton Wetlands;
- DoE water quality information (*Inflow*);
- The impacts of high and low water-levels on fringing vegetation and wildlife;
- Conservation and enhancement of wetland habitat and fringing remnant vegetation;
- The draft *Water Resources Statement of Planning Policy 2.9*;
- Wetlands Co-ordinating Committee guidelines on provision of wetland buffers and setbacks (being considered at the time of writing);
- The 'Landscape Value Area', 'Floodway Area' 'Wetland Area' and 'Coastal Management Area' as identified in the Shire of Busselton DTPS No. 20;
- The relationship between water-levels and water quality regimes, development and nuisance insects;
- Flood mitigation and drainage management, the diversion drains and the floodgates (operation and upgrading);
- The effect of land use activities in the upper Geographe Bay catchment on the wetlands, e.g. clearing, run-off of excess nutrients and stormwater management;
- Openings of the Wonnerup Inlet sand bar;
- Conditions likely to contribute to mass fish deaths;
- Anticipated sea level rise;
- The effects of water pollutants such as petrol, oil and industrial waste entering directly into the wetland system; and
- Investigation and monitoring of the wetlands regarding key abiotic and biotic indicators.

Guidelines and Actions

- GeoCatch and DoE, in conjunction with CALM, WC and local government, should establish environmental 'targets' regarding 'optimal' water-level and water quality regimes. **(ST)**
- CALM, in conjunction with relevant agencies, and in consultation with the community, should resource and develop an ongoing mapping and monitoring program of the key abiotic and biotic

Water-Levels and Water Quality Regimes

Guidelines and Actions (cont.)

elements of the wetlands system. The program is essential to the implementation of this strategy and should identify, at the detailed local scale, areas of importance of all habitat types, degrading

habitats and the habitats of key species and consider the cumulative effects of intensified land use. The program should be regularly reviewed to ensure useful results. **(S/MT)**

- CALM, in conjunction with relevant agencies, and in consultation with community groups, will prepare and implement a management plan(s) to protect habitats for those wetlands to be vested in the Conservation Commission in accordance with the Conservation and Land Management Act 1984 as amended. The management program is essential to the implementation of this strategy and should be reviewed every ten years. **(MT)**

- The Shire of Busselton should review the 'Floodway Area', 'Wetland Area' and 'Landscape Value Area' identified in DTPS No. 20, having regard for this Strategy and updated information. **(ST)**

- The WC, in consultation with relevant agencies and the local community, should:
  - up-grade, operate and manage the floodgates to maintain the existing salinity regime (fresh-brackish) of the Vasse-Wonnerup estuaries **(ST)**; and
  - operate and manage the diversion drains to ensure adequate flood protection for Busselton and to ensure the water-levels and water quality regimes of the wetlands conserve and enhance the biodiversity and environmental functions of the Busselton Wetlands. **(ST)**

- With guidance from the Vasse Estuary Technical Working Group, the WC can open the Wonnerup Inlet sand bar in summer to reduce the likelihood of mass fish deaths in the estuaries. **(ST)**

- Recognising ICM principles and the environmental requirements of, and impacts on, the Busselton Wetlands, DoE in consultation with the community should identify the availability and allocation of water resources for groundwater extraction and surface water use, particularly for agricultural and urban purposes. **(ST)**

- GeoCatch and DoE, in conjunction with relevant agencies, and together with the community, should continue to implement the relevant strategies of the Geographe Catchment Management Strategy. **(ST)**

- The Shires of Busselton and Capel, WC, CALM, DPI and other relevant agencies are requested to integrate sustainability principles and the Ramsar principles of wise use in relation to maintaining and enhancing the biodiversity, environmental and landscape values of the Busselton Wetlands area into their maintenance, operational and capital works programs. **(ST)**

- Land Conservation District Committees (LCDCs), other community groups including school groups, GeoCatch and relevant agencies should foster collaborative partnerships to lift awareness of and provide access to relevant wetlands information and activities to facilitate the conservation of flora, fauna and habitat values. **(ST)**

- GeoCatch and DoE, in conjunction with the Shires of Busselton and Capel, CALM, DAWA, WC and DoE should promote awareness raising amongst land owners regarding:

Water-Levels and Water Quality Regimes	
Guidelines and Actions (cont.)	• the international significance of the Ramsar-listed portion of the Busselton Wetlands; • appropriate wastewater and drainage management; • a code of land use and land management behaviour for land owners, users and stakeholders; • partnerships between users and stakeholders; and • commitment to the objectives of the Strategy. **(ST)**

Note: **(ST)** = Short Term 0 – 2 yrs
(MT) = Medium Term 3 – 10 yrs

2.3.2 Agricultural Land

Overview

This section focuses on land that is used primarily for agricultural pursuits. In these areas much of the native vegetation on the margins of the wetlands has been cleared for pasture production and livestock grazing. Conservation and enhancement of the remnant vegetation of the wetlands plays an essential role in maintaining the biodiversity of the area through the native fauna and flora habitat it provides. This Strategy does not support further clearing of native vegetation in the policy area for agricultural purposes.

Historically, agriculture has been the predominant land use in the study area. It has economic and social importance, as well as aesthetic qualities that add to rural landscape character. A strong theme expressed through community workshops and consultation was to maintain broad-acre farming and to conserve or enhance the landscape and natural values of the Busselton Wetlands, notably the flora and fauna habitat, particularly for waterbirds. Generally, this Strategy supports sustainable agricultural practices, compatible with wetland conservation.

Strategies that address agricultural land use and land management issues should encourage land use practices and measures that maintain or enhance the natural values of the wetlands and their margins. Agricultural land use activities that protect and enhance heritage, education and ecotourism values and opportunities should be encouraged. This Strategy encourages the implementation of the Department of Agriculture *Guidelines for Management of Farmland Adjacent to the Busselton Wetlands, 2002* (see Section 4.4). The many recommended strategies, guidelines and actions relate to ongoing management and use of the land. Their application may be best achieved through co-operative efforts of land owners and the advisory services of various departments and agencies of State and local governments.

Integrated weed management in the Geographe Catchment needs to be addressed. The Strategy acknowledges that the Geographe Catchment Weed Plan is an appropriate reference dealing with the issue of weed management. It should be noted that government agencies have a budget and weed program for weed management on government owned land.

Agricultural intensification, such as an increase in the area devoted to horticultural production, could lead to increased nutrient export into the wetlands. The nutrient of main concern to water quality and the wetlands is phosphorus owing to its ability to promote algal growth. Nitrogen is a nutrient, which, under certain conditions, is a concern. Landowners should be aware of the nitrogen-phosphorous ratio. Soils high in iron and aluminium oxides have greater ability to hold or 'fix' nutrients. When soil is eroded, phosphorus bound to soil particles may be carried from the property by run-off and enter the wetlands. Application of phosphorus fertiliser above crop requirements can saturate the nutrient fixing capacity of the lighter soils. Soils with a low fixing capacity leach nutrients more readily.

Management guidelines to reduce nutrient export into wetlands need to recognise the strong interrelationship between soil type, depth to watertable, fertiliser, irrigation and agricultural practices. Additionally, horticulture should be consistent with the horticulture codes of best management practice for the area, notably Department of Agriculture land use guidelines. Within agricultural areas where broad-acre farming is supported, the Strategy encourages best management practices.

Elsewhere on the Swan Coastal Plain near sensitive wetlands, this issue of nutrient export into wetlands has been addressed; for example, the *Coastal and Lakelands Planning Strategy, 1999* recommends a minimum setback of 150m for horticulture adjacent to Lake Clifton (including at least 20m of unused Spearwood soils) and 100m for wetlands of regional significance for ecosystem maintenance. The recommended management criteria for the Lake Clifton catchment also included guidelines on vegetated buffers; minimum depth to groundwater of 2m; maximum fertiliser rates; irrigation design; over watering; surface water run-off from the horticulture area; and regular soil testing so that fertiliser application rates can be modified.

Poorly drained soils occur near the wetlands. The Quindalup Wet Flats (Qw) (also see Section 3.2) are poorly drained wet flats on raised terraces around the edge of the estuaries. Generally, horticulture is not practised on the Qw soils due to year round high water tables and the proximity to the wetlands. Many of these soils have high organic matter and calcium carbonate content and as such have a high ability to retain nutrients.

The Quindalup Very Wet Saline Flats (Qwy) occur in low-lying depressions which are often underwater in winter and saline in summer. Their location matches the location of open water areas and areas of seasonal inundation.

Ludlow soils are generally found on the southern side of the wetlands. Ludlow Wet Rocky Flats (Lwr) are moderately deep to shallow brown and yellow sands over limestone and experience subsoil waterlogging in winter. The Ludlow soils are comparable with Spearwood sands which have a high ability to retain phosphorus. These soils may be suitable for horticulture where there is sufficient soil depth to the water table and where there is sufficient separation from the poorly drained Quindalup soils.

Rural and Wetland Amenity Area

With respect to the significant soil-natural environment-land use relationship, the Strategy Land Use Plan (Figure 1) shows a **Rural and Wetland Amenity Area**, defined by the soil criteria outlined below. The main purpose of the 'Rural and Wetland Amenity Area' is to define the area where future development of intensive agriculture and development of 'lifestyle' lots would be inconsistent with the conservation objectives of this Strategy, and should not occur.

The 'Rural and Wetland Amenity Area' boundary should be at least 100 metres from the Quindalup Very Wet Saline Flats (Qwy) soil type or 20 metres from the Quindalup Wet Flats (Qw) soil type, and should include at least 20 metres of Ludlow soils, whichever is greater. On the northern side of the wetlands the same soil criteria separation should apply. However, in lieu of 'Ludlow soils', the separation should include at least 20 metres of Quindalup (Q) coastal sands.

The Strategy Land Use Plan does not show the 'Rural and Wetland Amenity Area' in areas which are currently zoned for urban purposes or areas identified as reserves.

The 'Rural and Wetland Amenity Area' forms a narrow margin, generally following the flats adjoining the Wonnerup Estuary and Malbup Creek areas, (Figure 1). Near the Vasse Estuary, the 'Rural and Wetland Amenity Area' is identified on 'Agriculture' zoned land i.e. on the northern side of the Vasse Estuary (Lot 7 Layman Road) and on the southern side near Ford Road.

Given the above, the 'Rural and Wetland Amenity Area' has particular relevance to land use in the 'Agriculture' zone. This Strategy supports continuation of broad-acre farming within the

'Rural and Wetland Amenity Area' in accordance with the Department of Agriculture Western Australia *Guidelines for Management of Farmland Adjacent to the Busselton Wetlands, 2002*.

The Strategy Land Use Plan also shows a 'Wetland Amenity Line', based on the above soil criteria. The 'Wetland Amenity Line' forms a discontinuous line on both the northern and southern sides of the wetlands.

In the 'Agriculture', 'Conservation' and 'Rural Residential' zones, where the existing Shire of Busselton DTPS No. 20 'Wetland Area' line is closer to the wetlands than the 'Wetland Amenity Line', it is recommended that the Shire of Busselton amend the DTPS so that the 'Wetland Area' line accords with the 'Wetland Amenity Line'. Any proposed variation to these boundaries should be based on detailed site investigation. However, this Strategy supports the retention of the 'Floodway Area' and 'Landscape Value Area' and provisions under the DTPS.

Subdivision

There is a presumption against further subdivision of agricultural land for non-agricultural purposes. However, this Strategy supports limited rural clustered subdivision of agricultural land where suitable land can be set aside for reserves for conservation, landscape and foreshore protection, subject to proposals meeting criteria, as set out in the General Strategies listed below. Subdivision and development proposals should be compatible with the conservation and environmental values of the wetlands and should be in accord with sustainability and Ramsar wise use principles. Prior to approval of subdivision and development proposals, development setbacks, interface with conservation reserves (no additional burden on adjoining reserves), the provision of fencing and bushfire protection measures should be addressed. This Strategy recommends that consideration be given in each instance to the most appropriate options (reservation, covenants, or combinations thereof) to ensure the conservation objectives of this Strategy.

Proposed subdivision of agricultural lots 20 hectares and greater at the date of approval of this Strategy, may be considered for approval where the subject land is entirely or partly designated 'Rural and Wetland Amenity Area'. Such proposals must demonstrate compatibility with the conservation objectives of the Strategy. The minimum requirements to meet the conservation objectives of the Strategy are:

- ceding free of cost a conservation reserve extending at least 30 metres from the Quindalup Very Wet Saline Flats (Qwy) soil type and incorporating existing native vegetation that contributes to the wetland function; and
- the whole of the land subject to the application for subdivision being zoned 'Conservation'.

In addition, consideration will be given to the need for conservation covenants over portions of land retained in private ownership. As a guide, this should include at least the area designated 'Rural and Wetland Amenity Area' in the Strategy. Where appropriate, negotiation with the landowner(s) should occur to address farm management concerns (e.g. stock crossings) and access to reserves for management purposes.

Where 'lifestyle' lots are proposed, these should be based on rural cluster principles, be within the range from 1 to 2 hectares in area and should not be located within the 'Rural and Wetland Amenity Area', where possible. There may be circumstances where smaller rural 'lifestyle' lots, i.e. lots below 1 hectare in area are justified and result in a more desirable outcome for the Busselton Wetlands. For lots 20 hectares and greater at the date of approval of the Strategy, based on a ratio of one additional lot per 20 hectares, there should a maximum of five additional lots to limit the number of new dwellings and any potentially adverse environmental and landscape impacts.

The above subdivision criteria should not be regarded as supplementary or additional to any other future 'subdivision for conservation' incentives, including those outlined in the

Biodiversity Conservation Strategy for Private Land in the Busselton Shire .

Statement of Intent

This unique area combines the outstanding values of the internationally significant Busselton Wetlands with rural ambience and remnant vegetation areas, including endemic tuart forests. Agricultural land use activities are encouraged to provide an acceptable balance between sustainability, conservation objectives and the social and economic objectives of the community, having particular regard for:

- retaining the agricultural land use pattern while providing for change in land management in recognition of the need to maintain and enhance the environment and landscape character of the Busselton Wetlands;
- the role that farmers can, and do, play in the conservation of wetland biodiversity and habitat;
- the importance of integrated catchment management and the *Geographe Catchment Management Strategy, 2000*;
- the need to address the issues relating to weeds, feral animals and nuisance insects within the wetlands environment; and
- the need to ensure that other options for land use functions such as ecotourism are retained or developed as complementary functions to agriculture and wetland conservation.

Agricultural Land

General Strategies

- There is a general presumption against the clearing of remnant vegetation other than for approved areas such as building envelopes, access and services. Clearing of remnant vegetation should not threaten the presence of rare and threatened flora, fauna and ecological communities.
- Environmental corridors which link areas of native vegetation and/or the Busselton Wetlands along roads, water courses, the wetlands and conservation reserves should be supported.
- Support best management practices for the farmed areas near the Busselton Wetlands, as per the Department of Agriculture *Guidelines for the Management of Farmland Adjacent to the Busselton Wetlands, 2002.*
- Support financial and non-financial incentive programs which encourage owners of land adjoining or near the Busselton Wetlands to protect and manage biodiversity and conservation values on their land.
- Encourage awareness-raising regarding the benefits of broad-acre grazing near the Busselton Wetlands to manage introduced grasses, including weeds.
- The adverse impact of weeds and pests, including domestic and feral animals, on the environmental values of the Busselton Wetlands should be reduced through implementation of appropriate weed and pest control measures and programs, as necessary. Opportunities to combine efforts on such programs, on public and private land, should be promoted.

Agricultural Land (continued)

General Strategies (cont.)

Subdivision and Development

- Maintaining and enhancing the conservation of the biodiversity, environmental and landscape values of the strategy area will be the primary criteria against which proposals for land use, subdivision or development should be assessed.

- There is a presumption against further subdivision of agricultural land for non-agricultural purposes. However, subdivision of agricultural land, where a portion of the land is designated 'Rural and Wetland Amenity Area', can be considered in limited circumstances. As an incentive for land owners to maintain and enhance the conservation of the biodiversity, environmental and landscape values of the wetlands in perpetuity, the following can be considered, unless otherwise specified in Section 2.4 Precinct Strategies (from the date this Strategy is approved).

  In each instance, consideration will be given to the most appropriate reservation and covenanting options (or combinations thereof) to secure the maintenance of conservation and landscape values.

  For lots 20 hectares and greater (Figure 1), at the date this Strategy is approved, subdivision based on a ratio of one additional lot per 20 hectares to a maximum of 5 additional lots can be considered where proposals meet the following criteria:
  - subdivision should be in clustered form - unless based on existing dwellings;
  - the rural clustered lots should be within the range 1 to 2 hectares in area, however there may be circumstances where lots below 1 hectare are justified and result in a more desirable outcome for the Busselton Wetlands;
  - ceding free of cost land adjacent to the Busselton Wetlands, as reserves for conservation, landscape and foreshore protection purposes. The width of the reserve should be at least 30 metres from the Quindalup Very Wet Saline Flats. Additionally, land retained in private ownership should be protected by conservation covenants to guarantee the perpetual maintenance of conservation and landscape values;
  - rezoning of the proposed rural clustered lots and the balance of the land being to 'Conservation' zone;
  - the proposed rural clustered lots not being located within the 'Rural and Wetland Amenity Area', where possible;
  - revegetating (with local native species) and enhancing appropriate locations adjoining the wetlands. Plantings in suitable areas should reduce water run-off, revegetate degraded areas and maintain or enhance vegetation and landscape linkages;
  - being unlikely to have a significant detrimental impact on wildlife;
  - not detracting from the ongoing viability of the balance of the lot for long-term agricultural land use;
  - not detracting from important education, scientific and ecotourism values and opportunities;
  - not detracting from the visual quality of the landscape; and
  - ensuring the provision of adequate measures for fencing, emergency access and bushfire protection without burdening the values and management of the wetlands.

  Rural strata subdivision will be considered where the proposal is consistent with WAPC Policy DC 3.4 and the objectives of this Strategy.

Agricultural Land (continued)

General Strategies (cont.)

- This Strategy supports sustainable agricultural practices compatible with wetland conservation. There is a general presumption against the approval of non-agricultural use and development. However, low-impact development will be considered where the proponent can demonstrate that any approval will:

  - be compatible with the agricultural use of adjoining or nearby land and, where required, include appropriate 'buffers' within the subject land;
  - be limited to one dwelling per lot and low-impact ecotourism or recreation facilities in limited locations or be incidental or complementary to the role and function of agricultural land;
  - not compromise the role and function of agricultural land in maintaining and enhancing the natural attributes and conservation values of the Busselton Wetlands;
  - not be detrimental to the wetlands, or remnant vegetation, other than for the approved building envelope(s) and services, if necessary;
  - retain vegetated 'buffer' areas;
  - observe relevant development setbacks from the wetlands, having regard for 100 year flood level protection, and be based on a consideration of the existing landscape, soil, landform, and vegetation, but with a minimum distance of 100m (where reticulated sewerage is not available);
  - maintain or enhance the natural and rural landscape values of the subject land. The style and appearance of any development will be unobtrusive, small in scale, and should be compatible with the landscape character of the area;
  - not detract from important heritage, education, scientific and/or ecotourism values associated with the Busselton Wetlands and adjoining farmland;
  - appropriately recognise local floodplain development control strategies having regard for major flooding, as identified in the Shire of Busselton DTPS No. 20;
  - not adversely impact on the water-levels and water quality of watercourses, wetlands and groundwater;
  - have an appropriate Bushfire Management Plan;
  - require local government approval for new dams or artificial lakes ;
  - generally accord with local government and WAPC approved subdivision and development guide plans, that have due regard to conservation objectives of the Strategy; and
  - demonstrate continued management of the land to maintain and enhance the conservation and landscape values.

- Land use changes, subdivision and development should accord with sustainability and Ramsar wise use principles; should ensure that there will be no additional nutrient or other pollutant input to the Busselton Wetlands; and should have regard for separation from the wetlands based on consideration of existing wildlife, landscape, soil, landform and vegetation conditions, and EPA environmental criteria. The separation distance should be at least 100 metres from the Quindalup Very Wet Saline Flats (Qwy) soil type or 20 metres from the Quindalup Wet Flats (Qw) soil type, and include at least 20 metres of Ludlow soils, whichever is greater. This line is shown on the Strategy Land Use Plan as the 'Wetland Amenity Line' and forms the boundary for the 'Rural and Wetland Amenity Area'. Any proposed variation of these soil type boundaries should be based on detailed site investigation.

Agricultural Land (continued)

General Strategies (cont.)	◆ Proposals for development in areas adjoining reserved land, notably, the Tuart Forest National Park and State Forest, should be required to demonstrate that the development will meet fire hazard and risk standards associated with reserved land. Also, proposals for development should demonstrate that there will be no adverse impact on the fire management regimes of adjacent land owners.
Planning and Environmental Considerations (also see the Overall Planning and Environmental Considerations listed above. Due regard should be given to the principles and issues in the draft policies and strategies listed.)	◆ Maintenance of the biodiversity and environmental values of the wetlands depends on appropriate land use and management practices as recommended in the Department of Agriculture *Guidelines for the Management of Farmland Adjacent to the Busselton Wetlands, 2002*; ◆ *Environmental Protection Act 1986* (e.g. for referral of intensive horticulture proposals for assessment); ◆ WAPC SPP No. 2.5 *Agricultural and Rural Land Use Planning Policy*; ◆ WAPC *Development Control Policy 3.4 Subdivision of Rural Land*; ◆ In the Busselton Wetlands and adjoining low-lying areas uses other than nature conservation and agriculture are generally undesirable; ◆ The impacts of high and low water-levels on farmland; ◆ Wetland margins contain significant remnant vegetation and waterbird habitats and nesting areas; ◆ WAPC Draft *Greater Bunbury Region Scheme 2000* (where applicable); ◆ Recommendations of the *Busselton Regional Flood Study*; ◆ Existing land use zones and development control provisions under the local government town planning schemes; ◆ The Shire of Busselton *Rural Strategy*; ◆ WA *Soil and Land Conservation Act 1945*; ◆ WA *Land Clearing Regulations 1999*; ◆ Financial and other incentives, funding assistance and other assistance currently available; and ◆ Pests and weeds, such as arum lilies, feral animals (rabbits and foxes), and domestic pets. ◆ Geographe Catchment Weed Plan.
Guidelines and Actions	◆ DAWA, in conjunction with CALM and the Shires of Busselton and Capel, and in consultation with land owners and community groups should promote the uptake of the Department of Agriculture *Guidelines for the Management of Farmland Adjacent to the Busselton Wetlands, 2002* and review such to ensure appropriate land management and rehabilitation measures that maintain or enhance the margins of the Busselton Wetlands. **(ST)**

Agricultural Land (continued)

Guidelines and Actions (cont.)

- CALM, in conjunction with GeoCatch/DoE, DAWA, DoE and the Shires of Busselton and Capel are encouraged to promote the positive role that farmers can, and do, play in the conservation of wetland biodiversity and habitat and to promote incentives for private land owners to set aside portions of land perpetually for conservation. **(ST)**

- The Shire of Busselton should review the 'Wetland Area' line shown in the 'Agriculture', 'Conservation' and 'Rural Residential' zones in DTPS No. 20, having regard for the Wetland Amenity Line identified in this Strategy. **(ST)**

- This Strategy supports alliances with relevant agencies and community groups to lift awareness and disseminate relevant land use management information to land owners and interested people. **(ST)**

- The Shires of Busselton and Capel, in consultation with relevant agencies and community groups, should prepare and implement biodiversity incentive strategies that encourage landowners to conserve biodiversity values on their land. **(MT)**

- GeoCatch, in conjunction with DoE, CALM, the Shires of Busselton and Capel, landowners and community groups should prepare and implement local revegetation plans identifying those areas in need of revegetation to protect waterways and waterbird habitats. **(ST)**

- Wherever possible, corridors should be re-established with locally indigenous vegetation between areas of native vegetation and/or the Busselton Wetlands. In particular, CALM and relevant agencies should promote the establishment of habitat, where appropriate, to enhance corridor connections between the core areas of Western Ringtail Possum habitat.**(MT)**

- GeoCatch, DoE, CALM and the Shires of Busselton and Capel can identify suitable areas and sources of funding for fencing of appropriate parts of the Busselton Wetlands fringes and for native vegetation planting. **(ST)**

- DAWA, in conjunction with GeoCatch, CALM and the Shires of Busselton and Capel, should disseminate relevant information on weed and pest control programs and, in consultation with land owners, implement and review the *Geographe Catchment Weed Plan*. **(M)**

- DAWA, GeoCatch, DoE, CALM and the Shires of Busselton and Capel, whilst working towards long term rehabilitation of the wetlands, recognise that controlled grazing can manage introduced grasses and other weeds in the interim, however stock should be excluded from areas of natural vegetation. **(S/MT)**

- CALM, in conjunction with GeoCatch, the Shire of Busselton and DAWA, and in partnership with landowners and the community, should develop and implement an integrated environmental weed management program for public and private land, which recognises the need to protect the biodiversity values of the Busselton Wetlands.

- DAWA, in conjunction with GeoCatch and DoE, are requested to prepare and review guidelines or awareness-raising activities that promote sustainability. **(ST)**

Note: **(ST)** = Short Term 0 – 2 yrs
(MT) = Medium Term 3 – 10 yrs

2.3.3 Urban and Rural Residential Land

Overview

Busselton has been, and continues to be, one of Australia's fastest growing centres, and portions of the Strategy area experience urban development pressure. Growth and development must be well planned and managed, otherwise it will adversely impact on the wetlands.

A consistent theme raised through community consultation was that activities in urban areas (including industrial areas) and rural residential areas can impact on the wetlands. Although urban development is not the primary focus of this Strategy, it is considered appropriate to highlight and recommend actions to address urban and rural residential issues that may directly affect the wetlands.

Generally, this Strategy does not support new zones for urban (including industrial) and rural residential development adjoining the wetlands, in productive and potentially productive agricultural areas, in important natural and rural landscapes, and in areas where urban development will put pressure upon the visual resource. Urban and rural residential development should generally be confined to committed areas, with the possible exception of limited subdivision in exchange for land to be set aside as reserves, for conservation, and for landscape and foreshore protection purposes, based on consideration of natural topographic and environmental features.

Any subdivision or development proposals near the wetlands should accord with the conservation objectives of this Strategy, including sustainability and Ramsar principles.

In committed areas or future urban areas, residential design should:

- be innovative and sympathetic to its site and setting;
- provide a range of lifestyle opportunities;
- reflect the urban development principles in WAPC *Liveable Neighbourhoods*; and
- incorporate the Department of Environment (DoE) water-sensitive urban design principles.

In areas where rural residential living is contemplated, subdivision design that is based on rural cluster principles and is responsive to retaining landscape values and allow agricultural pursuits can be considered.

Statement of Intent

Urban development near the Busselton Wetlands forms part of the setting and backdrop of the wetlands and has interrelationships with the wetlands that need to be carefully managed and monitored. Urban development, therefore, should ensure that the biodiversity, environmental, heritage and landscape values of the Strategy area are maintained or enhanced by:

- promoting land use and development that is consistent with sustainability principles and is compatible with the biodiversity, environmental and landscape values of the Busselton Wetlands;
- ensuring suitable separation distance(s) between future urban development and the Busselton Wetlands;
- promoting the DoE water-sensitive urban design principles;
- limiting Rural Residential 'lifestyle lots' to existing or committed areas or areas that do not conflict with the biodiversity, environmental and landscape values of the Busselton Wetlands; and
- encouraging infrastructure provision in locations that do not compromise the existing agricultural land use and conservation and landscape values of the Busselton Wetlands.

Urban and Rural Residential Land (cont.)

General Strategies

- Recognise existing urban development and areas committed by zoning, endorsed structure plans and planning strategies.
- Urban and rural residential subdivision and development should be confined to committed areas, with the possible exception of limited rural clustered subdivision in exchange for land to be set aside for reserves for conservation, and for landscape and foreshore protection purposes.
- Future urban growth should avoid a continuation of linear coastal strip development and avoid areas adjacent to the wetlands.
- Maintaining or enhancing the biodiversity, environmental, heritage and landscape values of the strategy area will be the primary criteria against which proposals for subdivision or development should be assessed. Such proposals should be assessed having particular regard for:
  - innovative residential design which reflects WAPC Liveable Neighbourhoods and DoE water-sensitive urban design principles, and maintains and enhances the biodiversity, environmental, heritage and landscape values of the Busselton Wetlands;
  - adequate development setbacks between future urban development and the Busselton Wetlands;
  - floodplain development control strategies to ensure adequate flood protection as per the Shire of Busselton DTPS No 20;
  - visual landscape features, including rural landscape, minimising visual impact and ensuring the proposed urban design is sympathetic with its natural setting.
- Infrastructure and servicing should have regard for:
  - sustainability principles;
  - the existing natural and rural setting and the built character of the area;
  - low-impact forms of development;
  - promoting clustering; and
  - alternate forms of transport and transport efficiency.

Planning and Environmental Considerations

(also see the Overall Planning and Environmental Considerations listed above.)

- Future subdivision should provide for a range of lot sizes to accommodate lifestyle opportunities;
- The expansion of existing urban areas should be contingent upon the incorporation of DoE water-sensitive urban design principles and, in particular, the management of urban (including industrial) stormwater run-off and effluent;
- WAPC *Liveable Neighbourhoods Edition 3, 2004*;
- WAPC SPP No. 4.1 draft *State Industrial Buffer Policy* ;
- Environmentally acceptable development setbacks from the wetlands;
- Existing land use zones and development control provisions under the local government District Planning Schemes;

Urban and Rural Residential Land (cont.)

Planning and Environmental Considerations (also see the Overall Planning and Environmental Considerations listed above.)	◆ Protection of significant heritage places; ◆ Flood plain development control strategies to ensure adequate flood protection; ◆ Maintaining and enhancing rural and scenic landscape values; ◆ Conservation of views across the wetlands, in particular those from major traffic routes, notably Layman Road, Forrest Beach Road, Causeway Road, Bussell Highway and the Busselton Bypass Road; ◆ Minimising direct entry into the wetlands system of polluting materials such as hydrocarbons and pesticides; ◆ No direct discharge of wastewater or contaminated stormwater to occur from industrial premises; and ◆ Prescribed premises require licensing under the *Environment Protection Act 1986* and, therefore, require referral to the DEP for assessment. ◆ DoE *Manual of Managing Urban Stormwater Quality in Western Australia.*
Guidelines and Actions	◆ Proponents of subdivision and development should have regard for the following: • conservation and foreshore reserve(s); • development setbacks from the wetlands should be adequate to prevent adverse impacts on the wetlands, having regard for 1:100 year flood level protection, and be based on a consideration of existing soil, landform, and vegetation, but with a minimum distance of 50m in urban areas (assuming reticulated sewerage is installed), and 100m in rural residential areas (where alternative effluent disposal systems are required). • retention of vegetated buffer zones along the wetlands to prevent adjacent land uses from degrading water quality by means of polluted surface water run-off; • visual impacts of urban development should be minimised, particularly near the wetlands; • development should be sympathetic to site and setting; and • subdivision and development to generally accord with local government and WAPC approved subdivision and development guide plans, having due regard to the conservation objectives of the Strategy. **(S/MT)** ◆ The Shire of Busselton and relevant State Government agencies should work with the private sector to develop innovative urban design guidelines that respond to the unique identity, site and setting of Busselton between the wetlands and Geographe Bay. **(S/MT)** ◆ The WC, DoE and DoE, in conjunction with the Shire of Busselton should: • pursue the installation of reticulated sewerage for urban and future urban areas and, where appropriate, monitor conditions of groundwater adjacent to wetlands; • manage, review and improve urban and industrial drains that connect to the wetlands to minimise the direct entry of hydrocarbons and nutrients into the wetlands system. **(ST)**

Urban and Rural Residential Land (cont.)

Guidelines and Actions (cont.)	◆ GeoCatch, in conjunction with DoE, the WC and the Shire of Busselton, should promote the 'Clean Drains Program' and awareness raising amongst land owners in urban areas regarding appropriate wastewater and drainage management and prepare and disseminate information regarding measures that reduce noxious material such as urban and industrial wastes and pesticides entering the wetlands system. **(ST)** ◆ GeoCatch, Water Corp and DoE, should prepare and implement awareness-raising activities dealing with drainage management which includes not only flood control but methods that achieve environmental and social objectives. **(ST)** ◆ Relevant agencies should continuously review awareness-raising activities to ensure they provide useful results. **(S/MT)**

Note: **(ST)** = Short Term 0 – 2 yrs
(MT) = Medium Term 3 – 10 yrs

2.3.4 Heritage, Education and Ecotourism

Overview

The Busselton Wetlands area is recognised as a wonderful asset in the region, possessing significant heritage, educational, scientific, ecotourism and interpretation values and opportunities. There is potential to promote community awareness, to provide access to sites that highlight these values and opportunities and to develop low-impact facilities for present and future generations to enjoy and learn about the wetland values.

Sites of cultural significance to Aboriginal people are registered with the Department of Indigenous Affairs (DIA) and recorded on the Aboriginal Sites Register. Aboriginal sites in WA are protected under the *Aboriginal Heritage Act (1972 – 1980)*. The locations of most of these sites are not known to the general public because of their traditional/secret importance to Aboriginal people. Consultation with the traditional custodians of the land must occur as an integral part of the planning and development process.

Conservation of non-Aboriginal cultural heritage should also be an integral part of the planning and development process. The area surrounding the wetlands has aesthetic, historic, scientific and social qualities valued by the community. Several significant heritage places, notably Wonnerup House, lie within the study area (see Section 3.7). Heritage areas which have historic subdivision patterns, such as the Wonnerup townsite, should be conserved. The *Municipal Inventory of Heritage Places* is a list of locally recognised heritage places compiled in consultation with the local community and in accordance with the *Heritage of Western Australia Act 1990.*

Community workshops and consultation conducted in the preparation of this Strategy recognised the importance of education, scientific and ecotourism values and opportunities within the study area. It was considered that there is a need to promote community awareness of the natural values and attributes of the wetlands and to provide managed access to specific wetland sites, avoiding adverse impacts on waterbird nesting and breeding areas, for appreciation and enjoyment of the wetlands environment. Ecotourism and interpretation facilities should be managed in a sustainable way. Careful management planning will, therefore, be necessary.

Another theme raised through community consultation relates to the role that school groups can, and do, play in monitoring and conservation activities. It was considered that these activities should be encouraged.

Statement of Intent

Places of heritage significance and places of education, scientific and ecotourism value should be conserved for the benefit of present and future generations. In so doing, planning and development should have particular regard for:

- establishment of the cultural heritage significance of the place;
- development and implementation of an appropriate conservation policy for the place;
- preparation of management plans and appropriate management of places in the public domain;
- encouragement of the use of available and future incentives for heritage conservation; and
- encouragement of the use of available and future resources to facilitate sustainable opportunities for education, scientific and ecotourism activities.

Heritage, Education and Ecotourism

General Strategies

- Promote understanding and appreciation of local cultural heritage and diversity and the natural heritage values of the Strategy area.
- Promote the consolidation of reserves adjoining and within the Busselton Wetlands.
- Consultation with the custodians of places of Aboriginal cultural heritage significance will be required at the onset of the planning and development process. Proposals should include an appropriate heritage study and, if considered necessary, the preparation of a conservation plan to guide future development.
- Support raising awareness of Aboriginal and non-Aboriginal heritage, education and scientific values and attributes of the Busselton Wetlands.
- Support low-impact education, scientific and appropriate nature-based ecotourism and interpretation activities/facilities, including strategic walk trails and bird hides, in suitable locations abutting or near the Busselton Wetlands. However, proposals for such activities/facilities should be assessed for their direct and indirect impact on the natural environmental values of the wetlands and their surrounds. Accordingly, proposals will be considered where the proponent can demonstrate that the proposal:
  - will not adversely affect the conservation and landscape values of the Busselton Wetlands;
  - is consistent with the conservation strategies of this Strategy; and
  - is consistent with the non-agricultural use/development criteria specified in Section 2.3.2 above.
- Subdivision and development applications relating to places which are the subject of heritage registration or heritage agreements must comply with the conditions of registration or agreement.
- Recognise the existing heritage places identified in the Shire of Busselton DTPS No. 20.

Heritage, Education and Ecotourism (cont.)

Planning and Environmental Considerations

(also see the Overall Planning and Environmental Considerations listed above.)

- Rural landscape amenity and visual impacts of development;
- Identification of suitable sites for appreciation and enjoyment of the wetlands environment;
- Recognition of Aboriginal and non-Aboriginal heritage and historically significant places;
- Recognition of the role that Noongar people can and should play in the protection of cultural and natural heritage values;
- Funding assistance to promote the educational and ecotourism values of the Busselton Wetlands;
- Contribution of community and school groups in protecting, conserving and enhancing the Busselton Wetlands;
- Programs that inform the community of catchment management activities with a focus on youth and education such as Ribbons of Blue; and
- *Nature Based Tourism Strategy for Western Australia, 2005.*

Guidelines and Actions

- DIA, in conjunction with CALM and local government, should clarify responsibility for Aboriginal heritage, including site protection and management, native title issues relating to heritage and monitoring of approvals or agreements under the Aboriginal Heritage Act, 1972. **(ST)**
- CALM, GeoCatch, DoE, DIA and local government should facilitate a dialogue with the local Noongar community and other stakeholders, to provide for greater involvement for the management of Noongar cultural resources in the wetlands area by the Noongar community. **(S/MT)**
- CALM, DoE, DIA and local government, in consultation with key stakeholders, should promote awareness of Aboriginal and non-Aboriginal heritage, education and scientific values and attributes of the Busselton Wetlands and prepare programs for their progressive implementation. **(S/MT)**
- Promotion of interpretive and educational opportunities should be encouraged utilising local resources wherever possible. Aboriginal involvement in tourism initiatives should be encouraged by relevant agencies. **(S/MT)**
- Tourist developments should be consistent with CALM's management plan(s) for the wetlands.
- DoE and CALM should promote the role that school groups can play in relation to the protection, conservation and enhancement of the Busselton Wetlands. **(S/MT)**
- CALM, DoE, DPI and local government, in consultation with land owners and community groups, should identify suitable sites, access, facilities and funding for education, ecotourism and interpretation purposes. Such access and sites should minimise disturbance of waterbirds and habitats. **(S/MT)**

Note: **(ST)** = Short Term 0 – 2 yrs
(MT) = Medium Term 3 – 10 yrs

2.3.5 Amenity

Overview

This Strategy supports maintaining or enhancing the amenity of the wetlands for the benefit, use and enjoyment of the area by residents and visitors, and to benefit the quality of life for residents. 'Amenity' refers to those environmental (natural and cultural) attributes which combine to form the present character and likely future character of an area and which are increasingly appreciated and valued by the community.

During community consultation, a theme expressed was to maintain the visual or landscape character of both the rural and natural landscape of the area. The visual landscape was considered important, needing to be maintained or enhanced. Many of the issues addressed in Sections 2.3.1 – 2.3.4 above relate to the visual landscape and, to avoid unnecessary duplication, are not addressed in this section.

At the time of writing, DPI is co-ordinating a project to develop landscape planning guidelines for WA. When finalised, these guidelines should raise the importance of visual landscape planning as a valid consideration within the planning process and should assist in preparing landscape planning guidelines for the study area.

Statement of Intent

The Busselton Wetlands and their surrounds have rich and diverse natural and cultural landscape attributes that combine to produce significant amenity values, which should be conserved and enhanced, having regard for:

- protection of the existing biodiversity, landscape and environmental attributes;
- maintaining the existing natural and rural landscape values while providing for change that benefits the social and economic aspirations of the community; and
- ensuring the scenic values of the natural and rural landscape are not compromised by development.

Amenity

General Strategies

- Promote the role that landowners, community groups and agencies play in maintaining and enhancing the biodiversity, environmental and visual landscape values of the privately and publicly owned land adjoining, within or near the Busselton Wetlands.
- Subdivision and development proposals in areas adjoining or near the Busselton Wetlands should be assessed having high regard for adverse amenity impacts. Proponents of subdivision and development should ensure that proposals:
  - are responsive to local values;
  - protect the natural and rural landscape character;
  - are in sympathy with the natural characteristics of the area;
  - are compatible with the landscape integrity and value of the rural and natural backdrops;
  - utilise sites of least visual impact and do not detract from the visual quality of the landscape; and
  - do not compromise the values of the adjoining conservation reserves.
- Improve quality of life for residents by addressing odour and nuisance insects issues in the wetlands area, subject to the over-arching objective to maintain or enhance the conservation and landscape values of the wetlands in balance with the social and economic aspirations of the community.

Planning and Environmental Considerations

(also see the Overall Planning and Environmental Considerations listed above.)

- Rural landscape amenity and visual aspects of development;
- Maintaining scenic views across the landscape to the Busselton Wetlands;
- The relationship between water-levels and water quality regimes, development and nuisance insects; and
- Midge and mosquito problems.

Guidelines and Actions

- GeoCatch and DoE, in conjunction with the Shires of Busselton and Capel, and in consultation with the community, should conduct a visual landscape assessment and prepare visual landscape planning guidelines to preserve the landscape values and amenity of the Strategy area. **(ST)**
- In relation to short-term odour nuisance, local government, in conjunction with State government agencies, should promote community awareness regarding the positive benefits of the seasonal variation in the water-level regime, for example, drying out of the margins of the Busselton Wetlands and the short-term benefit of reduced aquatic weed growth and other symptoms of nutrient enrichment. **(ST)**
- Local government, in conjunction with State government agencies, should identify suitable areas and methods for implementation of strategies to manage midge and mosquito problems that do not compromise the habitats of waterbirds and aquatic life. **(ST)**
- Relevant agencies should encourage the positive role that land owners can, and do, play in the conservation of wetland biodiversity and habitat, and in maintaining or enhancing rural landscape amenity. **(S/MT)**

2.4 Precinct Strategies

This section responds to the need for additional strategies to address specific issues for distinct portions of the study area. The study area has been divided into six precincts (Figure 5). Each precinct is further divided into areas where the General Strategies need to be supplemented with more precise land use strategies and actions to address particular issues. The precincts are:

- Wonnerup Estuary
- Vasse Estuary
- Coastal
- Town
- New River
- Broadwater

It should be noted that, in Section 2.3 above, the General Strategies apply to the overall study area. The Precinct Strategies contained in this section are additional to, and should be read in conjunction with, these General Strategies. The Planning and Environmental Considerations together with the Guidelines and Actions listed in Section 2.3 should be read in conjunction with the Precinct Strategies.

2.4.1 Wonnerup Estuary Precinct

Overview

The Wonnerup Estuary Precinct contains the Wonnerup Estuary, the adjoining land which is predominantly privately owned agricultural land (used mainly for grazing, with a portion devoted to horticulture) and adjoining reserves. Generally, this area is zoned 'Agriculture' under the Shire of Busselton District Town Planning Scheme (DTPS) No. 20 and 'Rural' under the Shire of Capel DPS No. 7. Portions of the precinct are zoned 'Conservation' and 'Rural Residential', or reserved for 'Recreation' under the Shire of Busselton DTPS. The precinct includes a portion of the Tuart Forest National Park and State Forest.

Land within this precinct is generally gently sloping and low-lying. This precinct has high landscape amenity. Extensive views across the estuary are afforded from vantage points, notably along Layman Road and Forrest Beach Road.

The floodgates on the exit channel of the Wonnerup Estuary perform the important task of managing water-levels and the freshwater/saline-water regime of the estuary. This has important consequences for the fringing vegetation and nearby agricultural land (see Sections 3.9 and 5.1).

The Wonnerup Townsite area is zoned 'Rural Residential' and is a heritage area under Council policy (see Figure 9). The precinct also contains several important historic buildings, listed in the Municipal Heritage Inventory (see Section 4.3.2).

This Strategy supports the existing pattern of agricultural land use in this precinct. There is a general presumption against closer settlement in areas which are agriculturally productive and in areas which would conflict with environmental, heritage and landscape values of the Busselton Wetlands.

Continuation of agricultural activities in this precinct should incorporate agricultural practices which conserve the environmental values of the wetlands and are consistent with the Department of Agriculture land use guidelines (see Section 4.4). There is also a presumption against development in the floodway. Where artificial lakes are proposed, early consultation with CALM and DoE regarding design and impacts on the wetlands and wildlife is recommended.

This Strategy supports further investigation of improved linkages and/or wildlife corridors between the Tuart Forest National Park and the Wonnerup Estuary, with controlled and managed public access and the creation of viewing facilities for ecotourism purposes.

This precinct has been further divided into two sectors for which specific land use strategies have been prepared, as follows:

- Wonnerup Agriculture Sector; and
- Wonnerup Rural Residential Sector.

Wonnerup Agriculture Sector

The majority of this sector comprises privately owned broad-acre farm land surrounding the Wonnerup Estuary and adjoining reserves. A portion of this sector is located on the north-eastern side of the estuary and is used for horticultural purposes. Generally, the land is low-lying and some areas are subject to winter inundation. Dampland areas contain some remnant vegetation. Mosquitos and odour nuisance can occur in spring and summer. A narrow portion of the sector extending along the northern side of the Wonnerup Estuary is shown as a 'Recreation' reserve in the Shire of Busselton DTPS.

There is a presumption against closer settlement in this sector. However, limited subdivision of the land based on rural cluster principles can be considered in conjunction with the General Strategies (e.g. see Section 2.3.2). As a subdivision 'trade-off', it is considered desirable that the margins of the Wonnerup Estuary should be reserved and managed primarily for conservation, landscape and foreshore protection purposes. This should be assessed according to the individual merits of any proposals, including consideration of the setting and environmental values. Where the land is retained in private ownership, incentives should be promoted such that the conservation and landscape values are maintained or enhanced.

Regarding reserved land and adjoining privately owned land, co-operative management for mutual benefit is encouraged, particularly in relation to the management of weeds and control of vermin.

Wonnerup Agriculture Sector

Strategies (These strategies should be read in conjunction with the General Strategies in Section 2.3.)	◆ The preferred land use in the Wonnerup Agriculture Sector is broad-acre farming (grazing). ◆ There is a presumption against land use changes, subdivision and development that would have adverse impacts on the wetlands. ◆ Subdivision and development proposals should demonstrate that the biodiversity, environment and landscape qualities of the wetlands and Tuart Forest National Park and State Forest will be maintained and enhanced and should conform to other relevant strategies under this Strategy, in particular, the strategies in Section 2.3.2. ◆ Proposed development that will adversely affect views of the wetlands and/or its scenic natural and rural backdrop, particularly views from developed areas and from major traffic routes, notably Layman Road and Forrest Beach Road, should not generally be supported.
Guidelines and Actions	◆ Read this part in conjunction with Section 2.3.2 Guidelines and Actions. ◆ CALM, in consultation with DoE and GeoCatch, the Shires of Busselton and Capel and local community groups, should prepare and implement statutory management plan(s) for the proposed Vasse-Wonnerup Wetlands conservation reserve over existing Crown land. This should address water quality and sediment management and incorporate public access and walk trails in appropriate locations. ◆ Early consultation with CALM, Shire of Busselton, DoE and GeoCatch about proposed artificial lakes on private property is recommended to ensure that designs will not be detrimental to, but will benefit the wetlands and wildlife.

Wonnerup Rural Residential Sector

This sector is located to the south-west of the Wonnerup Estuary and extends to the Vasse Estuary exit channel and the Vasse Estuary. Generally, this area is low-lying, level and cleared.

The sector is predominantly zoned 'Rural Residential', with a portion zoned 'Conservation' under the Shire of Busselton DTPS. Most lots have been developed for 'lifestyle' purposes. Under the Shire Council's heritage policy the historic subdivision pattern of the Wonnerup townsite rural residential area is recognised. As the existing pattern of subdivision has heritage significance, in this Strategy there is a presumption against further subdivision in this area. Also, the land is not suited to closer settlement for landscape, ecological, drainage, run-off and effluent disposal reasons. Part of the area extends into the 'Floodway Area' designated under the local scheme. This area contains important samphire areas that should be conserved.

Owners of land, particularly land containing samphire areas adjoining the wetlands, should be encouraged to voluntarily support sustainable management of the land for its conservation and landscape values.

Wonnerup Rural Residential Sector

Strategies (These strategies should be read in conjunction with the General Strategies in Section 2.3.)	◆ Rural residential subdivision and development should be confined to committed areas. Development within the 1:100 year floodline is generally discouraged. ◆ Due to heritage, ecological, drainage and wastewater disposal constraints there is a presumption against further subdivision. ◆ Development should ensure the biodiversity, environment and landscape qualities are maintained or enhanced. ◆ Development should be responsive to local values and sympathetic with its site and setting. ◆ There is a presumption against development in the 'Floodway Area' shown in the Shire of Busselton DTPS No. 20, subject to the development control provisions in the Scheme. ◆ There is a presumption against the clearing of remnant vegetation other than for approved building envelopes, access and services. ◆ Promote the establishment of locally indigenous vegetation that complements the environmental values of the wetlands.
Guidelines and Actions	◆ Read this part in conjunction with Section 2.3.3 'Urban and Rural Residential Land' Guidelines and Actions. ◆ Wherever possible, samphire areas should be conserved and recognised as areas of significant conservation value including as waterbird habitat. ◆ Early consultation with CALM, GeoCatch and DoE about proposed artificial lakes on private property is recommended to ensure that designs will not be detrimental to, but will benefit, the wetlands and wildlife.

2.4.2 Vasse Estuary Precinct

Overview

The Vasse Estuary Precinct contains the Vasse Estuary and the surrounding privately owned and reserved land. The precinct extends to Ford Road and abuts the Port Geographe development.

The precinct includes land that is zoned 'Agriculture', 'Rural Residential' and 'Conservation' and the adjoining land that is shown as reserved for 'Recreation' under the Shire of Busselton DTPS. The adjoining Tuart National Park and the Sabina Nature Reserve is managed by CALM.

The landform within this precinct is generally level and low-lying. The Vasse Estuary exit channel floodgates manage the water-levels and the freshwater/saline water regime. This has important consequences for the fringing vegetation and nearby agricultural land (see Sections 3.9 and 5.1).

Generally, the precinct has high landscape value. Scenic views across the estuary are afforded from vantage points, such as along Layman Road and Causeway Road, enabling the landscape quality and the proximity of the Busselton Wetlands to be appreciated.

This precinct is located in close proximity to Busselton's urbanised area and experiences urban development pressure. Community consultation conducted as part of the preparation of this Strategy generally supported retaining the existing agricultural activities in the 'Agriculture' zone.

Continuation of agricultural activities in this precinct should incorporate agricultural practices which conserve the environmental values of the wetlands. There is also a presumption against development in the floodway. Where artificial lakes are proposed early consultation with CALM and DoE regarding design and beneficial impacts on the wetlands and wildlife is recommended.

The privately owned land in this precinct has been further divided into two sectors for which specific land use strategies have been prepared, as follows:

- Vasse Agriculture Sector; and
- Vasse Rural Residential Sector.

Vasse Agriculture Sector

This sector comprises the 'Agriculture' zoned land and the adjoining land near the Vasse Estuary that is shown as 'Recreation' reserve in the Shire of Busselton DTPS. The privately owned farm land which is mainly used for grazing, is generally low-lying and subject to winter inundation.

Remnant vegetation, such as samphire and Melaleuca, occurs around the low-lying flats and margins of the estuary. This area also features two small swamps on the south side of Layman Road, near Avocet Boulevard. These are significant waterbird breeding and roosting habitats and it is noteworthy that there are no other remnant wetlands of this type remaining on the Vasse-Wonnerup floodplain. Accordingly, they warrant conservation. Maintenance of appropriate hydrological regime is a key issue that needs to be addressed to ensure their future.

The sector is situated near to Busselton's urbanised area and is experiencing urban expansion pressure. The Vasse Estuary is highly visible from two major roads that provide access to central Busselton, along Causeway Road and Layman Road. Vistas from these routes extend to the Vasse Estuary across rural land to the Vasse Estuary, and beyond.

Under this Strategy there is a presumption against closer settlement and development, particularly where it would conflict with the environmental, heritage and landscape amenity values of the nearby Vasse Estuary. This should apply particularly where the land is low lying and subject to extensive seasonal inundation. Accordingly, this Strategy recommends that the 'Wetland Area' be modified to include the soil types Quindalup Wet Flats and Quindalup Very Wet Saline Flats, as indicated in Section 2.3.2.

The land zoned 'Agriculture' located to the north of the Vasse and west of the Port Geographe development (Lot 7 Layman Road) affords scenic views to the Vasse Estuary, adjoins Ramsar wetlands and contains significant environmental values. It also lies within the 'Landscape Value Area' under the Shire of Busselton DTPS. It is strategically located close to Busselton's built up area and is accessible. The Strategy (Figure 1) includes Lot 7 as *Rural and Wetland Amenity Area.* As an alternative, the Strategy also recognises that due to the unique circumstances affecting Lot 7, there would be planning and environmental merit in investigating urban subdivision and development of a relatively small portion of the land, with the balance to be included in a conservation reserve and ceded free of cost for public purposes. Factors in favour of such an option include: limited 'rounding off' and integration with residential development near Layman Road; avoiding flood risk land, wetlands and fringing vegetation; potential for minor realignment of portion of Layman Road; and ceding of the balance land free of cost for inclusion in the wetlands reserve.

In the case of future rezoning and subdivision, statutory processes for approval would need to be followed. For example, an urban rezoning proposal would need to be referred to the Environmental Protection Authority for environmental assessment under the *Environmental Protection Act*. Accordingly, Figure 1 shows the western portion of lot 7 overlain with a cross hatch to indicate the extent of area subject to further investigation for its urban development potential, together with ceding of the balance of the land. Under the designation *Rural and Wetland Amenity Area* it is desirable that grazing of Lot 7 continues in the short to medium term. Should residential development of the cross hatch area be pursued following the necessary investigations and rezoning, consideration is to be given to continuation of grazing of portion of the ceded conservation area, subject to suitable environment management measures (the rationale for continued grazing of agricultural land in the Strategy area is outlined in Section 3.2). The first right of refusal to lease (back) the conservation portion of Lot 7 should be granted to the current owner.

Although the above recommendation regarding Lot 7 Layman Road relates to a relatively small portion of the lot, it is a departure from that outlined in the advertised draft Strategy. However, in this instance, re-advertising of the Strategy was not considered necessary given the overall planning and environmental benefit that would result, consistent with the overall purpose of the Strategy (see Section 1.2); insufficient Government funds available to acquire the land; and any future proposal for the land would, in any event, require advertising for public comment.

In regard to the 'Agriculture' zoned land to the south of the Vasse Estuary and east of Ford Road the Strategy recommends a subdivision incentive or, as an alternative, an ecotourism development incentive for this property should the owner

Wetlands near Layman Road.

Vasse Agriculture Sector

Strategies (These strategies should be read in conjunction with the General Strategies in Section 2.3.)	◆ Lot 7 Layman Road is designated *Rural and Wetland Amenity Area* and is subject to the strategies in Section 2.3, with the western portion of this property (as shown by cross-hatching in Figure 1) warranting further investigation for its future urban development potential. ◆ Any proposals for the 'Agriculture' zoned land to the north of the Vasse Estuary (Lot 7 Layman Road) should recognise that it contains two significant remnant wetlands of a type that do not occur elsewhere on the Vasse-Wonnerup floodplain, and which warrant conservation. Any development proposals should demonstrate that hydrological regimes will not be adversely impacted. Development within the 1:100 year floodline is generally discouraged. ◆ Proposed development that will adversely affect views of the wetlands and/or its scenic natural and rural backdrop, particularly views from developed areas and from major traffic routes, notably Layman Road and Causeway Road, should not be supported.
Guidelines and Actions (Read in conjunction with Section 2.3.2 Guidelines and Actions.)	◆ The agricultural land should be managed to protect the conservation and environmental values of the wetlands and margins. Drainage, including stormwater drainage, going through agricultural properties should be managed according to water-sensitive drainage design principles. Non-agricultural uses should be managed so that they do not compromise the social and economic values associated with the existing agricultural use. ◆ GeoCatch, DoE, Shire of Busselton and local community groups, should prepare and implement a statutory management plan for the conservation reserve. These should incorporate walk trails and bird hides in appropriate locations. ◆ Should portion Lot 7 be rezoned and subdivided for residential development, then CALM in conjunction with DoE and the Shire of Busselton should prepare and advertise a concept plan and management plan for the balance portion ceded for conservation and recreation purposes. ◆ Public access to the conservation reserve should be controlled and managed. ◆ Early consultation with CALM, GeoCatch and DoE about proposed artificial lakes on private property is recommended to ensure that designs will not be detrimental to, but will benefit the wetlands and wildlife.

wish to set aside a portion in a conservation reserve to protect wetland values, as indicated in Section 2.3.2.

Also, the 'Agriculture' zoned land west of Layman Road (and south of Wonnerup Rural Residential) is located within the 'Rural and Wetland Amenity Area'. In relation to subdivision and development, the Strategy recommends that the General Strategies in Section 2.3.2 should apply to this land.

Vasse Rural Residential Sector

This sector includes existing 'lifestyle' lots located on generally flat land to the south of the Vasse Estuary. This area is zoned 'Rural Residential' under the Shire of Busselton DTPS.

The adjoining land which abuts the Estuary is shown as 'Recreation' reserve in the local scheme. The 'Floodway Area' shown in the Scheme generally forms the northern limit of the 'Rural Residential' zoned land in this sector. In addition, 'Wetland Area' designated in the Scheme extends across this sector.

This Strategy considers that the existing Scheme provisions of the 'Rural Residential' zoned land in this sector are adequate. This Strategy does not support further subdivision in this sector, as the land is considered not suited to closer settlement for landscape, ecological, drainage, run-off and effluent disposal reasons.

Vasse Rural Residential Sector

Strategies (These strategies should be read in conjunction with the General Strategies in Section 2.3.)	◆ Rural residential subdivision and development should be confined to committed areas. ◆ Due to ecological, drainage and wastewater disposal constraints, there is a presumption against further subdivision. ◆ Development proposals should demonstrate that biodiversity, environment and landscape qualities will be maintained or enhanced. ◆ There is a presumption against development in the 'Floodway Area' and 'Wetland Area' shown in the Shire of Busselton DTPS No. 20, subject to the Scheme's development control provisions. ◆ Proponents of development should demonstrate that the proposed development will be responsive to local values and sympathetic with its site and setting. ◆ There is a presumption against the clearing of remnant vegetation other than for approved building envelopes, access and services. ◆ Establishment of locally indigenous vegetation that complements the environmental values of the wetlands should be promoted.
Guidelines and Actions (Read in conjunction with Section 2.3.3 'Urban and Rural Residential Land' Guidelines and Actions.)	◆ CALM, in consultation with DoE, GeoCatch, the Shire of Busselton, landowners and local community groups, should prepare and implement a management plan for the conservation reserve. These should incorporate walk trails and bird hides in appropriate locations. ◆ Regarding proposed artificial lakes, early consultation with CALM, GeoCatch and DoE is recommended to ensure that the design will result in beneficial impacts on the wetlands and wildlife.

2.4.3 Coastal Precinct

Overview

The Coastal Precinct extends along the environmentally sensitive Geographe Bay coast from the Wonnerup townsite to the northern limit of the study area and to Forrest Beach Road (see Figure 5). It contains the Wonnerup Inlet and sand bar, and the Deadwater. Low beach ridges of the Quindalup Dune System with remnant coastal vegetation are also significant features (see Section 3.2). The dynamic coastline experiences coastal processes that cause seasonal and longer term sand movements. Also, this coast is vulnerable to storm events.

The Geographe Bay coastal strip is attractive for residential and tourism-related development due to landscape values and proximity to beaches and wetlands environs. As well, agriculture has historically extended close to the coastal zone.

Most of this precinct is shown as 'Recreation' reserve in the Shire of Busselton DTPS and is vested with the Shire for coastal foreshore protection purposes. Additionally, much of this precinct is affected by the Shire of Busselton Scheme's 'Coastal Management Area'. The balance portion is predominantly privately owned and zoned 'Agriculture' and 'Conservation' under the Shire of Busselton DTPS. The portion of this precinct extending into the Shire of Capel is zoned 'Rural' under the Shire of Capel DPS No. 7 and is also affected by the DPS 'Foreshore Protection Zone'.

Existing coastal management planning for the Geographe Bay coastline is recognised by the Strategy, i.e. the Geographe Bay Foreshore Management Plan.

The Strategy supports the principles contained in the WAPC *Coastal Zone Management Policy for Western Australia, 2001*, which has been advertised for public comment (see Section 4.2.3). Management policies aim to provide for the protection, conservation and wise use of the land and resources.

The Strategy recommends that proposals for land use change have due regard to the principles in Recommendations for Coastal Reserves, Building Setbacks and Development Controls Along Geographe Bay (see Section 4.3.7) and the *Statement of Planning Policy (SPP) State Coastal Planning Policy 2001*.

Due to the inherent environmental characteristics of the coast in this area there is a presumption against further subdivision of freehold land. A foreshore reserve should be retained and, ideally, extended along the coast. Vegetation retention on the dunes and fringing areas of the coastal wetlands minimises erosion and is required as a buffer for water quality protection and to maintain biodiversity, environment and landscape values. Environmentally sensitive areas should be protected from adverse impacts. Accordingly, there is a presumption against the clearing of remnant vegetation other than for approved building envelopes, access and services. Development should recognise coastal processes. Appropriate development setbacks should protect the coastal Quindalup foredune areas and the wetlands.

Coastal Precinct

Strategies

(These strategies should be read in conjunction with the General Strategies in Section 2.3.)

- The existing foreshore reserve should be retained and extended northwards to Forrest Beach, with due regard to the draft *Greater Bunbury Region Scheme*. The reserve should be of sufficient width to provide a buffer against physical processes and shoreline instability with public access managed and controlled.
- There is a presumption against land use changes, subdivision and development that would have adverse impacts on the wetlands and the coastal dune system. Any proposals for subdivision and development should be assessed for their compatibility with the conservation of biodiversity, environmental and landscape values and should conform to the relevant General Strategies in Section 2.3. Development within the 1:100 year floodline is generally discouraged.
- There is a presumption against the clearing of remnant vegetation other than for approved areas such as building envelopes, access and services, noting that these will be preferentially situated in already cleared portions of land.
- Proposed development that will adversely affect views of the coast and wetlands and/or its scenic natural and rural backdrop, particularly views from developed areas and from traffic routes, notably Layman Road and Forrest Beach Road, should not be supported.

Planning and Environmental Considerations

Refer to the Overall Planning and Environmental Considerations listed in Section 2.3 above and the following (with regard to the principles and issues in the draft policies and strategies listed):

- WAPC *Coastal Zone Management Policy for Western Australia, 2001*;
- WAPC *SPP 2.6 State Coastal Planning Policy, 2001;*
- DPUD Recommendations for Coastal Reserves, Building Setbacks and Development Controls Along Geographe Bay (Review);
- *GeoCatch Geographe Catchment Management Strategy, 2000*;
- Shire of Busselton DTPS No. 20 'Coastal Management Area';
- Shire of Busselton Geographe Bay Foreshore Management Plan;
- Coastal dunes are particularly attractive for residential and tourism-related development due to landscape values, limited potential for agricultural use and proximity to beach and estuary environs;
- Sea level change;
- Coastal erosion and accretion phases;
- Location and design of public beach access and beach facilities, including small nodal carparks;
- Four-wheel drive vehicle access; and
- Heritage significance of subdivision pattern within the Wonnerup townsite.

Coastal Precinct

Guidelines and Actions	
	◆ The Shire of Busselton, in conjunction with CALM, GeoCatch and relevant community groups should continue to implement the Geographe Bay Foreshore Management Plan. ◆ Management plan(s) should be prepared and implemented for all coastal and wetland foreshore reserves in this precinct. ◆ Public access to the coast, including access for four-wheel drive vehicles, should be controlled and managed. ◆ Proponents of subdivision and development should have regard to: • conserving or enhancing environmental and landscape values; • maximising the retention of natural vegetation; • local landscape management guidelines; • appropriate coastal development setbacks; • availability of services; • suitable means of effluent management; • acceptable bushfire protection; and • overall impact on coastal and wetland values.

2.4.4 Town Precinct

Overview

The Town Precinct is located near the centre of Busselton, between the New River Wetland and the Vasse Estuary. This area contains the portion of the Vasse River upstream from Ford Road. Under the Shire of Busselton DTPS, most of the precinct is zoned 'Residential', 'Industrial' or 'Tourist'. The remainder is either zoned 'Agriculture' or is shown as 'Recreation' reserve or 'Community Purposes' reserve.

Generally, the issues affecting this area are addressed in Section 2.3, in particular Section 2.3.3 'Urban and Rural Residential Land'. Important issues in the precinct relate to urban stormwater management and industrial drainage.

In relation to the 'Agriculture' zoned land located west of Ford Road, the Strategy does not support urbanisation or further subdivision. This land contains samphire and is low-lying and flood-prone. It contains some development and fill and is located within the Shire of Busselton DTPS 'Wetland Area'. In addition, the land is highly visible from Causeway Road and Bussell Highway, which are major roads providing access to the town. This area has landscape and amenity value which should be retained and enhanced. As per the recommended strategies, guidelines and actions in Section 2.3.5 'Amenity', the Strategy recommends a visual landscape assessment and the preparation of visual landscape planning guidelines for such areas.

Town Precinct

Strategies

(These strategies should be read in conjunction with the General Strategies in Section 2.3.)

- There is a presumption against further subdivision of 'Agriculture' zoned land in this precinct. Development within the 1:100 year floodline is generally discouraged.
- This Strategy:
  - encourages the installation of reticulated sewerage for existing and future urban and industrial areas;
  - promotes urban design which recognises sustainability principles, water-sensitive design principles and landscape elements, including site-specific cultural and natural heritage features; protects remnant vegetation; promotes safe access by walking and cycling and, where appropriate, links with wetland walk trails and bird hides; integrates with the traditional and urban character, and promotes energy efficiency;
  - promotes townscape/landscape improvement programs to enhance the visual landscape for areas adjacent to or near the wetlands, and recognise the conservation and environmental values of the wetlands; and
  - promotes road design in the Strategy area that responds to the conservation and environmental values of the wetlands and which does not detract from the visual landscape.
- Proposals for subdivision and development should demonstrate that the biodiversity, environmental and landscape values of the wetlands, in particular, the water quality regimes of the Lower Vasse River and the Vasse Estuary, will not be adversely affected.

Guidelines and Actions

Read this part in conjunction with the relevant in Section 2.3.3 'Urban and Rural Residential Land' Guidelines and Actions and Section 2.3.5 'Amenity'.

- The Shire of Busselton in conjunction with DPI, CALM, GeoCatch and DoE should prepare and implement programs to facilitate townscape/landscape improvement. The programs should foster the town's unique identity, site and setting between the Lower Vasse River and Geographe Bay.
- Relevant agencies should identify and seek funding sources for townscape/landscape improvement programs.
- DoE/Geocatch, where appropriate, should monitor water quality.
- CALM, in consultation with GeoCatch, DoE, the Shire of Busselton and local community groups should develop a concept plan to guide management of the wetland system, with the focus being on restoring Lower Vasse River Wetland functions and values, reducing nutrient inputs, and providing defined public access, observation and interpretive facilities.
- Shire of Busselton, GeoCatch and DoE to continue implementation and maintenance of the Lower Vasse River Cleanup Program, including sediment treatment and removal, restoring river ecology, urban/industrial catchment management, and rural catchment management to improve the ecological health of the Lower Vasse River.

2.4.5 New River Precinct

Overview

This precinct contains the section of the New River which drains into the Lower Vasse River. The area is seasonally inundated flood-prone land, although in recent years it has not dried up in summer. It contains a large area of natural vegetation forming part of the open space system.

The precinct is predominantly shown as 'Recreation' reserve in the Shire of Busselton DTPS. Also, it is mainly within the 'Floodway Area' and 'Wetland Area'. The surrounding land is mainly urban. The Strategy supports the retention of the existing reserves and zones and recommends that urban development be confined to areas committed by zoning under the Shire of Busselton DTPS, endorsed structure plans or planning strategies.

New River Precinct	
Strategies	◆ There is a presumption against further subdivision in this precinct. However, any proposals for subdivision and development should be assessed for their compatibility with the conservation of biodiversity, environmental and landscape values, with water sensitive drainage design and with relevant General Strategies in Section 2.3. ◆ Urban development should be confined to areas committed by zoning under the local scheme, endorsed structure plans or planning strategies. ◆ There is a presumption against the clearing of remnant vegetation other than for approved areas such as building envelopes, access and services, noting that these will be preferentially situated in already cleared portions of land. ◆ Any development proposals should be responsive to its site and setting; have due regard for the landscape integrity and value of the rural and natural backdrops; utilise sites of least visual impact; and not compromise the conservation values of the adjoining or nearby reserves.
Guidelines and Actions	◆ CALM, in consultation with GeoCatch, DoE, the Shire of Busselton, landowners and local community groups, including nearby primary and secondary schools, should prepare and implement a management plan for the conservation reserve. These should incorporate public access, walk trails and bird hides in appropriate locations.

2.4.6 Broadwater Precinct

Overview

This precinct contains the Broadwater wetland area, which is separated from the Vasse-Wonnerup estuaries and New River by the Vasse Diversion Drain to the east. The Buayanyup Diversion Drain marks its western boundary.

The area is low-lying and experiences extensive winter inundation. Flood protection is reliant upon both the Vasse Diversion Drain and the Buayanyup Diversion Drain. Breeching of these drains can result in extensive inundation of the Broadwater area. Generally, flooding in the Broadwater discharges via the Vasse Diversion Drain with flood waters in the upper catchment discharged via the Buayanyup Diversion Drain.

Broad-acre farming is an important land use within this precinct, notably on historically and relatively small (approximately 5 to 10 hectares) privately owned farming lots. Generally, these lots are 'consolidated' to form holdings for effective farm management and operation and are predominantly zoned 'Conservation' with the remainder zoned 'Agriculture' under the Shire of Busselton DTPS. Contiguous with the Broadwater wetlands are the Shire of Busselton DTPS 'Wetland Area', 'Floodway Area' and 'Landscape Value Area' (see Figure 9).

This Strategy supports maintaining and enhancing the biodiversity, environment and landscape values of these areas around the wetlands. This Strategy also recognises that the floodwater drainage discharge problems in this precinct need to be addressed.

Also, 'lifestyle' lots have been developed in this precinct in areas which are zoned 'Rural Residential' and 'Conservation'. A significant portion of the precinct is shown as 'Recreation' reserve in the local scheme. This precinct contains the Broadwater Nature Reserve and is managed by CALM for conservation purposes.

In this precinct there is a general presumption against further subdivision of land within the 'Agriculture' and 'Conservation' zoned land.

However, subdivision and development based on rural cluster principles can be considered in circumstances where proponents demonstrate that proposals reflect detailed site investigation and will result in no adverse impacts on the biodiversity, landscape and environmental values of the wetlands. In such circumstances, proposals should accord with the relevant General Strategies in Section 2.3.2.

This precinct adjoins existing and committed urban areas which have endorsed structure plans (see Section 4.3.3). The Vasse New Town Development Guide Plan has been endorsed and provides for significant expansion of the Vasse Townsite.

Broadwater Precinct

Strategies

(These strategies should be read in conjunction with the General Strategies in Section 2.3.)

- Proposed development which will adversely affect views of the wetlands and/or its scenic natural and rural backdrop, particularly views from developed areas and from major traffic routes, including the Bypass Road, should not be supported. Development within the 1:100 year floodline is generally discouraged.

- There is a presumption against further subdivision of land zoned 'Agriculture' and 'Conservation' within this precinct. However, subdivision and development of land based on rural cluster principles can be considered in circumstances where proponents demonstrate that proposals reflect detailed site investigation and will result in no adverse impacts on the biodiversity, landscape and environmental values of the wetlands. In such circumstances, proposals should accord with the relevant General Strategies in Section 2.3.2, including the reference to the 'Wetland Amenity Line', based on the soil criteria that defines the 'Rural and Wetland Amenity Area'. Development within the 1:100 year floodline is generally discouraged.

- Low-impact ecotourism or educational facilities proposed on low capability agricultural land, based on natural attractions and compatible with neighbouring existing land uses, and which do not compromise the biodiversity, environmental and landscape values, can be considered.

Guidelines and ActionsGuidelines and Actions

Read this part in conjunction with the relevant Guidelines and Actions and Sections 2.3.1 to 2.3.5.

- CALM, in consultation with GeoCatch, DoE, the Shire of Busselton, landowners and local community groups, should prepare and implement a management plan for the conservation reserve. These should incorporate public access, walk trails and bird hides in appropriate locations. Emphasis should be placed in linking those areas with existing native vegetation.

- Subdivision or development proposals, in particular, low-impact ecotourism or educational development proposals, should demonstrate that the development will not prejudice current agricultural land use activities within the precinct. The acceptability of any proposal within this precinct should be determined having regard to advice from relevant agencies, planning and environmental considerations, including policies of the WAPC and adopted policies of the Shire of Busselton.

2.5 Implementation

This Strategy provides the broad framework within which sound land use planning and management decisions can take place. The Strategy has been prepared as a strategic plan and provides guidance only. The Strategy will not replace the need for the local government to prepare strategies or resolve issues of local concern.

It is acknowledged that there may be areas within the study area where development pressure will require more detailed planning and environmental investigation. Such pressure may give rise to the need to consider establishing greater guidance or statutory controls to address specific proposals/issues which may impact on the biodiversity and environmental values of the wetlands.

Successful implementation of the final Strategy is reliant upon its acceptance and ownership by the local community and the support of both State and local governments. Agreement on the framework for implementation is necessary for the success of the final Strategy.

2.5.1 Preferred Method of Strategy Implementation

The success of the Strategy's implementation lies in its acceptance by the local community and a structured decision-making process. The preferred method of Strategy implementation is as follows:

Government Agencies

Implementation will be largely effected through the agencies listed as having carriage of each of the recommended Guidelines and Actions (see Section 2.3 and 2.4). These agencies have various roles to play in planning for the environmental, social and economic sustainability of the area.

Landowners

The Strategy recognises the past and ongoing contribution of rural landholders in maintaining the conservation values of the wetlands. The Strategy acknowledges and encourages the voluntary work that landowners do in relation to conserving and enhancing wetland values.

Community Groups

The Strategy also acknowledges and encourages the voluntary work that community members do in relation to conserving and enhancing wetland values. In addition, the Strategy supports the establishment of a 'Friends of the Busselton Wetlands Group' to assist in this work through co-ordination and promotion of positive actions, and access to funds for such.

Statement of Planning Policy

Notwithstanding the role that individual agencies, landowners and community groups may play in implementing the strategies, guidelines and actions contained in Sections 2.3 and 2.4, which are considered essential for successful Strategy implementation, a Statement of Planning Policy (SPP) under Section 5AA of the *Town Planning and Development Act 1928* should be prepared in consultation with landowners, community groups and relevant agencies. An SPP can provide a statutory basis for implementation of the Strategy.

Busselton Wetlands Conservation Strategy Implementation Committee

An implementation committee should be formed to oversee the implementation of the Strategy, including co-ordination between all affected parties. The committee could set priorities and report annually to relevant agencies, landowners and the community through GeoCatch.

Technical Advisory Group

A Technical Advisory Group (TAG) consisting of a group of technical officers should be convened as appropriate to consider specific contentious proposals to ensure that all relevant agency groups are brought together to consider such in a timely way and to assist the Shires of Busselton and Capel regarding the technical resources burden. This group could also consider issues or implementation difficulties that may arise and report its findings to relevant agencies or authorities as appropriate.

Co-ordination Officer

A Co-ordination Officer should be appointed to a relevant agency with prime responsibility for co-ordinating the implementation of the Strategy and for disseminating scientific information regarding the Busselton Wetlands. Although lead agencies have been nominated for the majority of the guidelines and actions, successful implementation will be facilitated by such an officer, appointed on a full-time, two-year limited tenure basis.

2.6 Monitoring and Review

The Strategy should be the subject of ongoing monitoring and be amended as required. To maintain the relevance of the Strategy, it should be reviewed every five years.

At the time of writing, the Wetlands Coordinating Committee is addressing the implementation requirements of the *Wetlands Conservation Policy for Western Australia*. This includes consideration of draft guidelines for identifying wetland buffers. It is recommended that in the review of the Strategy, if appropriate, the recommendations of the study on guidelines for the identification of wetland buffers be incorporated in the Strategy.

Additionally, an evaluation or measure of the success of implementation should be reported annually to relevant agencies and the community.

The information gaps and further research needs identified in the report should be rigorously pursued and incorporated in the Strategy where appropriate.

The Natural and Cultural Landscape 3

3 The Natural and Cultural Landscape

In this chapter the key elements of both the natural and cultural landscape are described. The natural landscape elements are features such as landforms, waterforms and drainage features, soil, vegetation and wildlife, whereas the cultural landscape may be seen as human modification of the original (natural) landscape.

In summary, the natural and cultural landscape features of the study area are as follows:

- The Busselton Wetlands are located on the Swan Coastal Plain. They form part of the Geographe Bay catchment.
- The area experiences a Mediterranean-type climate with warm, dry summers and cool, wet winters. Its coastal proximity results in moderating oceanic influences.
- The study area generally has low relative relief, sandy soils surrounding the wetlands and fine grained estuarine soils underlying the water-bodies. Areas of remnant fringing vegetation include samphire, sedgeland, open scrub, tuart forest and peppermint woodlands. The landform units show variation as follows:
  - between Geographe Bay and the wetland chain is a series of low, coastal dunes which are vegetated with peppermint woodland. Small areas of this land unit have been cleared for agriculture. However, this area does not have a high capability for that use;
  - behind the beach ridge system is the long, narrow depression associated with the water bodies of the wetland system;
  - both sides of the water-bodies are slightly raised terraces of calcareous sand and estuarine deposits. The lower terraces, which experience winter inundation, are generally vegetated with samphire. The higher terraces, which have sufficient elevation to escape winter inundation, were some of the first lands developed for agriculture in the district. Currently, they support good perennial pastures and the bulk the wetland's grazing animals; and
  - on the inland side of these southern agriculturally productive areas, the land rises to low sandy ridges over limestone supporting tuart and peppermint. Parts of this unit have been parkland cleared for grazing. More recently, areas are being used for irrigated agriculture, potato and lucerne production.
- Traditionally the semi-nomadic Aboriginal people of the Wardandi tribe occupied the area, making use of permanent water, abundant and reliable food resources including waterbirds and marine life, and other animal and vegetable food resources.
- European settlement of the Vasse area for farming occurred in the 1830s.
- The cultural landscape of the study area is now characterised by livestock grazing, with some rural residential lifestyle uses and urban development.

3.1 Geographe Bay Catchment - Overview

The Geographe Bay catchment area is approximately 2,000 square kilometres (see Figure 4) and lies within the boundaries of four local government authorities, mainly the Busselton and Capel shires with small portions lying in Donnybrook-Balingup and Augusta – Margaret River shires. Extensive clearing has occurred in the catchment. It is highly valued for its natural and cultural attributes: there is significant demand for residential, recreational, agricultural, industrial and commercial activities. These uses, combined with a rapidly increasing population in the region, have contributed to significant environmental pressure on the catchment with resultant land and water degradation.

The main physical features of the upper catchment, and the source of headwaters, are the Darling Scarp, the Whicher Scarp and the Leeuwin-Naturaliste Ridge. The upland terrain is undulating and heavily dissected by watercourses. They provide a scenic backdrop to the Swan Coastal Plain, wetlands, watercourses and the coastline of Geographe Bay.

Geographe Bay forms the southern coastal extent of the Swan Coastal Plain proper which is a regional geomorphologic feature extending from Gingin Brook to the north of Perth to Dunsborough (Seddon 1972). Its surface expression consists of four distinctive parallel landform features and related soil types: successive coastal sand dunes, alluvial plains and the foothills (see Section 3.2). Geographe Bay is a shallow, gently sloping, generally sandy bottomed bay that is vegetated by extensive and diverse seagrass meadows.

The natural drainage network of the lower catchment has been extensively modified to assist agricultural productivity and flood protection (see Section 3.9). There is a system of drains that discharges primarily to the Vasse Estuary. The Vasse River Diversion drains directly into the bay. Drains in the Ludlow area drain into the Wonnerup Estuary. Beyond the study area, at Quindalup to the west, drains flow into Toby Inlet and, to the north, Stirling drains to the Capel River.

The Geographe catchment is an important agricultural area – over half the area is used for this purpose. Traditionally, sheep and cattle grazing have been the predominant agricultural activities. In recent years, horticulture and viticulture have become more important. Other important economic activity includes tourism, recreation, fishing, forestry (some limited harvesting of jarrah and tuart) and mining (heavy mineral sands and gravel and sand extraction).

The soils of the catchment have been described by McArthur and Bettanay (1974) and mapped by Tille and Lantzke (1990). They occur in a patchwork pattern over the predominantly level terrain. Generally, they are sandy, low in natural fertility and require drainage and the application of fertilisers to establish and maintain agricultural productivity (see Section 3.2).

The native vegetation and fauna of the study area are described in Sections 3.4 and 3.5 respectively. Historically, there was considerable biodiversity within the catchment area. There are endemic communities in the region and many species have become rare. There are 30 Declared Rare species in the Geographe Bay catchment (see Appendix 7) and numerous Priority Listed Species.
The fauna of the catchment is under pressure from loss or fragmentation of habitat. The decline of habitat is attributed to clearing, land degradation, changes to fire regimes and the introduction of non-native species (weeds, pests, feral animals and domestic animals). Population numbers of most faunal species have declined and several species have become extinct.

The values that people hold for the area were identified in the preparation of the *Geographe Catchment Management Strategy*, (see Section 4.3). In summary, there is a strong desire to retain the natural qualities of the area and the semi-rural lifestyle people enjoy, whilst meeting the need for continued economic and employment growth.

3.2 Geology, Hydrogeology, Geomorphology and Soils

The Busselton Wetlands are located on the Swan Coastal Plain, which is geologically young, generally less than 2.5 million years old (Seddon, 1972). A portion of the study area extends to the coast, near the Vasse-Wonnerup exit channels and the Wonnerup Inlet.

In the last 15,000 to 20,000 years, sea level changes have occurred in the region. About 20,000 years ago, the sea level was much lower and the coastline was considerably seawards of its present position; about 7,000 years ago, the level was about 2.5 metres higher; and small-scale fluctuations occurred about 4,000 to 5,000 years ago (Balla, 1994). However, present levels were reached about 6,000 years ago. These changes in sea level produced a dynamic and changeable landscape composed of a series of landform units that correspond to particular sea levels.

The Swan Coastal Plain consists of marine, aeolian (wind) and alluvial (riverine) sediments, arranged in a sequence of four main geomorphic units, each of which have distinctive geology, topography, soil, vegetation and drainage features. The four geomorphic units are the Quindalup Dune System, the Spearwood Dune System, the

Bassendean Dune System and the Pinjarra Plain (Seddon, 1972).

- The **Quindalup Dune System** is the most recently formed dune system and fringes the present coastline in the study area. These dunes are low beach ridges and largely comprise unconsolidated quartz grain sand and calcareous material. They are recent aeolian and marine deposits stemming from the Pleistocene age – most having formed in the last 7,500 years. Quindalup soils are alkaline, have low water holding capability, drain rapidly, have little soil development and have low agricultural value.

  Within the study area three Quindalup soil types have been classified (see Figure 6):

  - Quindalup Flats (Q) – flats and low rises with deep pale calcareous sands;
  - Quindalup Wet Flats (Qw) - poorly drained wet flats on raised terraces around the edge of the estuaries and consist of a variety of soils with dark calcareous sands and marine deposits being predominant. Generally these soils have high organic matter and calcium carbonate content and have low phosphorus retention capability; and
  - Quindalup Very Wet Saline Flats (Qwy) – Vasse-Wonnerup estuaries and the Broadwater and in low-lying depressions which are often underwater in winter and saline in summer (Tille and Lantzke, 1990).

- The **Spearwood Dune System** is higher, older and inland of the Quindalup Dune System. This system contains old dune ridges each representing former coastlines in the Pleistocene age. Locally, this unit corresponds to the Ludlow Plain Land System. The Spearwood Dune System parallels the Geographe Bay shoreline and the Quindalup Dune System, and overlies the Tamala Limestone. Spearwood soils consist of yellow-brown siliceous sands overlying aeolian or marine Tamala limestone at varying depths. These soils have low moisture-holding capacity. However, under irrigation, and with the use of fertilisers, they are productive for vegetable crops and pasture. Careful management is required to prevent nutrients entering wetlands. Where the terrain is level, waterlogging can occur.

  Within the study area Ludlow soils have been classified and are comparable with the Spearwood soils. The Ludlow soils have a recognised ability to retain phosphorus. Where there is sufficient depth of soil to the watertable these soils are suitable for horticultural activity because they have moisture and nutrient retaining qualities. Of note are the following Ludlow soils:

  - Ludlow Wet Flats (Lw) – flats with poor subsoil drainage in winter characterised by deep yellow - brown siliceous sands over limestone;
  - Ludlow Flats (L) – flats and very low dunes characterised by deep yellow - brown siliceous sands over limestone;
  - Ludlow Wet Rocky Flats (Lwr) – flats with subsoil waterlogging and moderately deep to shallow brown and yellow sands over limestone (Tille and Lantzke, 1990).

- The **Bassendean Dune System** lies inland of the Spearwood system. It is characterised by low dune ridges of leached siliceous sand interspersed with sand flats prone to waterlogging and usually inundated in winter, particularly where the lower soil horizon contains clay layers. Bassendean soils have low fertility and moisture holding capacity and low ability to hold nutrients. They have lower agricultural value than Spearwood soils. However, under irrigation and appropriate fertiliser application, they can support plant growth. Careful management is required to avoid leaching of nutrients into wetlands and watercourses.

- The **Pinjarra Plain** consists of alluvial sediments deposited at the base of the scarp, extending approximately 8 kilometres inland from the Vasse-Wonnerup estuaries. The sediments have been transported by streams from the upland area since the retreat of the sea 240,000 years ago (McArthur and Bettenay, 1974).

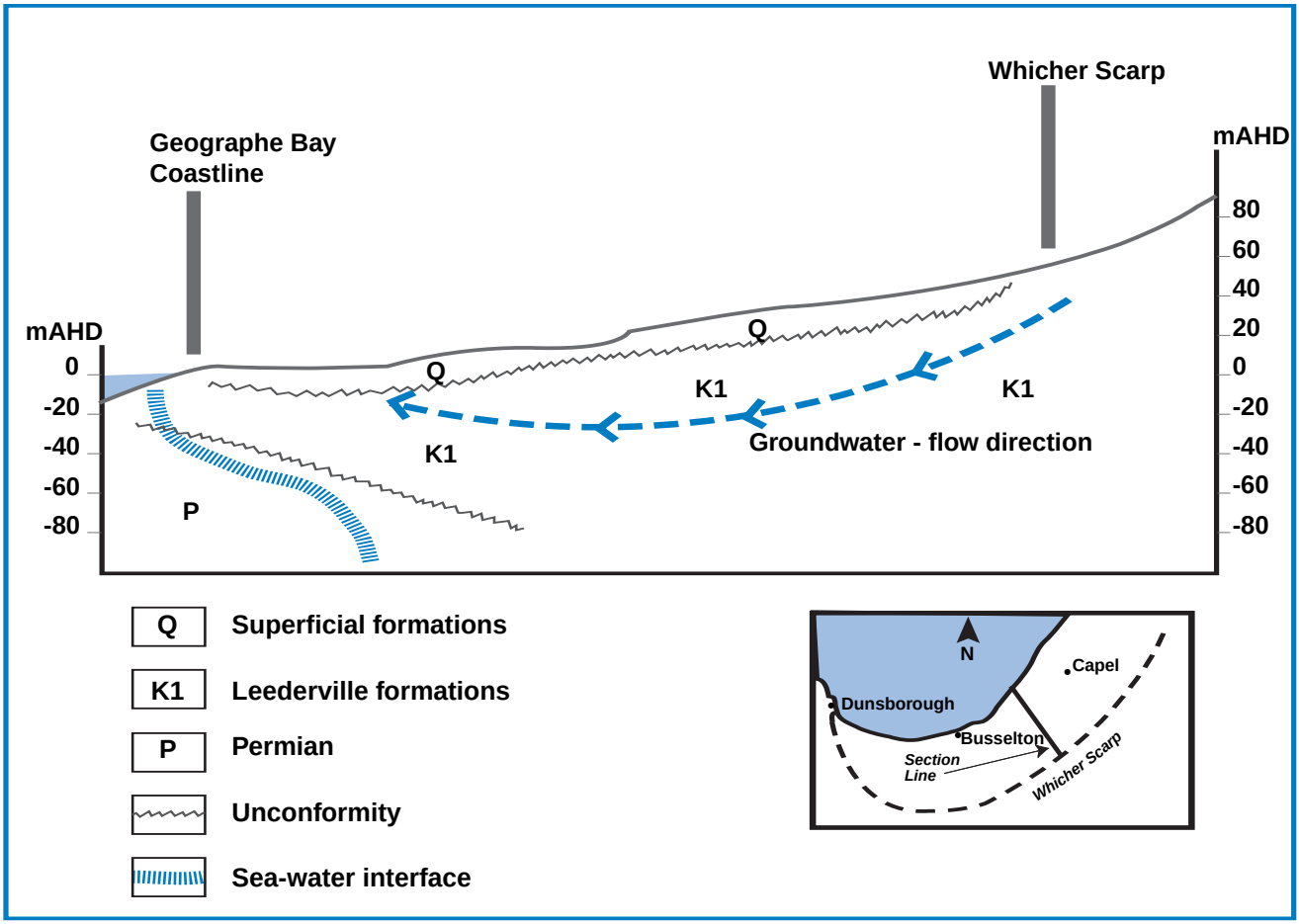

Figure 7 Generalised Cross-section East of Busselton

The Busselton Wetlands lie within an elongated depression located between the Quindalup system on the coast and further inland the Spearwood Dune System. They contain saline dark calcareous sands mixed with estuarine and lacustrine sediments (Vasse deposits or Quindalup wet flats). Beneath these sediments are the underlying older sedimentary sandstone units of the Perth Basin (see Figure 6).

Groundwater in the study area forms part of the Busselton-Capel Groundwater Area which has significant sustainable groundwater resources, estimated to be approximately 130 million kilolitres per year.

There are two main groundwater flow systems in the Geographe Bay catchment area: the unconfined aquifer within the near surface Superficial Formation, and the confined system in the underlying formations (confined water is water held within rock/clay layers), notably the Leederville Formation:

- The **Superficial Formation** consists predominantly of Quaternary deposits of sand and limestone. The water table fluctuates seasonally, rising in winter. The groundwater flow regime is complex – generally the flow direction is towards the coast. Most recharging is by rainfall but some inflow occurs from the underlying Leederville Formation.
- The **Leederville Formation** consists of interbedded sand and shale of Upper Cretaceous age. It ranges from 50 metres thickness in the west to about 500 metres in the east of Busselton Shire. Groundwater flow is generally north, towards the ocean, where it discharges. Potable water supplies in Busselton and Dunsborough are obtained

from the Leederville Formation. Below the Leederville Formation, at varying depths, are the Cockleshell Gully and Sue Coal Measures in the west and the Yarragadee Formation in the east. The Sue Coal Measures aquifer does not contain significant groundwater resources. At the time of writing additional work is being carried out regarding groundwater resources.

Confined groundwater is used for public water supplies, horticulture and mining. Groundwater management including licence allocation is important to ensure sustainable groundwater stores and maintenance of the groundwater – saltwater interface (see Section 3.9.5).

3.3 Climate

The study area experiences a Mediterranean-type climate, with warm, dry summers and cool wet winters.

The seasonal migration of air pressure belts primarily determines climatic conditions. The winter pattern is dominated by mid-latitude low-pressure systems and associated cold fronts that produce squally, wet, cool conditions. During winter, storms occur frequently (approximately every three to five days) bringing strong northerly to north-westerly winds, backing to the south-west. Although the northerly to north-westerly phase is of short duration, the storms can be of sufficient magnitude to cause substantial coastal erosion due to storm surge and high energy waves. Most rainfall is recorded between May and September, when approximately 650mm of the mean annual total of 830mm is received.

The summer pattern is dominated by subtropical high-pressure air masses that produce fine, dry conditions. Frequently experienced are easterly winds in the early part of the day and south-westerly winds in afternoons. Occasionally, during January to April decaying tropical cyclones reach the region and can produce heavy rainfall, high winds and significant storm surges. For example, the storm associated with Cyclone Alby in 1978 produced a storm surge of 1.94 m AHD.

The January and July temperature and rainfall figures for the area are as follows:

- January: a mean maximum temperature of approximately 25°C, a mean minimum temperature of 15°C and a mean rainfall amount of 11mm; and
- July: a mean maximum temperature of approximately 16°C, a mean minimum temperature of 10°C and a mean rainfall amount of 165mm.

Greenhouse Effect

Many scientists now agree that the atmosphere is warming and sea level rising. Global sea levels have already risen between 10cm and 25cm over the past 100 years. The United Nations Intergovernmental Panel on Climatic Change acknowledges the growing body of climatic and sea level change evidence and also acknowledges that this is likely to continue in the future (WAPC *draft Coastal Zone Management Policy for Western Australia 2001*). The extent of this change remains uncertain.

In the South-West of WA it is anticipated that changing weather patterns will result in increasing storm activity and intensity. The potential impacts of this are cause for concern. Estimates regarding the 'greenhouse effect' scenario for South-West waters suggest a mean sea level rise of 20cm (plus or minus 10cm) to the year 2030.

The coastline of Geographe Bay is regarded as one of Australia's most vulnerable to the future potential impacts of sea-level rise (Kay, Eliot and Klem, 1992). The impact of increasing storm activity and anticipated sea-level rise is considered in the *Geographe Catchment Management Strategy*. Although this document highlights the impacts of increased erosion and loss of shoreline any consequential impacts on the wetlands are uncertain.

3.4 Native Vegetation

Non-wetland Vegetation

The Quindalup dunes previously supported peppermint Agonis flexuosa associations of varying densities and heights. Peppermints now mainly occur as remnants due to clearing for agriculture and urban development. However, in some places stands survive as low closed forest, low open forest and low open woodland with occasional taller stands of closed and open forest. The understorey of these associations includes introduced pasture plants and weeds and typical dune shrubs: *Acacia littorea, Acacia cyclops, Adriana quadripartita, Hibbertia cuneiformis, Eremophila glabra, Lepidosperma gladiatum, Trachyandra divaricata, Spyridium globulosum, Diploaena dampieri and Hardenbergia comptoniana.*

Small depressions between the parallel dunes have generally been cleared and support only remnant swamp paperbarks *Melaleuca raphiophylla*, flooded gum *Eucalyptus rudis*, and various rushes and sedges.

The rising land south of the wetlands supports marri Eucalyptus calophylla. Tuart Eucalyptus gomphocephala, high woodland and high open woodland, occurs to the southeast and east of the Vasse-Wonnerup estuaries. Typical understorey of the marri open forest consisted of trees and shrubs including bracken fern, zamia palm, bull banksia, *Persoonia longifolia, Acacia pulchella, Acacia cyclops, Acacia saligna, Hibbertia cuneiformis, Hakea prostrata* and *Xanthorrhea priessi*. Much of the original open forest has been cleared leaving remnant trees and isolated understorey shrubs.

The tuart high woodland occurs from just south of the Abba River, northwards around Ludlow and beyond. The understorey consists principally of dense peppermints Agonis flexuosa and numerous but sparsely distributed low species. The high woodland is immediately adjacent to the eastern edge of the Vasse-Wonnerup estuaries, confined to land generally above the 2.5 metre contour. Below this contour, and on the banks of the Abba River, it is replaced by flooded gum *Eucalyptus rudis* open forest and swamp paperbark *Melaleuca rhaphiophylla* low open forest.

Wetland Vegetation

Wetland vegetation consists of:

- samphire dominated by *Sarcocornia blackiana* and *Halosarcia pergranulata*;
- sedgeland consisting of *Juncus kraussii* or *Bolboschoenus caldwelli* and occurrences of *Lepidosperma leptostachyum* and *Carex divisa;*
- open scrub of *Melaleuca cuticularis, M. hamulosa* and *M. rhaphiophylla,* which is extensive and intact near Sabina River and part of the Broadwater and the New River;
- flooded gum *Eucalyptus rudis* (Jaensch 1993, Tingay and Tingay, 1980).

Fringing vegetation New River

In places, the samphire associations have been cleared, but are extensive and vigorous, particularly to the north-east of both estuaries. Dense *Bolboschoenus caldwelli* occurs extensively at the Vasse River deltaic marshes and in smaller areas around the Vasse lagoon.

The fringing vegetation around the New River is generally in good condition to the east of Queen

Elizabeth Avenue where there are stands of *Melaleuca cuticularis*, low closed forest and *Juncus krausii* sedgeland. To the south is an extensive low lying area of mixed shrub low open woodland and Eucalyptus rudis open woodland.

Encroachment of weeds and pasture grasses has occurred on the margins of the wetlands. In some areas introduced grasses such as couch and kikuyu have contributed to a severe weed problem. Declared noxious weeds are controlled by the *Agriculture Protection Board Act 1950*.

In the period from 1995 to 1997 additional seawater flooded the wetlands in summer, as a consequence of changes in floodgate management. Subsequently, a study of the fringing vegetation of the Vasse Estuary was conducted by Froend et al, 2000 (see Section 4.4). Most of the selected sites around the estuary showed:

- evidence of degradation through salinisation as well as removal and trampling of the fringing vegetation by people and livestock;
- significant decline of native overstorey species, although at some sites there was evidence of overstorey recruitment; and
- salt-tolerant species such as samphire are widespread and encroaching to higher elevations. Invasive introduced species have restricted native species and the potential for seedling recruitment.

3.5 Wildlife

The Busselton Wetlands support a great abundance and variety of waterbirds. Total numbers on the whole wetland system are unknown. However, surveys conducted during the mid 1980s and late 1990s have revealed that more than 30,000 birds of 60 species inhabit the Vasse-Wonnerup component alone, each year. The total number of waterbird species recorded in all surveys to date is now almost 90.
Waterbirds are present in greatest numbers during the hot, dry months of summer, when both 'over-wintering' transequatorial migrants and many resident birds gather to feed on abundant plant and animal life that becomes more accessible as nutrient-rich waters recede.

The most abundant waterbird species are Grey Teal (14,000 in January 1989), Australian Shelduck (6,108 in November 1989) and Black-winged Stilt (5,000 in January 1986). The system supports more than 1% of the national population of Black-winged Stilt, Red-necked Avocet (4,000 in January 1986), Wood Sandpiper (72 in January 1989), Greenshank (200 in January 1986), Sharp-tailed Sandpiper, Long-toed Stint and Curlew Sandpiper. Other species for which the system is regionally significant are Australian Pelican (750), White-faced Heron (250), Great Egret (237), Yellow-billed Spoonbill (140), Black Swan (2,855), Pacific Black Duck (4,264), Australasian Shoveler (500), Eurasian Coot (4,000), Whiskered Tern (180) and White-winged Tern (70).

The transequatorial migrants are small species of waders or shorebirds such as stints and sandpipers. Their breeding grounds are in northern Asia, principally northern China and Siberia. Following nesting in June-July these diminutive birds gather in large flocks and migrate southwards to south-east Asia, Australia and New Zealand to escape the harsh northern winter. Most arrive in September-October and remain until March when they begin the return to their breeding grounds. The smallest of these birds, the Red-necked Stint, travels more than 20,000 kilometres each year to complete this daunting cycle.

Resident birds may be locals, spending their life on wetlands of the Swan Coastal plain, or birds with breeding grounds in other parts of Australia, from arid regions of the interior (Banded Stilt) to islands off the north-west coast (e.g. some of the many pelicans that visit the south-west) or from wetlands of the Murray-Darling Basin (large numbers of Grey Teal and other ducks occasionally disperse across the continent).

At least 13 species of waterbirds breed on the Busselton Wetlands. An aggregation of around 150 breeding pairs of Black Swan occurs annually in a samphire-covered basin at the north end of the system; tens of pairs breed on the Wonnerup and Vasse estuaries and on the Broadwater. This is the largest regular breeding concentration of swans in Western Australia. Late in the breeding season, around November, thousands of swans and cygnets may at times be seen spread out across the wetlands' shallow expanses. Other species known to breed regularly in the system include the Darter, Pacific Black Duck, Grey Teal, Australian Shelduck, Australasian Shoveler, Eurasian Coot, Dusky Moorhen, Purple Swamphen, Buff-banded Rail and Spotless Crake.

Nesting swan

Courtesy: Jim Lane, Department of Conservation and Land Management

At least 19 species of migratory shorebird occur, 10-12 regularly. The most abundant species are Curlew Sandpiper (2,500 in January 1989), Sharp-tailed Sandpiper (2,300 in January 1986) and Red-necked Stint (2,000 in January 1986). These transequatorial migratory waders make annual journeys of 10,000 kilometres or more from their summer breeding grounds in northern China or Siberia to their wintering grounds in the Busselton Wetlands.

Some uncommon species have been recorded on the Busselton Wetlands. An Australasian Bittern was seen in extensive low sedgeland (*Bolboschoenus*) at the Vasse River deltaic marshes in November 1986. A Painted Snipe was seen nearby in samphire and sedgeland in January 1986; this habitat appears suitable for breeding. Pectoral Sandpiper probably occur annually; seven were counted in January 1989. Long-toed Stint also occurs regularly, probably annually; maximum count was 49 in January 1988. The sandpipers mainly occur in the marshy margins and stunted wet samphire of central Vasse Estuary. A Gallinago snipe, probably a Pin-tailed Snipe, was seen in this area in January 1986. A Ruff was recorded in February 1986.

Native mammals inhabiting the fringing areas of the wetlands include the shy Native Water Rat, Bandicoot and Western Ringtail Possum. Grey Kangaroos are very abundant on the margins of the Broadwater and on surrounding farmland. Small numbers also venture east along the New River towards Fairway Drive.

The most abundant reptile of the wetlands is the Tiger Snake. Single individuals are often seen sunning themselves on fringing rushbeds and grasses and frequently venture into surrounding suburbs. The Long-necked Tortoise is also found in the New River and Broadwater areas.

Freshwater components of the Busselton Wetlands, such as the 'lower Vasse River wetlands' between Ford Road and the Butter Factory Museum, and the New River wetlands, provide habitat for several frog species, notably Squelching and Lea's Froglets and the Motorbike, Banjo and Moaning Frogs. The mating chorus of thousands of male Squelching Froglets can be clearly heard throughout much of Busselton during cold, calm nights of winter.

3.6 Aboriginal Heritage

Aboriginal people have occupied the South-West region of Western Australia for at least 38,000 years (Pearce and Barbetti, 1981). By 1829, at the time of British colonisation of Western Australia, the Aboriginal people who occupied the region extending from the Jurien Bay area to Esperance formed a distinctive socio-cultural bloc, collectively known as **Noongar** (meaning 'man' or 'person').

The **Wardandi** group traditionally occupied the area from Bunbury to Cape Leeuwin on the coast and inland as far as Nannup (Berndt 1979; Tindale, 1974). It is considered that these people moved seasonally from the coast to the upland plateau area in nuclear families or larger bands, coming together for social and ceremonial purposes that coincided with the availability of food sources (O'Connor *et al,* 1995).

As the wetlands contained seasonally stable, large populations of waterbirds and abundant marine life, they provided a significant and reliable food resource. Late spring and summer were the times that concentrations of people may have been highest. Many fish and waterbirds were found in the coastal waterways in summer, moving away in winter, while other animal and vegetable food sources were more readily available inland in winter months. Additionally, the flooding of large areas of the coastal plain in winter made movement difficult.

The existing archaeological evidence shows that the majority of recorded sites in the region are located near various water sources such as rivers, creeks, lakes, swamps and estuaries (O'Connor R., Quartermaine G., and Yates A., 1995). Larger sites are considered more likely to occur near bodies of permanent water where food, shelter and other resources were abundant.

Aboriginal sites are protected in WA under the *Aboriginal Heritage Act (1972 –1980)*. They can be broadly categorised as 'ethnographic sites', which include those sites for which first-hand Aboriginal comment is or has been available, and 'archaeological sites', which usually contain physical evidence of Aboriginal occupation, such as artefacts from tool-making or seed grinding. The WA Aboriginal Sites Register contains 16 recorded sites within or in close proximity to the study area. It is possible that this number could increase. (See section 4.1 regarding the Commonwealth *Native Title Act 1993*.)

European Contact

In June 1801, Aborigines in the Wonnerup Inlet area were sighted by members of the French expedition led by Baudin (Marchant, L.R., 1982). Scientists sent ashore found the entrance to the sea barred by an Aboriginal fish trap of stakes. Peron, the zoologist, discovered what he considered to be a ceremonial mound. Other members of the party discovered an Aboriginal bark hut on the banks of saline marsh. (During this expedition Baudin's long boat was wrecked on the beach near Wonnerup Inlet. Parts of the boat and 30 muskets are believed to be still lying buried under the sand).

The initial peaceful relationships degenerated in the late 1830s and 1840s, notably in the Vasse River settlement and at Wonnerup (see Section 3.7). European contact with Aboriginal people in the area was marked by conflicts, disease, tribal vendettas and forcible shifts to schools and 'native camps'. However, the period of European pastoral expansion also saw local Aboriginal people settle on properties in the district and obtain a livelihood as shepherds and farm labourers.

By 1900, many aspects of the traditional lifestyle of the Wardandi people had declined or disappeared. Today, many Noongar people maintain cultural and familial links with the Geographe sub-region. The interests maintained by Aboriginal people include the identification and management of Aboriginal heritage sites, native title claims, research and community education, ecotourism, employment and training, access and recreation.

3.7 European Settlement

In 1827 Stirling inspected Geographe Bay, near where the French had landed. On 25 November 1829, Mr Collie and Lieutenant Preston of the British Royal Navy explored Wonnerup Inlet and the lowest reaches of the Vasse estuary in whale boats (Cross, 1833). In 1836-37 Lieutenant HW Bunbury of the 21st Fusiliers spent some months in the vicinity of the Vasse-Wonnerup (Bunbury and Morrell, 1930).

The Vasse region, immediately south-west of the tuart forest, was the site of the earliest recorded European settlement of the area in 1834–1837 (Jennings R, 1983). John Bussell established 'Cattle Chosen' on the banks of the Vasse. Later, the Molloys, James Turner, George Layman, Elijah Dawson and the Chapman Brothers, who had endured harsh conditions at Augusta, settled in the district. The early settlers were primarily interested in arable land. They grew a variety of crops and vegetables and raised livestock generally for their own use, local consumption or trade with merchants in Fremantle and American whalers. They later produced and exported cheese and other dairy products, as well as vegetables and beef. The low-lying land bordering the wetlands was used for potato and dairy production. Some early settlers supplied horses for the Indian market, swimming the animals out to trading vessels. European agricultural practices in the region saw extensive clearing for livestock grazing, broad-acre cropping, draining, fertilising and irrigation (also see Sections 3.9 and 3.10).

The timber industry began to develop in the 1850s. The first Busselton jetty was constructed in 1860 and in the early 1870s the Ballarat Timber Company established a saw mill for jarrah and tuart near the ocean at 'Lockeville', with a direct rail link to the port. The rail link passed through the tuart forest near Wonnerup and across the wetlands. Early settlement at Wonnerup was based on timber processing and exports, and to a lesser extent on exporting agricultural products. The population of the initial settlement was not stable as the majority of the early settlers were reliant on newly establishing industries, such as timber. (McAlpine, Spice and Humphries, 1989.) At one time, the area consisted of timber mills, hotels, schools, halls, barracks and a prison. Clipper ships berthed at the mouth of the Wonnerup Estuary and at the Wonnerup jetty. The WA Timber Company was based at 'Lockeville'.

The settlers were assisted at times by various government settlement and development programs such as the Estates Settlement Scheme in the 1820s and 30s; the construction of a road and rail network in the regions between 1889 and 1918; the Group Settlement Schemes in the 1920s and 1930s in conjunction with the development of irrigation and drainage facilities under Government Works Programs.

European heritage places of significance, which are listed in the Shire of Busselton's Municipal Inventory of Heritage Places, are provided in Section 4.3.

3.8 Busselton Townsite

Busselton was declared a townsite in 1836. Today, its population is approximately 14,000 and it is one of the fastest growing centres in Australia. It has a unique location on the north-facing shoreline of Geographe Bay. This has influenced the development of an east-west lineal form along the coast.

Busselton is continuing to extend to the west in the Broadwater area and to the east in Port Geographe (see Section 4.3). However, its urban morphology and future expansion is influenced generally by the Busselton Wetlands, the extensive reserve system, areas of natural and rural scenic landscape values, and existing rural 'lifestyle' areas. Expansion to the west along the coast, beyond the Broadwater Structure Plan area (see Section 4.3), is considered undesirable as this area has significant environmental values, and its rural and scenic landscape values separate Busselton and Dunsborough.

Some departure from Busselton's traditional coastal lineal form has occurred in recent years with urban development extending to the south of the wetlands in residential estates such as Kalgaritch, Peppermint Park, Cloisters, Kingsford and Country Road. As a result, the spatial

advantages of more compact urban development are being obtained (e.g. better access to centrally located services and facilities).

3.9 Modification of the Wetlands and the Drainage Network

It appears that there are no records of descriptions and measurements of seasonal or year-to-year changes in the water-levels of the Vasse estuary until the floodgates were first constructed in 1908 (Lane, Hardcastle, Tregonning and Holtfreter, 1997). Before the construction of the floodgates it is probable that the level during summer and autumn varied around mean sea level and larger variations (over several days) would have occurred under the influence of high and low pressure systems. Occasional cyclonic storm surges in summer and autumn would have flooded the estuary with seawater, and in winter and early spring water-levels would have been relatively high with prolonged periods of flooding due to the extensive native vegetation cover in the catchment.

3.9.1 River Diversions

Prior to European settlement, the rivers that flowed into the Busselton Wetlands discharged into Geographe Bay via the mouth of the Vasse and Wonnerup estuaries. However, most of these rivers have since been diverted.

During the 1860s, the Capel River was diverted to the ocean via Higgins Cut, 5 kilometres to the north-east of the Wonnerup estuary. Prior to this diversion, the Capel River would have had some influence on the water-levels in the Vasse estuary via the Wonnerup estuary (Lane, Hardcastle, Tregonning and Holtfreter, 1997). In 1915, a cut was made to drain water from New River to the ocean, thereby reducing its input to the Vasse. In previous years similar cuts had been made connecting other watercourses west of Busselton to the sea.

During the 1920s extensive drainage networks were constructed in the Capel, Ludlow, Abba, Vasse, Buayanyup and Carbanup River catchments (Lane, Hardcastle, Tregonning and Holtfreter, 1997). These works increased the rate and volume of river flows. Additional works were then needed to prevent more frequent flooding of farms and other developments, including the Busselton townsite, located on low-lying land near the coast. In 1927, a major drain was commenced to divert the headwaters of the Sabina River and virtually all of the flow of the Vasse River direct to the ocean (the Vasse River Diversion Drain). This diversion is important for agricultural productivity of the plain and flood protection for urban areas. Soon afterwards, the Buayanyup and Carbanup Rivers were also diverted to the sea. However, significant areas are still flood-prone from a number of watercourses and wetlands.

3.9.2 Installation of the Floodgates

The floodgates located on the exit channels of the Vasse-Wonnerup estuaries have major influences on the hydrology and ecology of the wetlands. Initially, they were installed on the Vasse and Wonnerup estuaries in 1908 and were later replaced at the same locations in 1929.

Floodgates on the Vasse Estuary

The floodgates were designed to prevent tidal saltwater intrusion onto farmland on the wetland margins, while allowing winter outflow of freshwater. When the water-level is higher on the upstream side the gates swing open and estuary waters discharge. When the water-level is higher

on the downstream side the gates close, preventing the entry of seawater. The water-levels in the estuaries can be adjusted using stop-boards at the floodgates. At the end of winter, the floodgates hold water at a predetermined level to allow for summer evaporation. At the beginning of winter, the floodgates enable freshwater outflow from the wetlands.

The wetlands have a vital role in flood protection. The floodgates prevent sea water entry in winter while allowing fresh water to flow to Geographe Bay. The floodgates also prevent most storm surges (large rises in sea level associated with strong northerly winds and low air pressure) from flooding low-lying land adjacent to the estuaries and in Busselton.

Construction of the floodgates near the mouths of the Vasse-Wonnerup estuaries has modified the hydrological regimes of these partially-connected waterbodies. These changes have been significant. The estuaries are now used by large numbers of waterbirds partly because their fresh-brackish waters slowly dry out each summer. As waters retreat, vast food resources become available for a wide variety of species (Lane, Hardcastle, Tregonning and Holtfreter, 1997).

Floodgates on the Vasse Estuary replaced in 2004

Replacement of the old floodgates on the Vasse Estuary exit channel by the Water Corporation began in late January 2004 and has been completed. The new floodgates are not expected to change the water level regime.

3.9.3 The Sand Bar

A sand bar forms at the mouth of the Wonnerup Inlet, which is not unusual for estuaries in Western Australia.

The mouth of Wonnerup Inlet has been narrow and shallow since at least 1829. At one time, there were two entrances a few hundred metres apart. The westernmost closed over late last century and is now vegetated. The other has migrated a little further east and is now the only opening to the sea.

At any time of the year, sea conditions, tide heights and the rate of discharge from the estuaries determine if the bar remains open or closed. Re-opening of the bar may occur naturally. However, one or more times each year, the bar is opened artificially by backhoe or hydraulic excavator. The Water Corporation also manages the opening of the bar to ensure that it does not remain closed over winter, which could lead to flooding of farmland and parts of Busselton. Summer opening may be attempted if fish are dying, subject to favourable winds and tides. Attempts to resolve the fish kill issue (see Section 4.4) in an environmentally-acceptable manner require an understanding of the behaviour of the sand bar, as well as the purpose and operation of the floodgates and the influence of both on the system.

Occasionally, a seaweed bar may be formed by heavy seas dumping large amounts of uprooted seagrass and marine macroalgae across the mouth of the inlet. This mostly happens during severe winter storms. In former times, seaweed was removed manually by pitch forks as machinery was unsuitable for the task. (Lane, Hardcastle, Tregonning and Holtfreter, 1997.)

3.9.4 Depths, Salinities and Nutrients

The broad expanses of the Vasse-Wonnerup estuaries now fill to a depth of approximately one metre during winter. However, the exit channels of the estuaries are deeper (about two metres).

Although it appears that there are no records of measurements of salinities of the Vasse and Wonnerup estuaries prior to the construction of the floodgates on the exit channels of the estuaries (see Section 3.9.2), historically, the waters would have been fresh during winter and early spring with increasing intrusion of saltwater during summer resulting in near seawater salinity levels by late summer – autumn (Lane, Hardcastle, Tregonning and Holtfreter, 1997). The installation of the floodgates altered the water quality characteristics from estuarine to predominantly fresh-brackish ecosystems with most of the beds drying each summer (also see Section 5.1). However, since 1988, increasing amounts of seawater have been allowed back into the Vasse estuary during summer and autumn, which has resulted in the inundation of broad areas with saline to hypersaline water for up to five months each year (Lane, Hardcastle, Tregonning and Holtfreter, 1997).

Nutrient levels in the waters and sediments of the Vasse-Wonnerup wetland system have increased considerably since European settlement and the system is now one of the most nutrient-enriched in the south-west of Western Australia (McAlpine, Spice and Humphries, 1989). Fertilisers have been used extensively in the Vasse-Wonnerup catchment. Over time, fertiliser losses, livestock wastes and drainage from the Busselton townsite have dramatically increased nutrient inputs to the estuary. While much of the nutrient entering the Vasse-Wonnerup flows into Geographe Bay, the Vasse-Wonnerup estuaries remain highly nutrient enriched. A substantial portion is taken up by aquatic plants growing in the fringes of the estuaries or is retained in the bed of the estuaries bound to sediments (see Lane, Hardcastle, Tregonning and Holtfreter, 1997).

3.9.5 Use of Water Resources

Generally, groundwater and surface water in the Geographe Bay Catchment is used to meet the requirements of town supplies, horticulture, grazing, tourism, mining, industry and domestic use. Groundwater use in the catchment is mainly from the confined aquifers (see Section 3.2). The abstraction of groundwater near the Busselton Wetlands has little impact on water-levels. However, the use of groundwater may impact on water quality, for example, if nutrient-rich run-off enters the wetlands.

Sharing and use of water resources is central to integrated catchment management. The responsibility for the allocation of water resources lies with the DoE, which works with the local community to achieve equitable outcomes consistent with environmental sustainability principles. Issues that relate to this are groundwater use, drainage and drain water use, and protection of wetlands (see Chapter 5).

3.10 Land Use and Tenure

This section provides an outline of land use and tenure in the area surrounding the wetlands (also see Figures 10 and 11). Significant areas surrounding the wetlands are privately owned land. However, adjoining the wetlands are extensive areas that are reserved, notably the CALM-managed estate (see below).

Agriculture, mining, forestry (mainly pine harvesting) and urban (mainly residential) development are the main land uses surrounding the wetlands. In addition, the study area contains a range of environments and opportunities for passive recreation and ecotourism. Recreation activities include birdwatching, nature observation, sightseeing and bushwalking. Near the centre of the Busselton townsite the Vasse River area offers facilities for passive recreation.

Agriculture: The predominant land use within the study area is agriculture. Cattle grazing for both beef and dairy production is a major rural land use activity. Near Ludlow there is some limited horticulture production. Within the study area there are seventeen major owners of this farmland area.

Timber: Pine plantations in Ludlow State Forest are progressively being harvested. Where these plantations occur on former tuart forest sites, tuart forest is being regenerated after pine has been removed.

Mining: Within the study area mineral sands have been mined from the vicinity of the Wonnerup townsite and near the upper reaches of the Wonnerup Estuary. In the broader catchment area mining of mineral sands has been, and continues to be a significant land use activity.

At the time of writing, a feasibility study is being conducted for the 'Ludlow Mineral Sands Project'. The project area lies immediately outside the study area, within State Forest which is currently under pine plantation and intended to be harvested by CALM and returned to tuart bushland. The site adjoins the Tuart Forest National Park. If the mining proposal gains approval, Cable Sands, the proponent, intends to rehabilitate the proposed mining area, returning it to a tuart forest area, to be incorporated in the Tuart Forest National Park, and to contribute to a long-term conservation management plan. Additionally, the proponent proposes to create a 120 hectare 'green' corridor linking the National Park to the Wonnerup Estuary.

Mining and mining exploration leases, and a petroleum exploration permit affect portions of the study area. There is a known deposit of heavy minerals sands (the 'Forrest Beach' deposit) located on the coast at the northern end of the study area. The extent of this deposit has not been comprehensively delineated. However, it is expected to be contained within agricultural land. As of June 2003, the deposit is not the subject of a mining tenement. It should be noted that any proposals to mine land for exploration or production are subject to environmental impact assessment by relevant agencies and approval by the EPA.

Rural Residential Land: 'Lifestyle' Rural Residential lots have been created within the study area and near the wetlands, including the Wonnerup Pigeon Grove and Vasse Estuary Structure Plan Precincts 1 and 2 and Dunbarton-Vasse. They comprise a range of lot sizes and configurations. Such areas can assist in maintaining landscape character and environmental values.

Reserves: within the study area, the majority of the land designated 'Recreation' under the Shire of Busselton DTPS is along the margins of the Vasse Estuary, New River and the Broadwater wetlands. The Tuart Forest National Park is nearby. The prime management objective for the reserves relates to conservation of the natural environment of the wetlands and adjoining reserves and, in particular, its biodiversity. It is intended that limited, managed public access and facilities will be further developed in these areas in consultation with the community.

3.11 Visual Landscape

Located near Busselton, the gateway to the South-West and one of WA's most visited tourist regions, the wetlands area is considered to have significant

Tuart Forest Ludlow Area

landscape value and ecotourism potential. The area is valuable for studies in zoology, botany, geology, geography and history. As previously described (Section 3.5), the wetlands provide the habitat for approximately 90 species of waterbirds. Included are transequatorial migratory waterbirds and large breeding colonies of waterfowl.

The elongated wetlands and associated floodplain form a distinctive landscape area. The wetlands vary from broad expanses of open water to sheltered bays and inlets. Margins contain native vegetation in some areas, while other areas are characterised by seasonally flooded pastures or nearby urban development. Tuart forest bounds its inland side, forming an attractive backdrop for views south-eastwards across the wetlands. There are also views of paperbarks, birds and historic buildings. Coastal dunes and low-lying peppermints bound the ocean side. The open, expansive wetlands are framed with these definite 'edges'.

To the south of the wetlands exists endemic tuart forest (approximately 2,000 hectares). The scenic tall tuart trees grow with either soft foliaged peppermints or in grassy 'parkland' clearings. The park-like character is distinctive due to introduced pasture having replaced the native understorey plants in most areas. Along roads, trees form a canopy framing attractive vistas. The district also contains jarrah/marri woodlands with a rich understorey, dune heathlands, and orchids that are both plentiful and diverse.

The wetlands and its adjacent low-lying floodplain provide a marked visual contrast with the tuart forest. This landscape unit contains few vertical elements, and is mostly open water bodies, samphire flats and pasture. In some areas, variety to the native fringing vegetation is provided by small white-trunked paperbarks and the attractive peppermints with their weeping soft foliage and thick twisted trunks. The dominant visual elements in this landscape are the expanses and channels of open water. Varying microclimate and light conditions produce a variety of reflections. Both individual waterbirds and flocks of many thousands of birds highlight natural values. The visual landscape is augmented by the historic places located near the wetlands. Those constructed of local materials such as limestone add interest and significance to the landscape.

Urban development near the wetlands, such as residential development on infilled land and road upgrades, has visual impacts. A theme expressed through community consultation is the desire to limit such impacts in order to maintain the rural amenity and natural attributes of the wetlands.

Landscape Planning

Visual landscape planning is a valid consideration within the WA planning process. Under the *State Planning Strategy* (see Section 4.2) valued landscapes should be protected and development proposals should incorporate measures to retain valued landscape elements.

Visual landscape assessment methods will vary according to the type and scale of planning, from individual sites to district and regional-level planning. The purpose of landscape assessment is to identify landscape features and views valued by the community. Generally, this involves: objectively describing the natural and cultural landscape features; consultation with the community to obtain community perceptions, values and priorities, according to evaluative criteria such as 'high value', 'general character' and 'negative value' and recording this on a map; and, following additional community consultation, recommending categories of landscape management. For example, some features and views could be considered of high value and worthy of retaining wherever feasible.

Visual impact assessment is a different process from landscape assessment. It focuses on changes to the landscape and viewing experience which a proposed development would have on an area, whereas landscape assessment involves investigation of the characteristics of a landscape, together with recommendations for retaining valued elements. The two processes are interrelated as landscape assessment feeds into the visual impact assessment process.

Planning Context 4

4 Planning Context

This chapter highlights the national, State and local non-statutory and statutory background which has planning and environmental implications for the Strategy area, and which should be considered in addressing the issues. (The international significance of the wetlands, such as under the Ramsar Convention, is outlined in Section 1.3.3.)

Central to much of this planning context is the concept of **sustainability**. Sustainability has arisen from a global process. Although there is no universally agreed definition of 'sustainability', generally it is considered that the sustainability vision or process is to improve the health and welfare of the planet and its people into the future. Increasingly, sustainability is recognised as fundamental to land use planning. Planning can be a powerful tool to implement sustainability principles due to its ability to influence land use and development and to promote strategies to engage the community.

'Sustainability' acknowledges the finite limits of ecological systems including biological diversity and recognises that humankind exists within these limits and depends on these systems for survival. Given the pace of ecological change at the global scale, sustainability is not likely to be achieved without an elemental shift in economic and social values and rate of natural resource utilisation.

The concept promotes changes by people and communities that result in economic and social benefits together with the conservation and enhancement of biological diversity. This should translate to effective on-ground action at the regional and local level. To advance the 'sustainability' vision, actions will need to extend into political, economic and social systems. This is because sustainability is not limited to the environment – it is a concept that extends to social equity and economic growth or health. As established in the *State Planning Strategy* (see Section 4.2.1) 'sustainability' is directed towards achieving a balance between economic growth and the conservation and enhancement of our natural environment to provide for a better quality of life for present and future generations.

The *Western Australian State Sustainability Strategy* (2003) has been prepared by the Western Australian Government (see Section 4.2.2). Comprehensive and overarching sustainability principles for the State are provided in this document. Importantly, the WA State Sustainability Strategy promotes strategic actions to meet the needs of current and future generations through *'an integration of environmental protection, social advancement and economic prosperity'.*

4.1 National

Relevant Commonwealth non-statutory and statutory planning matters that may influence biodiversity conservation and land use in the Strategy area are as follows:

- ***Environment Protection and Biodiversity Conservation Act 1999 No. 91, 1999***

The *Commonwealth Environment Protection and Biodiversity Conservation Act 1999 No. 91, 1999,* which came into effect on 16 July, 2000, has potentially significant implications for proposed development adjoining or near the Ramsar-listed portion of the Busselton Wetlands.

The Act sets out requirements for environmental approvals for **actions** that will affect matters of national environmental significance, including Ramsar wetlands. (An **action** includes a project, development, undertaking or an activity or series of activities.) Under the Act, a person must not take action that has, or will have, significant impact on the ecological character of a declared Ramsar wetland. An action does not require approval if it is a lawful continuation of a use of the land that was occurring before the commencement of the Act. ('Continuation' does not mean expansion or intensification of a use.) The Act specifies criteria for determining whether an impact is significant and sets out a process for triggering Commonwealth environmental impact assessment.

The Commonwealth recognises measures that will result in a net benefit to biodiversity. The Commonwealth may provide financial or other

assistance to a person under a conservation agreement; for example, an agreement could provide for the Commonwealth to pay for fencing off remnant vegetation, on the basis that the landowner agrees to take steps to protect biodiversity values.

- ***National Water Quality Management Strategy***

Development of the *National Water Quality Management Strategy* (NWQMS) commenced in the early 1990s in response to growing community concern about the condition of the nation's water. It was developed jointly by two Commonwealth and State Ministerial Councils: Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) and the Australian and New Zealand Environment and Conservation Council (NZECC), and had input from the National Health and Medical Research Council (NHMRC). Western Australia is signatory to the NWQMS.

The NWQMS aims to deliver a nationally consistent approach to water quality management. Its prime objective is: *to achieve sustainable use of the Nation's water resources by protecting and enhancing their quality while maintaining economic and social development.*

To achieve the prime objective, the guiding principles of the NWQMS aim to encourage an integrated framework to address water quality management, promote the maintenance of community values for water quality, encourage the application of sustainable development and management practices, and minimise adverse impacts of development activities.

This strategy is based on the *National Strategy for Ecologically Sustainable Development, 1992* (see below) and provides information and tools to assist communities to manage resources for current and future needs. It provides policies, a process and a series of national guidelines for water quality management. A *State Water Quality Management Strategy* has been developed to implement the NWQMS in WA (see Section 4.2.7)

- ***National Strategy for Ecologically Sustainable Development (1992)***

This strategy, which recognises that the integration and balance of social, economic and environmental aspirations of the community are essential for successful attainment of sustainability, forms the basis of natural resource planning and management approaches throughout Australia. Western Australia is a signatory to this strategy. The core objectives and guiding principles are summarised in Appendix 5.

- ***National Strategy for the Conservation of Australia's Biological Diversity (1996)***

This strategy recognises that the loss of biodiversity is Australia's most important conservation issue and provides a range of actions to achieve biodiversity conservation. Western Australia is a signatory to this strategy. Also, the strategy recommends that biodiversity conservation be recognised as an important objective of local government. The *National Local Government Biodiversity Strategy (1999)*, which was endorsed by unanimous vote at the National Assembly of Local Government in 1998, recognises the role that local government can play in conservation and sustainable use of our natural resources through, for example, local area planning and management, along with community education and participation.

- ***Australian Heritage Commission – National Estate Listing***

The Australian Heritage Commission recognises the conservation and heritage value of the Vasse-Wonnerup estuaries and the Tuart National Park. The area has been listed on the register of the National Estate. This listing covers the Wonnerup and the north-eastern half of the Vasse, including farmland between the wetlands and the Tuart National Park. The register of the National Estate operates under Commonwealth legislation and, as such, Commonwealth agencies are required to refer development proposals to the Heritage Commission.

◆ ***Commonwealth Native Title Act, 1993***

Commonwealth *Native Title Act 1993* accepts that native title rights survived non-Aboriginal settlement. It attempts to strike a balance between the interests of native title holders and others affected by the recognition of native title. Native title holders are Aboriginal people who have had a continuous connection with land or waters.

The Act set up the National Native Title tribunal as an independent body to process native title applications by:

- claimants wanting to claim native title over their traditional land or waters, or compensation where native title has been extinguished or impaired;
- non-claimants wanting to find out whether native title exists over land or waters before acts are done on the lands or waters concerned.

The Tribunal has the power, as an arbitral body under the Act, to make a determination whether or not certain future acts (including the grant of mining leases) affecting native title can proceed, if a state or territory has not set up its arbitral bodies to do this.

Native title may exist in areas where it has not been extinguished by an act of government. Native title may exist in areas such as:

- vacant (or unallocated) Crown land
- forests
- beaches
- national parks
- public reserves
- some types of pastoral leases
- land held by government agencies
- land held in trust for Aboriginal communities
- any other public or Crown lands
- offshore waters or inland waters that are not privately owned.

Native title is extinguished on privately owned land, on residential, commercial and certain other leases, and in areas where government has built roads or other public works.

The Busselton Wetlands are included within two registered native title claims: the Harris family and the South - West Boojarah family, for whom the Noongar Land Council is the representative Aboriginal Body.

4.2 State and Regional

This section focuses on the State and regional level planning context with reference to planning policies and strategies, environmental protection policies and the Port Geographe development.

4.2.1 The State Planning Strategy

The *State Planning Strategy* prepared by the WAPC and adopted by Government in 1997 sets out five core principles, as follows:

- Environment Principle: To protect and enhance the key natural and cultural assets of the State and deliver to all Western Australians a high quality of life which is based on environmentally sustainable principles.
- Community Principle: To respond to social changes and facilitate the creation of vibrant, accessible, safe and self-reliant communities.
- Economic Principle: To actively assist in the creation of regional wealth, support the development of new industries and encourage economic activity in accordance with sustainable development principles.
- Infrastructure Principle: To facilitate strategic development by ensuring land use, transport and public utilities are mutually supportive.
- Regional Development Principle: To assist the development of regional Western Australia by taking account of the region's special assets and accommodating the individual requirements of each region.

The *State Planning Strategy* provides a regional land use planning and development framework. It recommends a series of planning initiatives for the South-West Region to assist in the protection of the following:

- prime agricultural land that is suitable for intensive use;
- tourism as a legitimate land use that is compatible with a range of existing land uses;
- valuable natural environments (the *State Planning Strategy* supports the need to investigate alternative methods of protection); and
- wetlands, by recognising the need to implement the *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992* and provide special protection to areas of World or National Heritage Significance.

Under the *State Planning Strategy* land use planning for the South-West Region occurs within an effective planning framework, minimises environmental impacts, supports social objectives and establishes a basis for staged expansion of infrastructure.

4.2.2 The Western Australian State Sustainability Strategy (2003)

The *Western Australian State Sustainability Strategy* has been prepared by the Western Australian Government to provide a set of sustainability principles and strategic actions to meet the 'needs of current and future generations through the integration of environmental protection, social advancement and economic prosperity'. These principles and actions are divided between six goals, one of which, for example, is stated: 'value and protect our environment and ensure the sustainable use and management of natural resources'. The WA State Sustainability Strategy recognises the importance of the involvement and interaction of natural resource management groups, local government and State agencies in natural resource management.

4.2.3 Statement of Planning Policies

Statement of Planning Policies (SPPs) are prepared and adopted by the WAPC under the *Town Planning and Development Act 1928* (also see Appendix 8). They are legally enforceable and must be reflected in local Town Planning Schemes.

The area subject to *SPP No. 7 Leeuwin-Naturalist Ridge* lies to the west of the Strategy area. The SPP promotes sustainability, conservation and land resource management. The scientific, social and economic values of the SPP area are recognised as considerable and worthy of conservation. The SPP also recognises that remnant vegetation plays a critical role in maintaining the biodiversity of the area, and consequently, recognises the need to protect linkages between these areas.

In particular, the SPP sets out policies for a 'Wetland Amenity Area', located to the west of the Busselton Wetlands study area. These policies include requirements for subdivision and development proposals to be compatible with wetland conservation, for recognition of Department of Transport and Ministry for Planning coastal planning guidelines, and for protection of the environmental and recreation values of the Wetland Amenity Area while facilitating tourism development responsive to its site and setting.

SPP No. 2.5 Agriculture and Rural Land Use Planning Policy (gazetted 2002) responds to calls from the community, industry and government to address impacts of land use change on significant (priority) agricultural areas and the conversion of land from agriculture to urban oriented uses. SPP No. 2.5 applies to all rural land in WA. The policy provides for a range of mechanisms, including local government local planning strategies and policies, and the use of zonings and scheme provisions to address a range of land use and resource management issues.

Two SPPs, which could influence land use planning in the study area, are the *Environment and Natural Resources Policy* and the *State*

Coastal Planning Policy. These SPPs are intended to have statewide application, consistent with the *State Planning Strategy*. They are briefly outlined below:

- *SPP 2 Environment and Natural Resources Policy* promotes the identification and protection of environmental and natural resource management issues of State importance. It provides for the incorporation of the principles of natural resources management and sustainability into the planning system, as required by the *State Planning Strategy.* Through this, the policy promotes land use decisions that acknowledge the often competing interests of the environment, and economic and social considerations that affect our natural resources. The policy identifies elements of the environment and natural resources that are considered important and significant, and requires these to be considered when making land use decisions.
- *SPP 2.6 State Coastal Planning Policy* has statewide application and addresses land use and planning issues as they relate specifically to coastal areas, providing guidance on issues to be considered during the planning process. The policy focuses on issues associated with protection and management of the coast and recommends provisions and requirements to accommodate them into regional and local strategies, schemes and plans. Schedule 1 of the policy provides setbacks for coastal processes and coastal foreshore areas and provides guidance for their determination.

  The policy is consistent with and complementary to the *draft Coastal Zone Management Policy for WA, 2001*. The vision statement for coastal zone management is that:

  - The principle of ecological sustainability and a commitment to maintaining healthy functioning ecosystems will underpin all planning, policy and management decisions about the coastal zone in Western Australia.
  - Coastal zone management will be co-ordinated across all of government leading to sensible balanced decisions and the most efficient use of resources, and will be undertaken in partnership with the community.
  - The management of Western Australia's coastal zone will engender international respect and admiration.

4.2.4 Regional Planning

The Leeuwin-Naturaliste Region Plan Stage One (1988)

Regional planning provides guidance for detailed planning and decision-making by local governments and other agencies. Region plans are not statutory instruments, but they may be reflected in town planning schemes. The *Leeuwin-Naturaliste Region Plan Stage One, 1988* applies to the Shire of Busselton and was adopted as policy by the (then) State Planning Commission. (Stage Two, 1988 applied to the Shire of Augusta – Margaret River.)

The general objective of *The Leeuwin-Naturaliste Region Plan Stage One, 1988* is to provide for the economic and social development potential of the region whilst maintaining and promoting the values of natural environments. The Vasse and Wonnerup estuaries and adjoining rural land are recognised as areas of landscape value and significant environmental value. The Region Plan includes the Broadwater area in its Policy Area 1, for example, which recommends comprehensive planning to provide for rural and residential living and conservation of the wetlands. The Region Plan recommends the following:

- The Broadwater and associated wetlands be retained as wetland for their entire length.
- Public use of significant Crown environmental areas be encouraged consistent with the maintenance of environmental values.
- Government agencies such as CALM and the DEP provide management advice to private owners of areas having significant environmental values.

Draft Greater Bunbury Region Scheme, 2000

The north-eastern portion of the study area, located within the Shire of Capel, is subject to the draft *Greater Bunbury Region Scheme*. The Region Scheme when finalised will provide the statutory basis for implementing regional plans and the legislative mechanisms to secure land for regional purposes. This is necessary to facilitate the co-ordination of planning activities carried out by State Government agencies and local governments to ensure the orderly and proper planning of the region.

The coastal portion of the study area within the Region Scheme is designated 'Regional Open Space' and the remainder is 'Rural' and 'State Forests'.

4.2.5 Conservation Through Reserves – System 1 Report

The Conservation Through Reserves Committee in its 1975 System 1 Report to the Environmental Protection Authority (EPA) identified the Vasse-Wonnerup estuaries and the Broadwater as an area of high conservation value requiring protection and suitable management.

In 1976, following discussion with local authorities and landowners, the EPA recommended that, subject to the voluntary involvement of the landowners concerned, the Ludlow-Wonnerup area should be managed for the purposes of preservation of the existing scenic, recreational and tourism values; improvement of wetland habitats; and conservation of the tuart *(E. gomphocephala)*.

A review in 1993 concluded that the System 1 recommendations were being implemented, or their intent was being met. CALM was designated as the key government agency for implementation of the recommendations. The System 1 Report recognises that the estuary system is under threat, and that its current environmental significance is essentially a result of human activities over a long period.

4.2.6 Environmental Protection Policies

Environmental Protection Policies (EPPs) are prepared under the *Environmental Protection Act 1986*. The wetlands are subject to the existing EPA *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992* which aims to protect the ecological functions of regionally significant wetlands and wetlands listed for protection under international agreements. Under the EPP, the wetlands are protected from unauthorised filling, excavation, mining, effluent disposal and drainage.

At the time of writing, the 1992 Lakes EPP had been reviewed and a revised draft *Environmental Protection (Swan Coastal Plain Wetlands) Policy 2004* prepared. The revised draft Wetlands EPP seeks to protect wetlands with high ecological value on the Swan Coastal Plain. The policy proposes a register of protected wetlands populated with wetlands recognised as having significant values. The policy includes criteria to determine wetland values and mechanisms to add, amend or remove wetlands from the register. Finalisation of the revised draft policy is currently being considered by government.

4.2.7 Wetlands Conservation Policy for Western Australia (1997)

The *Wetlands Conservation Policy for Western Australia*, is a whole-of-Government policy, (see 'Statement of Policy', Appendix 6). The policy recognises the Ramsar definition of wetlands (see Section 1.3.3) and its principal objectives relate to all types of wetlands, as follows:

- prevent further loss or degradation of valuable wetlands;
- promote wetland conservation, creation and restoration;
- secure viable representation of wetland types and habitats;
- maintain biological diversity of associated vegetation and fauna;
- maintain the abundance of waterbird numbers and species; and

- increase community awareness of local wetlands and the principles of wetland management.

The policy outlines a 'Strategy for Implementation' that will allow the objectives of the policy to be achieved and identifies 62 actions for Government agencies. Action 1.9, for example, is to "develop guidelines based on ecological grounds for provision of 'buffers' between proposed developments and wetlands". At the time of writing, the Wetlands Co-ordinating Committee is investigating this issue. Although the 'scope of the policy' includes all types of wetlands including estuaries, rivers and shallow marine areas, the Strategy for Implementation states that their specific conservation needs will be addressed 'through other government programs'.

Important State commitments, in particular the Ramsar Convention and the *National Strategy for Conservation of Australia's Biological Diversity, 1996,* are recognised under this policy.

The Wetlands Co-ordinating Committee and relevant authorities recognise the DoE Geomorphic Wetland Mapping. This dataset includes the evaluation of wetlands based on ecological attributes and functions and identifies priority wetlands for management. In addition, Conservation Category Wetlands, as defined by the DoE are recognised as 'valuable' wetlands.

4.2.8 State Water Quality Management Strategy (2000)

The *State Water Quality Management Strategy* (SWQMS) for WA is the strategy for implementation of the *National Water Quality Management Strategy* (NWQMS) (see section 4.1). The SWQMS is guided by other national policies, principles, objectives and agreements to which the WA Government is signatory. Ecologically sustainable development forms the foundation for water quality management in WA. An integrated resource management approach involving whole water catchments (e.g. the Geographe Bay catchment) is reflected in one of the guiding principles.

The primary objective of the SWQMS is to establish a co-ordinated and consultative framework for water quality management in WA within existing legislation and processes. Under the State framework for implementation, there will be greater co-ordination and consultation between State agencies, local government, the community, industry and landowners in the future development of water quality protection policies, plans and guidelines. In WA, the DoE is the prime agency responsible for implementing the NWQMS and is responsible for implementing the environmental protection components.

4.2.9 State Salinity Strategy (2000)

It has been estimated that approximately 40% of the southern portion of the Swan Coastal Plain has a moderate to high salinity risk (State Salinity Council). The threat of salinity in the catchment is real and could impact on productive land, waterways, groundwater and remnant vegetation. The *State Salinity Action Plan* and the *Geographe Catchment Management Strategy* provide guidance for the implementation of strategies to reduce salinity in the catchment.

In relation to the Geographe Bay catchment, the issue of salinity is also addressed in the *Geographe Catchment Management Strategy.* However, the *State Salinity Strategy* broadly outlines the major tools for restoring salinised areas within the South - West. It explains the causes and impacts of salinity problems in WA and sets out a strategy and actions to manage salinity.

- The proposed actions to achieve these goals are based on three principles:
- salinity needs to be addressed by treating the causes of the problem, focusing on managing recharge and rising watertable;
- developing practical and environmentally sound methods that mitigate the impact of salinity by managing discharge; and

- the strategy needs to be implemented in a partnership approach between all stakeholders at the regional and catchment scale.

4.2.10 Liveable Neighbourhoods

Liveable Neighbourhoods is a development control policy to facilitate development of sustainable communities. It addresses both strategic and operational aspects of structure planning and subdivision development. The policy guides the design and assessment of structure plans, subdivision and development for new urban (predominantly residential) areas, where two or more lots are created on 'greenfields' sites. Element 4 of the policy provides for the protection of important wetlands, recommending that an EPP wetland, conservation category wetland, or wetland of a similar environmental value shall be ceded to the Crown free of cost.

4.3 Local Area

Decision-making at the local level generally focuses on local issues. The local government is the most important influence on local planning matters. However, the WAPC determines subdivision applications and there are National and State Government policies and legislation that guide local government in its determinations.

4.3.1 Geographe Catchment Management Strategy (2000)

The Geographe Bay catchment experiences land use and development pressure, and it was recognised that there was a need to prepare a catchment management strategy to maintain and improve the health of the catchment. The *Geographe Catchment Management Strategy* was released in 2000 and represents a step in the region's integrated catchment management (ICM) process. The Geographe Catchment Council (GeoCatch) oversees and co-ordinates the implementation of the strategy.
The *Geographe Catchment Management Strategy* provides strategies to address environmental problems of Geographe Bay and its catchment. It also recognises that a primary goal of catchment management is to prevent excess nutrients from entering waterways. The strategy supports the preparation of a conservation strategy and a management plan for the Vasse-Wonnerup estuaries; recognises the conservation values of Geographe Bay, the wetlands and the catchment; and suggests how community and local and State government effort can be combined to maintain and improve the health of the catchment.

An example of the implementation of the strategy's recommendations relates to the *Lower Vasse River Clean-up Program.* The Lower Vasse River is a highly modified and degraded system, with extremely poor water quality and reduced habitat value. GeoCatch, Department of Environment and the Shire of Busselton have developed the Lower Vasse River Clean-up Program to improve the ecological health of the Lower Vasse River. The main components of the program are sediment remediation and removal, restoring river ecology, and managing sources of nutrients in the urban, industrial and rural catchments.

4.3.2 Local Government Town Planning Schemes

Shire of Busselton District Town Planning Scheme, 1999

The Shire of Busselton District *Town Planning Scheme No. 20* (the Scheme) was gazetted on 7 September 1999. The majority of the study area is zoned 'Agriculture', 'Rural Residential' or 'Conservation', with the remaining area zoned 'Tourist', 'Residential' or 'Industry' (see Figure 9). Areas are also depicted in the Scheme as 'Recreation' reserve, and to a lesser extent, 'Public Purposes' reserve.

The objectives of the 'Agriculture' zone are: to conserve the productive potential of rural land; to provide for new forms of agricultural development (particularly agroforestry), and changing patterns of existing agricultural development; and to encourage 'low-key rural tourism associated with traditional forms of agriculture or rural retreat as a contributor to

the overall rural economy of the Shire'. Within this zone Planning Consent from the Council is not required for 'Agriculture' or 'Intensive Agriculture' which are defined in the Scheme as follows:

'Agriculture' means any land or buildings used for the raising of stock or crops, but excludes intensive agriculture, poultry farms and feed lots.

'Intensive Agriculture' means any land or buildings used for trade or commercial purposes for the following:
the production of grapes, vegetables, flowers, fruit and nuts;
cultivating plants in a wholesale nursery.

Scheme 'Areas', which also apply to the study area, overlie the zones to provide additional guidance to the Council in relation to land use and development matters, including the application of certain controls and other requirements. The relevant Scheme Areas include the following:

- Landscape Value Area
- Development Investigation Area
- Wetland Area
- Floodway Area
- Coastal Management Area
- Port Geographe Development Area
- Special Provision Area.

The 'Wetland Area' identifies the flood fringe of the Vasse-Wonnerup estuaries. In this area, no development may be carried out without the approval of the Council, including clearing, filling or draining. Also, in determining development applications, the Council must consider any advice provided by CALM, DoE and WC.

Similarly, development is not permitted in the 'Floodway Area' without the Council's approval and subject to the advice of the DoE. The Council must consider the possible effects of the proposed development on floodway function, and the safety of lives and property.

The 'Landscape Value Area' identifies the Vasse-Wonnerup estuaries as comprising a high level of rural and scenic landscape character. Clearing of land, or development, is not permitted without the Council's approval. Development is assessed in relation to the maintenance and enhancement of existing landscape character and impacts on wetlands, wildlife and habitats.

The 'Coastal Management Area' applies to a Rural Residential area adjacent to the Wonnerup estuary and requires planning approval for all development, including assessment of likely impacts regarding coastal amenity and processes.

Heritage Places

With respect to cultural heritage, places of significance are listed in the Municipal Heritage Inventory and protected under the local scheme (see below). The future planning of the area should recognise all places of cultural heritage significance, in accordance with the relevant legislation.

Wonnerup House restored to its original condition by the National Trust of Australia (WA)

Shire of Capel District Planning Scheme

The northern portion of the study area is located within the Shire of Capel. Under the Shire of Capel District Planning Scheme No. 7 this area is predominantly zoned 'Rural' with a small portion designated 'Public Purpose – National Park'.

Table 2: Heritage Places Within the Study Area
(Listed in the Municipal Heritage Inventory)

Ref. No.	Name of Place	Location
007	Broadwater Homestead	Walsh Road. Lot 2
016	Busselton Townsite Precinct	Busselton
023	Fairlawn Lane Crossing	Fairlawn Road, over the Vasse River
025	Ford Road Causeway	Ford Road, Busselton
026	Fourth Bridge - New River ford	West Street, Busselton
034	Old Butter Factory Museum	Peel Terrace. Lots 1, 2 and 3
066	Ballarat Timber Mill Site	Layman Road Wonnerup, near the Floodgates
079	Chapman's Mill (Inlet Park Farm)	Wonnerup SL 2 Tuart Drive
085	Geographe Longboat Sinking Site	Wonnerup Inlet
094	Lockeville Farmhouse and St Mary's Church Hall	Wonnerup - Layman Road. Lot 26
112	Rushleigh (Dwelling)	Rushleigh Road, Wonnerup
114	Pidgeon Grove Homestead	Wonnerup - Barracks Road Lot 21
116	Reinscourt Homestead	Bussell Highway. Lot 20
123	Ballarat Railway Bridge	Layman Road, Wonnerup
131	The Shipwreck Site	Wonnerup Inlet - The Deadwater via Forrest Beach Road
138	Vasse River	Busselton Shire
147	Wonnerup Townsite Precinct	Wonnerup
148	Wonnerup Wetlands	Busselton Shire
160	Broadwater Wetlands	Broadwater
164	Richardson's Cottage	Layman Road, Geographe
167	Waljin Garden Peel Terrace,	Busselton

Key objectives of the 'Rural' zone is to preserve the character of the rural area, discourage the removal of prime agricultural land from agricultural production and prevent adverse affects on the continuation of established or potential agricultural industries. In this zone Planning Consent from the Council is not required for 'Intensive Agriculture' or 'Rural Pursuits' for existing lots greater than 15 ha. Under the Scheme these uses are defined as:

'**Intensive Agriculture**': means a horticultural use of rural land which serves to increase production from a given area and includes orchards, vegetable growing and viticulture.

'**Rural Pursuits**' means the use of land for any of the purposes set out hereunder and shall include such buildings normally associated therewith:

a. extensive dry land agriculture for crop production;

b. dry land production and pasturing of livestock;

c. production and pasturing of livestock on irrigated lands;

d. plantation growing of trees;

e. the sale of produce grown solely on the lot provided that if a roadside stall is used it is approved by Council and the Main Roads Department, where appropriate; and

f. the stabling, agistment or training of horses;

but does not include the following except as approved by the Council:

a. the keeping of pigs;

b. poultry farming;

c. the processing, treatment or packing of produce;

d. the breeding, rearing or boarding of domestic pets.

4.3.3 Shire of Busselton - Strategic Planning

At the time of writing, the Shire of Busselton DTPS generally reflects adopted structure plans, with the exception of the Vasse Newtown Development Guide Plan and the Old Broadwater Farm Structure Plan.

Vasse Newtown Development Guide Plan: This area is located outside the study area, to the west of the Broadwater wetlands. The plan intends to provide a framework for the urbanisation of the Vasse area, generally in accordance with the *Busselton Urban Growth Strategy, 1999*. It includes primary and high school sites, industrial and research park, mixed use village centre including commercial business, residential and some rural residential lots. The rezoning of this area to facilitate urban development was gazetted in October, 2004.

Broadwater Structure Plan Precincts 1 and 2 and the *Old Broadwater Farm Structure Plan:* These are structure plans for areas to the north and south of the Broadwater wetlands respectively. They provide a planning framework for residential development and depict conservation areas near the wetlands. The Shire of Busselton DTPS generally accords with the *Broadwater Structure Plan Precincts 1 and 2*. Approval of the structure plans is generally subject to adoption of management plans and programs to address the following (to the satisfaction of CALM, WAPC and the Shire of Busselton) flooding and flood management; wetland protection; mosquito management; kangaroo survey and management; and ethnographic and archaeological surveys.

New River Structure Plan: This includes the New River portion of the study area, most of which is shown as a 'Recreation' reserve in the Shire of Busselton DTPS. The structure plan designates 64 hectares as Conservation Reserve and residential lots extending to the south of the study area which are predominantly zoned 'Residential'.

Country Road Structure Plan: This predominantly 'Residential' zoned area adjoins the study area generally to the south of the Bypass Road. Its western portion adjoins the Vasse River. The structure plan provides planning guidelines for the residential development of the area and the majority of residential lots indicated in the structure plan have been created.

Busselton Airport Structure Plan: The structure plan area is outside of the study area, to the south of the Vasse Estuary. It provides planning guidelines for the area between the study area and the Busselton Regional Airport, including areas designated for Special Residential, Special Rural (development will require alternative septic treatment arrangements), Composite Residential/Industrial, Airport Industrial Park and a Special Development Site for Tourist Related Purposes (to include limited commercial, wine sales, weekend market, crafts, local produce, accommodation, tourist bureau). Further amendment to the Shire of Busselton DTPS will be required to reflect the structure plan.

East Busselton Sandilands Structure Plan: The structure plan area adjoins the study area and is located to north of Layman Road, in Geographe (near Port Geographe). The area is predominantly zone 'Residential' under the Shire of Busselton DTPS and the majority of the structure plan area has been developed for residential purposes.

Vasse Estuary Structure Plan, Precincts 1 and 2: The structure plan area is located within the study area to the south of the Vasse Estuary and to the north of Bussell Highway. The Shire of Busselton DTPS generally reflects the structure plan: the area is predominantly zoned 'Rural Residential' with an extensive area along the Vasse Estuary reserved for 'Recreation' under the Scheme. The western portion of the structure plan, in the vicinity of Ford Road, is zoned 'Agriculture' under the Scheme. However, the structure plan designates this area for possible sport and recreation.

The Busselton Urban Growth Strategy, 1999: The Council adopted the strategy in 1999 to identify those areas most suitable for urban growth, based on providing a suitable and sustainable urban form.

The strategy outlines Busselton's urban morphology (i.e. it has evolved in a linear form along the Geographe Bay coast and has also been influenced by the elongated wetlands running parallel to the coast) and notes that residential land in the Busselton townsite for the next five years can be accommodated within planned areas and existing zones, north of the Busselton Bypass Road and mainly to the west and south-west of the town. The strategy considers that limiting of short-term urban growth of the townsite by the Bypass is convenient and rational, "given it will assist in achieving a long-term compact urban form". A more compact urban form is favoured by Council to provide the resident population with closer and more direct access to the town's retail, commercial, industrial, community and recreation facilities, all of which are centrally located, and more efficient provision of service infrastructure.

Under the strategy, urban growth areas are not recommended within the study area, with the exception of the South Broadwater area, located west of Fairway Drive, which is identified within the short-term urban development category and is substantially subject to the Old Broadwater Farm Development Guide Plan.

4.3.4 Port Geographe

Located at East Busselton, adjacent to the study area, the Port Geographe project is a large harbour-residential development (see Figure 9). The EPA assessed the proposal under the *Environmental Protection Act 1986*. In 1989, the EPA Report and Recommendations (EPA Bulletin 386) concluded that the proposal should proceed subject to appropriate conditions. It also concluded that the opportunities afforded by the proposal outweighed the constraints.

The Report also noted the System 1 recommendations and cautioned that the environmental problems associated with the estuary **will intensify and worsen with potentially serious consequences** unless there is appropriate management of the wetlands system. The EPA recommended actions as follows:

- apply appropriate planning mechanisms to avoid adverse impacts on the adjoining estuary;
- include the Vasse-Wonnerup system under the Ramsar Convention;
- the Integrated Catchment Management Co-ordinating Group to prepare and implement an integrated catchment management plan to include encouraging appropriate management practices on private farmland adjacent to the estuary; and
- prepare an overall estuary conservation plan co-ordinated by CALM.

In 1990, the Port Geographe proposal was approved subject to Ministerial conditions which included implementation of the above measures. The Minister for the Environment also required that the Vasse-Wonnerup wetlands be protected and managed for conservation.

However, the project did not proceed to construction and in 1994 was sold. The project was reassessed and the EPA issued its report and recommendations in 1995, which included proponent commitments relating to:

- monitoring estuary water at a number of selected sites to detect any increase in the salinity of the Vasse-Wonnerup wetlands;
- installation of an impervious barrier at the perimeter of the canal development in the event of detection of increased salinity in estuary;
- recognising conservation and education values by ceding an area for reservation as a Waterfowl Conservation Area, provision of additional drought refuge areas and source of fresh water, construction of a channel to form a conservation island, construction and donation to the State of a waterbird study centre in consultation with CALM; and
- various commitments to minimise waterbird disturbance such as:
  - removal of stock animals and horses from reserve land;
  - provision of a 50 metre separation between development and the landward

edge of the wetlands fringing the edge of the estuary;

- construction of a dog-proof fence around the border to the Waterfowl Conservation Area;
- provision of appropriate landscaping and revegetation of the estuary edge of the development;
- control public access to the Waterfowl Conservation Area; and
- appropriate interface treatment between the development area and the conservation reserve area.

The conditions and commitments of the Port Geographe development are subject to regular auditing by the Department of Environment.

4.3.5 Shire of Busselton Rural Strategy

The *Shire of Busselton Rural Strategy* (1993) guides land use planning for the Shire's rural areas. It seeks to provide a balance between natural values, agricultural values and human values. The Rural Strategy recognises the conservation values of the Vasse-Wonnerup estuaries and the Broadwater wetland and recommends land use strategies aimed at the conservation of significant environments while enabling continuation of adjacent land uses in a manner consistent with those environments.

The study area is located within Precinct 1, Policy Area 1 'Busselton/Ludlow' of the Rural Strategy, which contains the overriding objective:

To secure the Precinct for urban and conservation planning purposes and against substantive land use decisions not consistent with current zoning and structure plans.

The Rural Strategy influences the determination of land use and development proposals in rural areas. However, most of the directions provided by the Rural Strategy in relation to the study area have been updated or superseded by the Shire's Urban Growth Strategy (see above).

4.3.6 Busselton–Dunsborough Land Release Plan 2000–01 to 2004–05

The *Busselton–Dunsborough Land Release Plan 2000–01 to 2004–05* aims to identify and monitor past, current and potential land development activity and associated services and infrastructure requirements in order to demonstrate opportunities and constraints for development. The document focuses on population, development and services infrastructure. It was prepared by the WAPC in consultation with the Shire of Busselton, relevant State agencies, services providers and the building and development community.

The document acknowledges and complements the existing statutory and non-statutory planning instruments which regulate and guide land use within the Shire and recognises the sensitivity of the natural environment and the need for sustainability. The document is not intended as a strategic document in its own right.

The document concluded that there is little prospect of a residential lot shortage within the Busselton townsite in the short to medium term, but in the longer term land development pressure on the environment is likely to increase. Among the recommendations it was considered that there is a need to develop the capability of measuring the extent to which planning policies, goals, strategies and programs are achieved, especially in the sensitive ecological, social and economic environments of the South–West, and that the *State of the Environment research* (Newton et al. 1998) has application in this regard.

4.3.7 Development Setbacks

The *Recommendations for Coastal Reserves, Building Setbacks and Development Controls, July 1992* was prepared by the (then) Department of Planning and Urban Development in conjunction with the Shire of Busselton. However, Council has not formally adopted the report. Responding to development pressures, the study provided guidelines for appropriate coastal reserve and development setbacks along the Geographe Bay coastline. The study also

recommended that setbacks required for the Vasse-Wonnerup estuaries should be the subject of a separate consideration.

4.3.8 Biodiversity Conservation Incentives

Increasingly, biodiversity conservation incentive programs are being prepared and implemented in areas around Australia. The aim of these programs is to encourage private landowners to manage or protect the conservation values on their properties. The incentives vary according to the resources available and whether the aims are to conserve existing values or to rehabilitate degraded areas.

The incentives may be financial or non-financial (see Appendix 8). For example, they may include rate rebates, offered in exchange for a management agreement (contract) that binds the landowner to undertake specified active management of 'environmental targets' such as weeds, pests and remnant vegetation, or to cease activities such as gazing in sensitive areas of the property. Rate rebates can be linked with voluntary conservation covenants, which has the advantage of running with the title of the land. Landowners in areas rezoned to facilitate biodiversity conservation objectives could be offered rate rebates, where a land management plan is prepared and approved by the local government authority for the property.

Contact the Shire of Busselton for information on the 'Biodiversity Incentive Strategy for Private Land in the Shire of Busselton'.

4.4 Relevant Studies and Reports

Department of Agriculture Western Australia *Guidelines for Management of Farmland Adjacent to the Busselton Wetlands, 2001*

The Department of Agriculture (DAWA) has prepared land use guidelines for farmland adjacent to the Busselton Wetlands in conjunction with GeoCatch, CALM and DPI. (Copies can be obtained by contacting the Busselton office of DAWA.) There was extensive consultation with the landowners and relevant agencies during the preparation of these land use guidelines.

This document summarises the accepted best management practices for agricultural land adjacent to the wetlands and describes the benefits of the recommended practices for landowners and the health of the wetlands. Information is organised according to farming operations, and includes recommendations for the following:

- fencing options
- stock and pasture management
- fertility of pastures
- shade and shelter
- water management
- chemical use
- declared weeds and vermin control
- funding.

This document will also assist many people without farming experience. The support of local residents, community groups, the local government and relevant agencies is important in managing the wetlands and the farming system.

Froend R.H., Pettit N. and Franke B. Vegetation Monitoring and Mapping of the Vasse Estuary, Unpublished report, 2000

In 1980, Tingay and Tingay undertook survey mapping and description of the vegetation of the Busselton wetlands (including the Vasse-Wonnerup estuaries, Deadwater, New River and Broadwater) for the (then) Department of Fisheries and Wildlife. In 1997, the Vasse Estuary Technical Working Group recommended a monitoring program to assess the composition and health of the vegetation of the Vasse Estuary. Also, updating and verification of the mapped units of Tingay and Tingay was recommended. It was considered that updated mapping would provide assistance in land management and land use planning decisions.

In 2000, R. Froend, N. Pettit and B. Franke conducted the above study for GeoCatch, CALM and DPI. A formal program to assess the fringing vegetation of the Vasse Estuary at ten selected sites was established. Methodology was designed to assess change in wetland vegetation in response to changes in hydrology and salinity (based on the Salinity Action Plan, 1998).

The study concluded that there are a number of impacts on the wetland vegetation at the Vasse Estuary that are significant and threaten the long-term viability of the vegetation component of the ecosystem. These impacts are identified in the study as relating to the influx of seawater into the Estuary, since partial openings of the floodgates in 1988 (also see Section 3.9.2); introduced invasive species, which are widespread and exclude most native vegetation, limit the potential for seedling recruitment, and present significant problems for vegetation conservation and rehabilitation; and removal and trampling of the fringing vegetation. The study noted that clearing native wetland vegetation (past and present) for agriculture and urban development has not only led to loss of vegetation and habitat but also the spread of invasive species. It can be observed that in many locations wetland vegetation is truncated by agricultural or urban land use.

Busselton Regional Flood Study, 2000

In 1987, the (then) Water Authority completed a detailed regional flood study from the Broadwater area to the Vasse-Wonnerup estuaries. The study delineated areas that are flood prone during major flooding, assessed the capacity of the main drains and watercourses and recommended strategies to ensure 1:100 year flood level protection is provided to existing and future development.

In 1993, based on the recommendations of the study, the capacity of the Vasse River Diversion was upgraded to provide Busselton with 1:100 year flood level protection. This was done by raising the levee banks 0.5 metre above what was then estimated to be the '1:100 year flood level'

In August 1997, intense rainfall occurred in the upper catchments of the Vasse River Diversion causing major flows with the levee bank overtopping in the lower reaches around Busselton. Prompt action by the local community and the Water Corporation prevented potentially significant property damage. Subsequently, a preliminary review indicated that Busselton had only 1:20 year flood level protection, not 1:100 year flood level protection, as previously thought.

In reviewing the 1987 Busselton Regional Flood Study, a consultant, overseen by the Busselton Flood Management Steering Committee, evaluated various flood mitigation measures that would provide the town with 100 year flood protection. The objective of the flood management study was to ensure that after the implementation of flood mitigation measures the 'new' 100 year flood levels are similar to the 1987 estimated 1:100 year flood levels (to ensure consistency with the minimum floor levels recommended for development since 1987).

This study confirmed that Busselton had only 1:20 year flood level protection and the level of flood protection should be increased. It recommended a combination of retaining floodwaters in the upper catchments (in detention basins) and minor upgrading of the Vasse River Diversion.

In June 2000, the Water Corporation completed a conceptual design of a detention basin network in the upper catchments that will provide 1:100 year flood level protection. Detailed contour mapping, aerial photography and hydrologic modelling have identified areas with potential for detention basins.

The first detention basin was constructed in the 2000–2001 summer period at the Department of Agriculture's Vasse Research Station. It is anticipated that by 2006–2007 the flood mitigation works will be completed. In the meantime, the areas likely to be significantly affected by 1:100 year flood flows are the Broadwater, New River and the Vasse River (see

Figure 12). The study also recommends local guidelines for building applications in flood prone areas.

Vasse Estuary Technical Working Group *Management of the Vasse-Wonnerup Wetland System in Relation to Sudden, Mass Fish Deaths, 1997*

This study was prepared by the Vasse Estuary Technical Working Group in response to community concerns raised in 1997 about sudden, mass fish deaths in the Vasse estuary exit channel, death of fringing vegetation, loss of pasture production on adjoining lands and a possible decline in the use of the estuary by waterbirds. The report:

- reviewed the history and management of the water-levels and water quality of the Vasse-Wonnerup estuaries, particularly in relation to mass fish deaths and measures taken to prevent them;
- discusses management options and makes recommendations aimed at reducing the incidence of fish deaths in an environmentally-acceptable manner;
- demonstrates that there is a long history of mass fish deaths in the lower reaches of the Vasse-Wonnerup estuaries (instances are reported between 1905 and 1960, and since 1960 mass fish deaths have occurred in 1966, 1988, 1989 and 1997). Measures used in the past to reduce the frequency and severity of fish kills have been artificial opening of the sand bar; increased harvesting of fish by netting; and partial opening of the Vasse estuary floodgates to allow fish to escape and to raise water-levels; and
- considered the principal cause of summer mass fish deaths is temporary declines in dissolved oxygen concentrations due to night-time respiration by algal blooms, algal bloom decay and high water temperatures, possibly in combination with toxic products of algal blooms and decaying seaweed.

The Working Group recommended the following measures be commenced in 1997-98:

- artificial opening of the Wonnerup Inlet sand bar during summer-autumn, particularly January and February;
- implementation of a fish and water quality monitoring program in the lower reaches of the Vasse-Wonnerup system;
- refinement of operational procedures for openings of the Vasse estuary floodgates; and
- partial shading of the Vasse estuary channel to reduce water temperatures during summer.

The Working Group also recommended investigation of the following (if the measures proposed for 1997-98 proved unsuccessful):

- artificial aeration of waters of the Vasse estuary channel;
- increased fish harvest before mid-summer;
- permanent opening of the mouth of Wonnerup Inlet;
- the measures raised by McAlpine, Spice and Humphries (1989) (see below), only after the above measures have been assessed, as they are expensive; and
- in respect of the proposed replacement of the Vasse estuary floodgates in 2003-04, provision of a Supervisory Control and Data Acquisition System (SCADA) for remote and/or automatic water-level control and monitoring to enhance management of water-levels and flows in comparison with a manual system.

McAlpine, Spice and Humphries *The Environmental Condition of the Vasse Wonnerup Wetland System and a Discussion of Management Options,* Environmental Protection Authority, Perth, WA, 1989

This report investigated the environmental status of the Vasse-Wonnerup estuaries. It considered that maintenance of the current hydrological regime is necessary to prevent severe, broad scale deterioration of the wetlands. This report

concluded that maintenance of the waterbird habitat is the most important environmental objective for the system and that the system should be managed as a 'beneficially nutrient-enriched habitat to sustain the waterbird populations' and not be returned to its original condition. It recommended potential management options and further investigation (summarised in Appendix 9).

This report warned that without competent management, the high nutrient loads, low tidal flushing and continued development of adjacent land constitute a recipe for environmental degradation. It considered that management of the system as compensation basins is not satisfactory, particularly considering its high conservation value and proposed the following short term and longer term management goals:

Short Term:

- the system's function as an important waterbird habitat;
- improve the water quality of the system over the summer period;
- prevent further fish deaths in the system;
- reduce the annual nutrient load retained in the lagoons; and
- maintain productivity in the catchment.

Longer Term:

- manage the nutrient budget for the Vasse-Wonnerup wetland system at an acceptable level for all activities; and
- improve the Vasse-Wonnerup system as a habitat for birds and fish and as an aesthetic and recreation resource for people.

The report acknowledged the limited available knowledge on the biology and environment of the Vasse-Wonnerup wetland system and recommended further investigation in both the catchment and estuaries.

Issues and Actions raised in Community Consultation 5

5 Planning and Environmental Issues

The major issues and actions raised during community consultation are summarised in this chapter. They are also described in the *Busselton Wetlands Conservation Strategy Discussion Paper.* (Appendix 4 summarises the responses received from the community regarding the discussion paper). This chapter also considers planning implications for each of the five key issues. For convenience, these issues are grouped as follows:

- water-levels and water quality regimes
- agricultural land use and land management
- urban and rural residential
- heritage, education and ecotourism
- amenity

Chapter 2 presents the strategies to guide land use planning and management in the strategy area.

5.1 Water-Levels and Water Quality Regimes

Within wetland systems, slight changes in water-levels and water quality regimes can bring about significant biological and habitat impacts. These issues need to be addressed by the Strategy to ensure that the biodiversity and health of the wetland system is maintained or enhanced.

Since European settlement, the water-levels and water quality regimes in the wetlands and the catchment have been changed by:

- Extensive clearing of native vegetation, mainly for agriculture and urban purposes.
- Modification of the natural drainage pattern by the construction of diversion drains (see Section 3.9.1).
- The installation of the floodgates (see Section 3.9.2).
- Reduced flushing of the Vasse-Wonnerup estuaries and the accumulation of nutrients *(eutrophication)* contributes to water quality problems. Stock allowed to graze near the wetland margins have contributed to the deterioration of the native vegetation. Water quality is also affected by reduced tidal currents at the mouth of the system, which have resulted in increased bar formation. Reduced water quality inhibits fish movement and breeding.
- Seasonal openings of the sand bar (see Section 3.9.3).

The wetlands are some of the most heavily nutrient-loaded systems in Western Australia. Both the Lower Vasse River and the Vasse-Wonnerup estuaries experience periods of extremely poor water quality particularly in summer-autumn. During these periods large *algal blooms* occur, often of species of blue-green algae, and necessitate public health warnings. Nitrogen and phosphorus are the main nutrients responsible for eutrophication of the wetlands (McAlpine *et al*, 1989). The blooms deplete water oxygen levels and can cause the death of aquatic organisms. The blooms are visible as discolouration of the water or unsightly scums on the water surface, and can cause unpleasant odours. Accelerated weed growth, fish deaths and damage to the seagrass beds in Geographe Bay also occur.

The specific water-levels and water quality issues relate to the following (not ranked in any order):

- the impacts of land use practices and clearing of native vegetation on water quality;
- the impacts of reduced water quality on fish and birds, their habitats and the fringing vegetation. The impact of eutrophication (nutrient enrichment) such as algal blooms and deoxygenation on water quality;
- floodgate operation: maintain water-levels at ranges beneficial to the water quality of the wetlands, wildlife, and fringing vegetation whilst ensuring pastures are not inundated;
- adequate flood protection to existing and future development of Busselton and its environs;
- drainage management: flood control, the effect of peak flows on the water-levels and the salinity level in the wetlands and impacts on fringing vegetation, birdlife and land use. Peak flows into the Vasse Diversion Drain and drainage of the

Broadwater area. Drains are 'expressways' for nutrients to enter water bodies;

- upper catchment drainage management (the installation of structures to retain and detain water during periods of peak flow is a related issue); and
- the adverse effects of water pollutants, such as petrol, oil and industrial waste, entering the wetland system.

A review of the positive benefits of the changed water-level regime for the wetlands, with regard to the need to limit salt water intrusion into farmland and prevent flooding in Busselton, is being conducted by the Vasse Estuary Technical Working Group, an inter-agency committee chaired by CALM. Examination of flows into the wetlands and upper catchment drainage is considered appropriate. A review of the seasonal opening of the sand bar is also being carried out. A desirable outcome is the ability to maintain an appropriate range of water-levels over the seasons that is beneficial to the wetlands and flood plain habitat.

As a consequence of the August 1997 flooding in Busselton, the flood plain mapping and associated floodplain development strategies have been reviewed. It is intended to develop options to ensure flood protection is provided to existing and future development.

At various sites in the Vasse-Wonnerup area, the DoE carries out routine water quality monitoring. River inflow during the June-August period results in fresh water, but salinity levels rise during summer. Hypersaline waters can occur in March-April due to evapo-concentration.

Some options to manage water-levels and water quality could be costly to implement and may not have long-term advantages, for example, construction of levee banks could lead to loss of fringing vegetation, dredging may not improve water quality and river re-diversion may increase the risk of flooding and result in increased nutrient enriched sediment load. A desirable outcome will be maintaining water-levels (over the seasons) that is beneficial to the wetlands.

Other considerations include river re-diversion; for example, re-diversion of flow from the Vasse diversion drain back into the Vasse Estuary, and dredging and/or construction of levee banks in selected areas.
A related issue is nutrient discharge into Geographe Bay via the Busselton Wetlands and the diversion drains. The *Geographe Catchment Management Strategy* suggests strategies for action to address this. It considers that immediate action is required to address the accumulated store of nutrients within river sediments. It also recognises the importance of awareness raising activities including the use of the Vasse River to demonstrate to local communities how river rehabilitation techniques and integrated management practices can be used to address the symptoms and causes of eutrophication.

Possible Actions

The possible actions summarised below were raised in consultation with the community, landowners and agencies.

- Appropriate management of drainage throughout the wetlands area and the water-levels of the wetlands is essential. Flood plain development strategies need to have regard for major flooding. In suitable areas, tree planting should be encouraged to reduce water run-off. Retention of native vegetation has benefits in protecting and conserving the wetlands. The recommendations of the *Geographe Catchment Management Strategy* and the *Busselton Regional Flood Study* provide guidance.
- The water quality of the wetlands should be managed to conserve and enhance its biodiversity and environmental values. The wetland system should be maintained as a fresh to saline system through water-level management.
- Nutrient additions to the wetlands, such as run-off of excess nutrients, should not cause eutrophication. Current community views and scientific expertise on water-levels and water quality issues should be sought and there should be ongoing investigation and

monitoring. The Department of Agriculture *Guidelines for the Management of Farmland Adjacent to the Busselton Wetlands* should be promoted (see Section 4.4 and 5.2).

- Water quality should not deteriorate because of noxious materials such as pesticides, urban and industrial wastes entering the wetland system. Community awareness that the wetlands are often key nursery areas and are placed under great pressure from clearing and development in the catchment should be raised.
- Investigate appropriate funding assistance to ensure ongoing examination, monitoring and measures to benefit implementation of conservation strategies.

5.2 Agricultural Land Use and Land Management

This section focuses on issues that relate to privately owned agricultural land. A variety of land use activities occur around the wetlands and within its catchment, notably agriculture, mining, forestry (some limited harvesting of jarrah, tuart and pine), rural residential development and urban development associated with Busselton (see Figure 10).

Historically, agriculture has been one of the Busselton area's most important land uses. Cattle grazing on privately owned land remains the predominant land use activity near the wetlands. Agriculture has economic and social values as well as aesthetic qualities. Rural vistas provide landscape amenity, and contrast with the adjoining urban development of Busselton. (Adjoining, or near to the wetlands, are Crown reserves which form part of the regional open space system. Management plan(s) will be prepared for those CALM estate conservation reserves adjoining or near the wetlands.)

Themes expressed in community consultation were: that appropriate agricultural land use management actions can have acceptable or beneficial impacts on the wetlands; that broad-acre farming near to the wetlands should be maintained; and that the strategy should recognise landowners' rights, while developing innovative mechanisms for the protection and conservation of the wetlands.

Land use and land management issues relate to the appropriate land use practices and measures near the wetlands. The Department of Agriculture has produced land use guidelines that provide landowners with accepted best land management practices (see Section 4.4).

The study area has significant pest and weed problems. For example, along margins of the Vasse Estuary, introduced invasive species are widespread. They exclude most native vegetation and limit the potential for seedling recruitment and present significant problems for vegetation conservation and rehabilitation (Froend et al 2000).

The parameters of land use and land management options are identified by the existing statutory and strategic planning framework and the requirements of agencies and relevant government policies (see Section 4.3).

Farmland on the margin of the Wonnerup Estuary

The specific agricultural land use and land management issues relate to the following (not ranked in any order):

- developing innovative mechanisms for the protection and conservation of the wetlands whilst maintaining broad-acre farming;
- addressing issues related to the clearing of native vegetation in the catchment and replacement with shallow rooted pasture grasses. These include increased nutrient transport into the wetlands and Geographe Bay; ecological impacts on biodiversity; and increased flooding potential (flood peaks).
- a community preference for a policy or strategy approach to land management. However, statutory controls are recognised as appropriate to address some issues to ensure compliance;
- drainage, fencing, tree planting and rehabilitation measures and funding assistance.
- pests and weeds, such as arum lilies, feral animals (rabbits and foxes) and domestic pets, for example, the need for ongoing, appropriate management of these problems. The need for long-term strategies, inter-agency control programs or CALM assistance in the control of weeds and vermin, and in management agreements with landowners, such as in relation to grazing stock near wetland margins to control the weed problem;
- land incentives to achieve conservation objectives, that is, set aside land for conservation purposes.

Possible Actions

The possible actions summarised below were raised in consultation with the community, landowners and agencies.

- Strategies should be developed to lift awareness and foster the role that farming properties do, and can, play in biodiversity conservation. Promote strategies that assist revegetation and rehabilitation, particularly wetland fringes, and encourage the protection of existing remnant vegetation. Funding assistance to fence appropriate parts of the wetlands fringes and for tree planting should be encouraged.
- Promotion of awareness of the importance of integrated catchment management, conservation of remnant vegetation and best land use management practices may benefit the area as per the *Guidelines for Management of Farmland Adjacent to the Busselton Wetlands* and the *Geographe Catchment Management Strategy.*
- Appropriate guidelines should be prepared regarding the need for separation between the wetlands and types of rural land use and development that could adversely impact on the wetlands.
- Consider additional statutory measures that would provide greater certainty to landowners and the broader community regarding development adjacent to or near the wetland system and a clear statement regarding the approval process and measures to ensure that development is consistent with the objectives of the Strategy. Two possible statutory approaches are as follows:
  - Special Control Area (SCA) provisions and/or relevant development control provisions could be recommended for incorporation in the local town planning scheme.
  - A Statement of Planning Policy (SPP) could be prepared under the *Town Planning and Development Act 1928* to provide a clear direction of land use in the study area. Under the Act SPPs should be reflected in town planning schemes.
- Active and ongoing management of pests and weeds is considered an important priority by the community. *The Guidelines for Management of Farmland Adjacent to the Busselton Wetlands* provide recommendations for weed and pest control. Users of chemicals should check the labelling of farm chemicals. Chemicals that impact on non-target organisms should be avoided and alternative chemicals should be sought.

- Regarding feral animals, which are considered to be a significant problem in the area, further investigation and review of specific control and management programs is necessary.
- Future subdivision or development in close proximity to the wetlands must be based on sustainability. Limited subdivision where some land is also proposed to be set aside for conservation purposes, subject to appropriate justification, should be considered.

It should be noted that under the WA *Government Wetlands Conservation Policy 1997*, 62 Government actions are provided to conserve and manage wetlands. Action 1.9 of this policy is to develop guidelines based on ecological grounds for the provision of 'buffers' between proposed development and wetlands. There is currently no consensus on what are appropriate generic buffers for wetlands or how buffers should be determined.

5.3 Urban and Rural Residential

Busselton is one of Australia's fastest growing centres (see Sections 3.8 and 4.3). Activities in Busselton's urbanised areas can impact on the wetlands. The existing statutory and strategic planning framework and development controls provides for appropriate management of urban and industrial development.

Issues relating to urbanisation near the wetlands raised during community consultation included the following:

- Future land uses: the issues of urban expansion and competing land uses; uncertainty and the effect on land values; and appropriate land use zone(s) and development control provisions under the local schemes.
- The need for flood plain mapping and associated flood plain development strategies.
- The impact of urbanisation on the wetlands and public health; for example, urban stormwater management and pollution and wastes, such as petrol, oil and industrial waste and sewage, entering directly or indirectly into the wetland system. Hydrocarbon and other contaminated run-off from the Busselton Light Industrial Area and individual industrial premises is an issue of concern. Hydrocarbon films reduce oxygen transfer into water bodies. Heavy metals and other contaminants can build up in bottom sediments.

Possible Actions

The possible actions summarised below were raised in consultation with the community, landowners and agencies.

- Increased development pressure near the wetlands highlights the need for investigation and monitoring of the key natural environmental attributes.
- Ensure appropriate separation between urban development and the wetlands to minimise land use conflicts and protect the wetlands. Limit urban development near the wetlands. Recognise the defined boundary between those areas suited to urban and industrial development and those areas prone to flooding.
- Urban development proposals should conform to recommended floodplain development strategies to ensure adequate flood protection.
- Urban and industrial drains should be improved to minimise the risk of hydrocarbon and nutrient entry into the wetland system.
- Review measures to prevent water quality from deteriorating because of noxious materials such as pesticides and urban and industrial wastes entering the wetland system.
- Support the DoE *A Manual for Managing Urban Stormwater Quality in Western Australia* which provides guidelines regarding best management practices in water-sensitive urban design provide appropriate measures to prevent water

quality from deteriorating because of noxious materials, such as pesticides, urban and industrial wastes entering the wetlands. recommend best management practices in water-sensitive urban design.

5.4 Heritage, Education and Ecotourism

The Busselton Wetlands area is a wonderful asset in the region. It has significant Aboriginal and non-Aboriginal heritage, educational, scientific and ecotourism values and attributes. Appreciation of these values and attributes needs to be recognised in the Strategy.

Ecotoursim, including nature based tourism and interpretation, depends on maintaining the integrity of the natural environment. Where the natural assets are fragile careful management and effective monitoring or measuring of the sustainability of ecotoursim needs to be implemented. The quality of the ecotourism experience is closely linked to the level of interpretation and quality of information available at sites.

Issues and opportunities raised in community consultation indicate a need for controlled public access to specific wetland sites, such as bird hides, and a need to raise awareness regarding the natural values and attributes of the wetlands. This raises challenges regarding the management of suitable sites, avoiding unacceptable impacts on waterbird nesting and breeding areas. In particular, the issues raised indicate a need to:

- explore the ongoing role that community and school groups can play in lifting community awareness and involvement regarding the need to protect and conserve the wetlands;
- encourage school group participation in programs that increase understanding and appreciation of the wetlands environment and contribute to protecting and enhancing the area and expand the Ribbons of Blue program co-ordinated by the Department of Environment (DoE);
- explore DoE and CALM assistance to promote the educational values of the wetlands to the wider community and schools;
- identify suitable access specific wetland sites for education, ecotourism and interpretation purposes; and
- promote funding assistance to promote the educational, ecotourism and interpretation values of the wetlands.

Possible Actions

The possible actions summarised below were raised in consultation with the community, landowners and agencies.

- The Busselton Wetlands area has a rich Aboriginal, non-Aboriginal and natural heritage. Significant places should be recorded, researched, and protected. Land use changes should not adversely impact upon such places of heritage significance. These places should be managed for the benefit and enjoyment of present and future generations.
- Significant education, scientific, ecotourism and interpretation opportunities are present within the study area, and should be recognised as follows:
  - provide for sustainable public use and access to specific wetland sites for appreciation and enjoyment of the wetlands environment;
  - manage access to identified sites to avoid wildlife disturbance, especially to breeding birds;
  - provide access and facilities for education and ecotourism at suitable sites;
  - investigate options for funding and/or assistance for the provision of education and ecotourism activities and facilities. Where appropriate, funding assistance to promote the values of the wetlands should be sought;
  - encourage the role that community and school groups to play a role in relation to the monitoring, measuring, conservation and enhancement of the wetlands, as

supported by local schools and the wider community; and

- promote the values of the wetlands through awareness-raising such as interpretation facilities and information brochures.

5.5 Amenity

'Amenity' refers to those visual and other attributes which combine to form the present character, and likely future character, of an area. The study area is valued for its natural and cultural features including scenic water bodies, rich and diverse wildlife, tuart forest and the rural landscape. The major distinctive natural and cultural landscape features are described in Chapter 3.

The majority of amenity issues raised during community consultation related to the above categories of issues. Amenity issues that relate to the visual landscape, for example, will be addressed together with the above issues. However, considered separately in this section are specific amenity issues relating to odour and nuisance insects.

Seasonal drying out of the wetlands results in odour problems for nearby residents. However, drying out may have a potential short-term benefit to wetlands as aquatic weed growth and other symptoms of nutrient enrichment are minimised. A theme raised in community consultation was to lift community awareness that seasonal drying out of the wetlands can benefit the wetlands.

Excessive midge and mosquito numbers can have adverse impacts on quality of life. The significance of mosquitoes is greater than that of midges, which are primarily nuisance insects. Mosquitoes, especially *Aedes vigilax* and *Culex anullirostris* are known carriers of Epidemic Polyarthritis, also known as Ross River Virus (Wright 1986). Mosquitoes are attracted to people and animals by the carbon dioxide that is breathed out. In urban areas, they are active on warm nights when there is a gentle breeze blowing from the urban areas to the wetlands. This allows mosquitoes to follow the carbon dioxide 'upstream' to their hosts. Excessive midge numbers may be a nuisance at night in built up areas because they are attracted to household and street lights. Some species are so small they can enter houses through flyscreens.

The key factors that affect midge and mosquito numbers are whether the wetland is permanent or seasonal; variations in the surface water-level; and the width and density of buffer vegetation around the wetland. Rises in water-levels trigger hatching of mosquito larvae, so if there are regular periods of falling and rising water-levels there will be a constant source of larvae. Dense vegetation buffers around wetlands is an effective option in reducing light penetration into the wetlands, which discourages midges and helps to disperse and disrupt carbon dioxide streams and reduce mosquito activity. There is no established standard width for such buffers. However, Davies and Lane 1995 indicate that the buffer should be determined by the vegetation characteristics, not by a set width.

Notwithstanding the amenity and health impacts of midge and mosquitoes, these insects form an integral part of the wetland ecology and, in particular, are an important food source for many species of waterbirds.

It is considered that there is an opportunity for the Strategy to recommend implementation of appropriate management of excessive midge and mosquito numbers and support the Health Department regarding definition of acceptable practices for the management of midges and mosquitoes in the wetlands area. A long term mosquito management program to minimise Ross River Virus and Barmah Forest Virus exposure or risks should be considered in conjunction with the Shire of Busselton .

Such a program should ensure that waterbird habitat is not compromised. There is an opportunity to investigate tree planting close to midge breeding areas to prevent midges flying large distances, or installation of light traps in selected midge pest areas. It is considered that larviciding of mosquitoes may not be an effective long-term measure as insect resistance may build

up, as has occurred with midge control. However, it may have some application as a short term measure, in some areas. Larviciding for mosquito control near Port Geographe is not permitted due to the environmental conditions imposed by the Minister for the Environment.

Possible Actions

The possible actions summarised below were raised in consultation with the community, landowners and agencies.

- The existing rural landscape character and amenity and the positive role that landowners can play in protecting the wetlands is recognised and should be maintained or encouraged.
- Promote awareness regarding the following:
  - management of the water-levels and water quality of the wetland system has landscape amenity benefits;
  - drying out of the wetland margins may provide a short-term benefit as aquatic weed growth and associated algal bloom problems are reduced;
  - harvesting aquatic weeds may benefit amenity; and
  - adverse amenity impacts can have an adverse impact on education and ecotourism opportunities.
- Midge and mosquito numbers, especially in summer months, can affect outdoor activities and enjoyment of the area. Mosquito-related illnesses are health and quality of life issues; for example, Ross River virus and Barmah Forest virus are notifiable diseases. Strategies that manage midge and mosquito problems, improve health and quality of life, and do not compromise the habitats of waterbirds and marine life should be supported.

Appendices

Appendix 1 Membership: Steering Committee and Technical Working Group

Steering Committee

Mr Bernie Masters - Chairman .....(MLA, Member for Vasse)
Mr Jack Guthrie .....(GeoCatch)
Cr Evelyn Brand .....(Busselton Shire Councillor)
Ms Pat Barblett .....(Conservation Commission WA)
Mr John Anderson .....(Western Australian Planning Commission)

Previous members of the Steering Committee:

Mr Hugh Browne .....(National Parks and Nature Conservation Authority)
Cr Isabelle Devoy .....(Busselton Shire Councillor)

Technical Working Group

A technical working group provides the technical support to assist the Steering Committee to prepare the draft Conservation Strategy. It consists of the following agency officers:

Mr Ken Dawson – Project Manager ....(Department for Planning and Infrastructure)
Mr Peter Hanly .....(Department of Conservation and Land Management)
Ms Sasha Taylor .....(Department of Environment/GeoCatch)
Mr Will Oldfield .....(Department of Agriculture Western Australia)
Mr Chris Bishop .....(Department of Environment)
Mr Graham Holtfreter .....(Water Corporation)
Mr Tim Shingles .....(Shire of Busselton)

Previous Technical Working Group Members:

Mr Kevin Martin .....(Department for Planning and Infrastructure)
Ms Marie Ward .....(Department for Planning and Infrastructure)
Mr Charlie Broadbent .....(Department of Conservation and Land Management)
Ms Claire Thorstensen .....(Department of Environment/GeoCatch)
Mr Anthony Sutton .....(Department of Environment/Geocatch)
Mr Iliya Hastings .....(Shire of Busselton)
Ms Kirrily White .....(Shire of Busselton)
Mr Damon Carter .....(Shire of Busselton)

Co-opted Members

Mr Larry Guise .....(Department for Planning and Infrastructure)
Mr Jim Lane .....(Department of Conservation and Land Management)
Mr Mark Pittavino .....(Department of Conservation and Land Management)
Mr Kim Williams .....(Department of Conservation and Land Management)
Mr Rob Paull .....(Shire of Busselton)
Mr Rick Bretnall .....(Department of Environment)
Mr Shane Kirk .....(Department for Planning and Infrastructure)

Appendix 2 Ramsar and the Wise Use of the Wetlands

The concept of **wise use** is important for the sustainable use of the wetlands. This concept is outlined below (after Hill *et al* 1996):

> *The wise use of wetlands is their sustainable utilisation for the benefit of humankind in a way compatible with the maintenance of the natural properties of the ecosystem.*

This definition of wise use specified under the Ramsar Convention, to which Australia is a signatory, provides a sound overarching objective for wetland management and protection.

Guidelines to wetland use as recommended by the Third Ramsar conference recognised that wise use involves the promotion of wetland policies containing the following elements:

1a. a national inventory of wetlands;

1b. identification of the benefits and values of these wetlands;

1c. definition of the priorities for each site in accordance with the needs and socio-economic conditions in each country;

1d. proper assessment of environmental impact before development projects are approved, continuing evaluation during the execution of projects and full implementation of environmental conservation measures which take full account of the recommendations of this process of environmental assessment and evaluation;

1e. use of development funds for projects which permit conservation and sustainable utilisation of wetland resources;

1f. regulated utilisation of wild fauna and flora such that these components of the wetland ecosystem are not over-exploited;

While detailed policies are being established, immediate action should be taken on:

2a. interchange of experience and information between countries seeking to elaborate national wetland policies;

2b. training of appropriate staff in the disciplines which will assist in the elaboration of such policies;

2c. pursuit of legislation and policies which will stimulate wetlands conservation action including the amendment as appropriate of existing legislation; and

2d. review of traditional techniques of sustainable wetland use and elaboration of pilot projects which demonstrate wise use of representative national and regional wetland types (*Environmental Policy and Law* 17/5, pages 203-204, 1987)

Appendix 3 Criteria for Identifying Wetlands of International Importance

The **Criteria for Identifying Wetlands of International Importance** as adopted by the 4th, 6th, and 7th Meetings of the Conference of the Contracting Parties to the Convention on Wetlands (Ramsar, Iran, 1971) to guide implementation of Article 2.1 on designation of **Ramsar** sites

[**Note:** This is just a simple list of the criteria themselves out of their explanatory settings. They should properly be used as part of the strategic framework and guidelines for the future development of the List of Wetlands of International Importance adopted by COP7, 1999.]

Group A of the Criteria. Sites containing representative, rare or unique wetland types

Criterion 1: A wetland should be considered internationally important if it contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographical region.

Group B of the Criteria. Sites of international importance for conserving biological diversity

Criteria based on species and ecological communities

Criterion 2: A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities.

Criterion 3:A wetland should be considered internationally important if it supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographical region.

Criterion 4: A wetland should be considered internationally important if it supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.

Specific criteria based on waterbirds

Criterion 5: A wetland should be considered internationally important if it regularly supports 20,000 or more waterbirds.

Criterion 6: A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of waterbird.

Specific criteria based on fish

Criterion 7:A wetland should be considered internationally important if it supports a significant proportion of indigenous fish subspecies, species or families, life-history stages, species interactions and/or populations that are representative of wetland benefits and/or values and thereby contributes to global biological diversity.

Criterion 8: A wetland should be considered internationally important if it is an important source of food for fishes, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere, depend.

Appendix 4 Summary of Submissions (Busselton Wetlands Conservation Strategy Discussion Paper)

Of the approximately 250 copies of the Discussion Paper distributed to landowners in the 'Agriculture', 'Rural Residential' and 'Conservation' zones (within the study area) and community groups 14, responses were received. In summary, the pattern of responses indicate the following:

- most respondents rated most of the actions as being of 'high importance', with the exception of regulatory controls on land use and development; and
- there is concern amongst landowners that additional land use and development controls could conflict with existing land use practices.

Additional matters raised included the following:

- agencies should assist in the conservation and revegetation of farmland closest to the wetlands;
- ongoing community consultation is supported so a big picture understanding of all the issues affecting the study area is achieved, within the context of the broader Geographe Bay catchment;
- concern that increasing urbanisation and industry activities represent point source pollution of the wetlands;
- the outcomes of the Conservation Strategy should provide the community with achievable objectives;
- implementation of the Strategy should include consideration of resourcing the actions;
- activities related to nutrient loads should focus on nutrient reduction;
- positive comments regarding community consultation;
- concern regarding the draft Swan Coastal Plain Wetlands EPP.

Appendix 5 National Strategy for Ecologically Sustainable Development (1992)

Under the National Strategy for Ecologically Sustainable Development ecologically sustainable development is defined as:

> *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 in the future, can be increased.*

Core Objectives:

- To enhance individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations.
- To provide for equity within and between generations.
- To protect biological diversity and maintain essential ecological processes and life-support systems.

Guiding Principles:

- Decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equity considerations.
- 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.
- The global dimension of environmental impacts of actions and policies should be recognised and considered.
- The need to develop a strong, growing and diversified economy, which can enhance the capacity for environmental protection, should be recognised.
- The need to maintain and enhance international competitiveness in an environmentally sound manner should be recognised.
- Cost effective and flexible policy instruments should be adopted, such as improved valuation, pricing and incentive mechanisms.
- Decisions and actions should provide for broad community involvement on issues which affect them.

Appendix 6 Wetlands Conservation Policy for Western Australia, 1997

1. Wetlands Conservation Policy for Western Australia, 1997

The policy has a 'Statement of Policy' which applies to all wetland types covered by the Ramsar Convention, as follows:

The Government of Western Australia recognises that wetlands,

- are essential habitats for a multitude of plant and animal species, many of which have high public appeal;
- play a key part in supporting the diversity and abundance of species within surrounding terrestrial ecosystems;
- add considerable landscape diversity and aesthetic appeal to a mainly arid land;
- provide many opportunities for enjoyment for the people of Western Australia;
- are, in some cases, of international significance, particularly as habitats for migratory bird species;
- have other significant values, including flood mitigation, water resource, soil conservation, biological filtration, fish nurseries, Aboriginal and historical significance, recreation and tourism;
- form one of the habitats that will be most affected by possible climatic change;
- have, in many instances, been unnecessarily lost or diminished in value through inappropriate use or management of the wetlands themselves and their catchments;
- may be conserved and enhanced through proper planning and management,

is committed to identifying, maintaining and managing the State's wetland resource, including the full range of wetland values, for the long term benefit of the people of Western Australia.

In making this commitment the Government establishes the following principal objectives with respect to conservation of the resource:

1. To prevent the further loss or degradation of valuable wetlands and wetland types, and promote wetland conservation, creation and restoration.
2. To include viable representatives of all major wetland types and key wildlife habitats and associated flora and fauna with a Statewide network of appropriately located and managed conservation reserves which ensure the continued survival of species, ecosystems and ecological functions.
3. To maintain, in viable wild populations, the species and genetic diversity or wetland-dependent flora and fauna.
4. To maintain the abundance of waterbird populations, particularly migratory species.
5. To greatly increase community awareness and appreciation of the many values of wetlands, and the importance of sound management of the wetlands and their catchments in the maintenance of those values.

This commitment is made in accordance with the conservation objectives of the *State Conservation Strategy for Western Australia (1987)* and contributes towards its implementation.

Appendix 7 Declared Rare Flora (DRF) known to occur in the Geographe Bay Catchment

Species Name	Priority	Common Name
Brachyscias verecundus	DRF	
Brachysema modestum	DRF	
Brachysema papilio	DRF	Butterfly Brachysema
Caladenia bussellianna ms	DRF	Bussell's Spider Orchid
Caladenia caesarea subsp. maritima ms	DRF	Cape Spider Orchid
Caladenia excelsa ms	DRF	Giant Spider Orchid
Caladenia huegelii	DRF	Grand Spider Orchid
Caladenia procera	DRF	
Caladenia viridescens ms	DRF	Dunsborough Spider Orchid
Chamelaucium roycei ms	DRF	
Darwinia sp. Williamson	DRF	Abba Bell
Daviesia elongata subsp. elongata	DRF	
Diuris drummondii	DRF	
Diuris purdiei	DRF	Purdie's Donkey Orchid
Drakaea elastica	DRF	Glossyleaved Hammer Orchid
Dryandra mimica	DRF	
Dryandra nivea subsp. uliginosa	DRF	
Dryandra nivea subsp. argillacea	DRF	
Eleocharis keigheryi	DRF	
Eucalyptus phylacis	DRF	Meelup mallee
Grevillea brachystylis subsp. grandis	DRF	
Grevillea elongata	DRF	
Grevillea maccutcheonii	DRF	Maccutcheon's Grevillea
Lambertia echinata subsp. occidentalis	DRF	
Laxmannia jamesii	DRF	James's Paperlily
Petrophile latericola	DRF	Laterite Petrophile
Tetraria australiensis	DRF	
Verticordia densiflora subsp. pedunculata	DRF	
Verticordia plumosa var vassensis	DRF	
Verticordia plumosa var ananetoes	DRF	

Appendix 8 Summary of Statutory and Non-statutory Mechanisms for Protection of Conservation and Landscape Values

The array of possible mechanisms for protection of conservation and landscape values ranges from those of a statutory nature to those that are non-statutory; i.e. policy or guideline oriented. Various options exist for both privately owned and Crown lands. A combination of mechanisms may serve to meet planning objectives. (The recommended mechanism(s) for implementation of the Strategy are provided in Chapter 2.)

Statement of Planning Policy (SPP)

SPPs are 'higher order' planning instruments that are prepared and adopted by the Western Australian Planning Commission under the statutory procedures set out in Section 5AA *Town Planning and Development Act 1928.* SPPs are not defined as a planning scheme under the Act and compensation is not provided for. Local town planning schemes should have due regard to SPPs.

SPPs are generally directed towards facilitating co-ordinated planning - to balance competing land uses at all levels of planning. They provide a flexible mechanism and can be prepared to manage critical environments or resources in specific locations, possibly in conjunction with environmental protection policies. Under the Act SPPs can be varied or revoked.

Implementation of such an SPP formulated for protection of conservation and landscape values would rely, in part, on statutes contained in other legislation: *Land Administration Act, Conservation and Land Management Act 1984, Environmental Protection Act 1986* and *Soil and Land Conservation Act 1945.*

Environmental Protection Policy (EPP)

EPPs are established under the *Environmental Protection Act 1986* and have the force of law, binding all government agencies, industries and members of the public. They are designed to protect a specific portion of the environment or prevent, control or abate pollution.

Local area planning strategies

Local planning strategies may take a broad, long-term view about the future of an area and, therefore, help provide direction for town planning schemes, which tend to be more short term and specific. They can be incorporated into town planning schemes to add statutory force.

Zoning under the local town planning scheme

Under this mechanism, private ownership is retained. However, under the local town planning scheme new land use and development control provisions can be incorporated for areas where there is a need for greater controls to meet landscape and conservation objectives. The scheme would specify those uses that are permitted and those that are discretionary (use which the local government may permit subject to compliance with particular conditions). In this case, uses of the land that are lawful immediately prior to a new scheme coming into effect, but which do not conform to the amended scheme, may continue as non-conforming uses.

Special Control Area (SCA) provisions

These can be included in the local town planning scheme to identify areas which are significant and where special provisions in the scheme may need to apply. SCAs could be shown on the scheme map overlapping any existing zones and reserves where special provisions could apply. Such provisions could target specific measures and requirements relating to, for example, development control, the process for referring applications to relevant agencies and matters that need to be taken into account in determining development proposals.

Reservation under the local town planning scheme is generally concerned with ensuring open space and public recreation areas. Regarding land with regionally significant conservation and landscape values, reservation under a local government town planning scheme is likely if financial support for the acquisition of land is available from the State Government.

Conservation agreements and conservation (restrictive) covenants

Conservation agreements and conservation covenanting may suit people who are committed to protecting the conservation values of their land. They are voluntary agreements between the landowner and the relevant Government department or agency. As flexible 'tools', they can be designed to reflect the individual needs of the landowner and the conservation requirements of the land. For example, they may limit the clearing and use of native vegetation, and the subdivision and development of land with special values. Agreements can be made to maintain fences and the ecological condition of the land.

Conservation agreements may be made between a private landowner and a relevant State Government department or agency (e.g. CALM) under Section 16 of the *Conservation and Land Management Act, 1984.* Under a statutory management agreement, the management would be undertaken by the Government department or agency. Under a contract management agreement, management is agreed between the two parties and may be undertaken jointly or by either party. Such agreements can provide for the land to be used as a private conservation reserve, with or without public access – depending on the desired objectives of the parties.

Conservation agreements are more secure when supported by restrictive covenants registered on the title of the land. The intention is that the covenants will 'run' with the land; i.e. be binding on future landowners. Protection of remnant vegetation, in return for fencing assistance, is often provided in Agreements to Reserve made between DAWA and private landowners under the *Soil and Land Conservation Act, 1945.*

Not all land may qualify for conservation agreements and conservation covenants. Land qualifies for a covenant if it has conservation values that can be maintained in the long term and if its owners wish to protect the land. More information can be provided by contacting either Department of Agriculture Western Australia, Department of Conservation and Land Management or the National Trust.

The Federal Government has announced changes to the taxation law to allow income tax deductions to landowners who enter into perpetual conservation covenants for the protection of their land. The new conditions applying to the deduction will be consistent with the existing gift provisions in the tax law in relation to donations of land and other property. It is understood that deductions will only be available for covenants that are supported by State legislation accredited by the Commonwealth Minister for the Environment and Heritage. The deduction will be equal to the change in the market value of the land as a direct result of entering into the covenant, as determined by the Commissioner. The aim of the tax reform is to provide valuable conservation incentives to landowners to enter into conservation covenants.

Subdivision for Conservation

In limited circumstances, the subdivision process may provide an opportunity to achieve conservation objectives. This can assist the protection of environmental values, including remnant vegetation, and the implementation of catchment land management and rehabilitation through sensitive subdivision design, development and land management conditions, subject to the individual circumstances and merits of the proposal.

Land exchange

Existing Crown land with lower conservation and landscape values can be exchanged for privately owned land with higher conservation and landscape values.

Acquiring land by purchase for inclusion into the Crown Estate

The State can acquire private land for re-inclusion in the Crown estate. Normally, this is done through negotiation with landowners. Acquisition of land for inclusion into a national park, requires a suitable fund or Government commitment to allocate funds via particular agencies such as CALM. Further investigation is recommended for alternate sources of funding for this purpose.

Revolving fund

The subject land would temporarily pass back to State ownership (i.e. a Government department or agency) before being re-sold to a private purchaser. The Government department or agency would place a covenant on the title to the land before selling it – the purchaser buys the land knowing it has permanent conservation protection. This mechanism has been used successfully in Victoria.

Subject to WAPC approval, the portion of a lot containing conservation or landscape values may be created as a separate lot with covenants attached and subsequently re-sold.

Rate rebates (reduced local government rates)

Rate rebates are usually granted in exchange for a management agreement that binds the landowner to undertake specific active management such as weed and pest control or to cease activities such as grazing in certain parts of the property. Criteria can be set as environmental targets for landowners in exchange for rate rebates; for example, in Mitchell Shire, Victoria, for properties over 4ha the 'targets' relate to weeds, feral animals, salinity, erosion and loss of native flora and fauna. Rate rebates can be used in conjunction with conservation covenants, which overcomes the disadvantage of rate rebates which is being that they do not run with the title of the land. Some local government authorities offer rate rebates on land rezoned to 'Conservation' zone. For example, Logan City Council in Queensland offers a general discount of between 25 – 50% on land rezoned to 'Conservation' and the Shire of Serpentine-Jarrahdale, WA, offers a 50% reduction in rates for land rezoned to 'Conservation', where a management plan is prepared for each property included in the process.

Contact the Shire of Busselton for information on the *'Biodiversity Incentive Strategy for Private Land in the Shire of Busselton'*.

Other Funding assistance

- CALM's Land for Wildlife scheme
- Natural Heritage Trust (NHT) provides funds for the implementation of the national environmental protection and natural resource management strategies, which include:
  - grants for the National Landcare Program
  - National Strategy for Environmentally Sustainable Development
  - COAG's Water Reform Framework
  - National Strategy for the Conservation of Australia's Biological Diversity
  - National Water Quality Management Strategy
  - National Reserves System
  - Coastcare (funded by NHT but delivered separately)
  - National Weeds Strategy
  - National Feral Animals Strategy
  - Endangered Species Program
  - Farm Forestry Program
- Funding through consultation with GeoCatch
- Save the Bush grants
- Gordon Reid Foundation grants for conservation purposes
- Fencing grants
- Taxation concessions for Landcare works

Other voluntary arrangements

- Donation of land with leaseback
- Financial donations, fund raising appeals
- Voluntary group purchase
- Community management
- Contributions to or partnerships with organisations listed in the Commonwealth Government's Register of Environmental Organisations, such as Wetland Care Australia which is a community-based not-for-profit organisation that aims to establish partnerships with people to restore, conserve and manage habitat to perpetuate native waterbirds and other wetland species in Australia and promote and conduct research, education and publication concerning wetland-related issues.

Appendix 9 Summary of Management Options in McAlpine, Spice and Humphries *The Environmental Condition of the Vasse Wonnerup Wetland System* and a *Discussion of Management Options*, EPA, Perth WA 1989

This report presents two groups of management options. It should be noted that at the time this report was prepared (1989) the options raised were considered relevant. As events have transpired, some options are now historic and no longer relevant.

Group 1: those management options which will require repeating periodically to ensure an ongoing improvement in environmental quality

- **Bar Management:** the report considered that leaving the bar to open and close naturally would cause water quality in the Wonnerup Inlet to continue to deteriorate each year resulting in almost annual fish deaths. It recommended the appropriate option is to open the bar in summer as conditions require.
- **Dredging:** the report considered two options: to dredge the Wonnerup Inlet to reduce the nutrient and organic store in the sediments; and to dredge a channel from the floodgates to the lagoon. Both approaches were considered likely to have a deleterious short term impact on bottom fauna (benthos).
- **Artificial Aeration:** to oxygenate water in the channels - further study would be required to determine the effects on sediment resuspension and algal growth.
- **Increase Water Volume in the Lagoon:** this option involves maintaining more water at greater depth over summer by sinking a bore into the deep Yarragadee formation and pumping groundwater into the lagoon over summer. It was considered expensive with a likelihood of a poor result because nutrients and organic matter would accumulate with the risk of saline stratification and deoxygenation.

Group 2: those management options which when instigated offer an ongoing improvement in environmental quality.

- **Floodgates:** the report considered three approaches to floodgate design and management: replace the existing structure but, with the facility to allow some marine water back into the lagoon over summer; open the Vasse-Wonnerup system to tidal influence; or increase the height of the gauge boards. (At the time the report was prepared it indicated that the first two approaches would require further evaluation. The third option was not recommended). There is now a Water Corporation (WC) commitment to replace the floodgates with a facility to allow controlled entry of some seawater.
- **Catchment Management:** at the time report was prepared it recommended an integrated catchment management plan (ICM) be prepared. (The ICM, the *Geographe Bay Catchment Management Plan* was released in 2000.)
- **Levee Banks:** this option was raised in conjunction with the option to remove the floodgates. The report indicated that levee banks would be likely to greatly damage the surrounding area and aesthetics and be detrimental to waterbirds. The report considered this an expensive option and recommended that it only be evaluated further if other options were considered inappropriate. (Given the WC commitment to replace and upgrade the floodgates this option is no longer relevant.)

- **River Re-diversion:** the report did not support the re-diversion of the Vasse and Sabina watercourses back into the Vasse lagoon as this re-diversion of the Vasse River through Busselton would cause large scale flooding and re-diversion of both rivers would bring additional nutrients into the Vasse lagoon and exacerbate its eutrophic condition.
- **Control of Land Use Fringing the Lagoons:** the report considered that this approach requires careful consideration and, given the national and international importance of the wetlands, it is imperative to develop a conservation management plan for the protection of the flora and fauna of the system. The plan would include land use control in areas fringing the lagoons and may involve exchange or voluntary agreements with landowners to manage specific areas for conservation.
- **Barrage Across the Lagoons:** the report suggested the option of constructing a barrage across the lagoon, at a height of 0.75 metres AHD and at a location upstream of the deeper area of lagoon water. However, the report considered that there would be difficulties in finding a suitable site. It could also prove to be an expensive option.

Note: for further recent discussion of the above options, see pages 29-31 of Lane, Hardcastle, Tregonning and Holtfreter (1997) *Management of the Vasse-Wonnerup Wetland System in Relation to Sudden, Mass Fish Deaths.*

Appendix 10 Glossary of Terms

Algae – mainly microscopic plants (phytoplankton) that contain chlorophyll and other photosynthetic pigments, and have a relatively simple body construction ranging from a single cell to a multicellular form, some can be large, and include large seaweeds (macroalgae).

Algal bloom – is a proliferation of algae (phytoplankton bloom) usually stimulated by the input of nutrients.

Amenity – those factors which combine to form the present character, and likely future character, of an area.

Aquatic – of a watery environment or a species that lives primarily in water.

Biological diversity (biodiversity) – variability within and between species and ecological complexes of which they are part, and of ecosystems.

Biogeography – the study of the geographic distribution of plants and animals.

Buffer – the area (or 'physical buffer') required to maintain wetland function, usually defined by biophysical criteria.

Catchment – the area of land from which water drains to form creeks, rivers, lakes, wetlands, reservoirs and aquifers.

Coastal foreshore reserve – the area of land on the coast set aside in public ownership to allow for coastal processes and provide protection of ecological values, landscape, visual amenity, indigenous and cultural heritage, and public access, recreation and safety.

Conservation – the protection, management, sustainable use and enhancement of the natural environment.

Conservation Covenant – a voluntary agreement between the present landowner (also subsequent landowners) and a public authority to protect and preserve native vegetation, wetlands or other special flora or fauna of the area. In WA the public authority is usually either the Commissioner of Soil and Land Conservation, the Department of Conservation and Land Management or the National Trust.

Cultural heritage – the value that a place has in terms of its aesthetic, historic, scientific or social significance for the present community and for future generations.

Development – any change to land use, including housing, any demolition, erection, construction, alteration of or addition to any building or structure on the land and any excavation or other works and, the case of a place to which a Conservation Order made under Section 59 of the *Heritage of Western Australia Act, 1990* applies, also includes any act or thing that:

a) is likely to change the character of that place or the external appearance of any building; or

b) would constitute an irreversible alteration of the fabric of any building.

Ecologically sustainable development (ESD) – development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends (for the ESD core objectives and guiding principles, see Council of Australian Governments (1992) *National Strategy for Ecologically Sustainable Development' AGPS, Canberra)*; SOE Advisory Council, *Australia: State of the Environment 1996* Department of the Environment, Sport and Territories, Canberra, 1996)

Ecology – study of the relationships of animals and plants, particularly of animal and plant communities, to their surroundings, living and non-living.

Ecosystem – a term used to describe a specific environment, e.g. estuary, to include all the biological, chemical and physical resources and the inter-relationships and dependencies that occur between those resources.

Ecotourism – identified in *National Ecotourism Strategy 1994* as nature-based tourism that involves education and interpretation of the natural environment and is managed to be ecologically sustainable. The *South-West Regional Tourism Strategy* identifies five principles: tourism activity must be sustainable, educative, conservation-supporting, locally beneficial and generate tourist satisfaction.

Environmental Protection Policy – protects a defined portion of the environment through controls on actions. An EPP has legislative power under the *Environmental Protection Act 1986.*

Estuary – the semi-enclosed tidal part of a river where salt water meets fresh water.

Eutrophication – the process of nutrient enrichment which leads to enhanced growth of aquatic plants, with attendant undesirable effects (e.g. algal blooms).

Flood fringe – the area of the floodplain, outside the floodway, which is affected by flooding, generally covered by still or very slow moving waters during the 1:100 year flood.

Floodplain – the portion of a river valley next to the river channel that is or has been periodically covered with water during flooding. This includes the floodway and flood fringe.

Flood – 1:100 year – a severe flood event that has a 1% chance of occurring in any given year i.e. on average, a probability of occurring once in 100 years. The 1:100 year flood level is generally defined as a line through the floodplain to which this flood will rise.

Floodway – the river channel and portion of the floodplain which forms the main flow of floodwaters once the main channel has overflowed.

Foreshore – area of land adjacent to a waterbody.

Integrated Catchment Management – the planning and management of our natural resources on a river, groundwater, or catchment basis with the aim of achieving sustainable use of those resources so that social and economic development do not affect the long-term future of the resources.

Intensive Agriculture – commercial horticultural use of rural land and associated buildings, includes market gardens, orchards and viticulture.

Interpretation – a means of communicating ideas and feelings which enrich people's understanding and appreciation of their world and their role within it. The Department of Conservation and Land Management defines interpretation as the craft of enriching visitor experience – it is an interactive process involving the visitor, medium and the resources which creates memorable and personal experiences which motivate people to greater understanding and care of the environment being interpreted, as well as an appreciation of the effort required to protect and sustain the environment.

Lacustrine – of or relating to lakes.

Land capability – the ability of the land to accept a type and intensity of use permanently, or for specified periods under specific management, without permanent damage. Based on an assessment of available biophysical land resources information. (Note: the land may be capable of sustaining various uses but some uses may be more suitable than others for reasons other than land management.)

Landscape values – natural and/or cultural landscape features that are highly valued, as defined by documented research.

Land suitability – the potential use of the land based upon multi-disciplinary evaluation of physical, technical, social and economic factors.

Low-impact development – means the use and development of land in such manner that does not detract from the rural and natural amenity of the area. Development should be sustainable, sensitively located and designed to minimise visual impact with screening vegetation or land form; and be sensitively located to have minimal and acceptable impacts on vegetation, wildlife, wetlands, soils and existing land uses. Development should have minimal and acceptable off-site impacts.

Low-impact ecotourism – is development of a predominantly tourist nature which meets the criteria of 'low-impact development'.

Low-impact recreational facilities – are facilities of a predominantly recreational or ancillary nature, excluding commercial accommodation, which meet the criteria of 'low-impact development', such as parking areas, public toilets, walk trails and board walks.

Natural properties of the ecosystem – those physical, biological or chemical components such as soil, water, plants, animals and nutrients, and the interactions between them' (Ramsar Convention, Article 3).

Remnant vegetation – stands of native vegetation indigenous to a locality.

Reserves – may be either (i) land classified in town planning schemes for public purposes (WAPC, 1996); or (ii) areas of Crown land reserved for public purposes as determined by the *Land Act, 1933* and the *Land Administration Act, 1997.*

Riparian zone – the area along or surrounding a water body where the vegetation and natural ecosystems benefit from and are influenced by the passage and storage of water.

Rural-residential – land use for residential purposes in a rural setting which provides for alternative residential lifestyle and which seeks to preserve the amenity of such areas and to control land use impacts.

Salinity – the degree of concentration of salt solutions as an abiotic measure of water quality in wetlands.

Setback – the area outside the wetland and 'buffer' that is required to adequately protect the wetland from potential impacts of adjacent land uses, in order to maintain the function of the wetland and its buffer. It is largely determined by the type of land use and management measures proposed ('management option').

Sustainability – meeting the needs of current and future generations through and integration of environmental protection, social advancement and economic prosperity (source: *Western Australian State Sustainability Strategy, 2003*).

Sustainable utilisation – under the Ramsar Convention, Article 3 it is defined as 'human use of a wetland so that it may yield the greatest continuous benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations'.

Visual Management System – developed in the US in the 1970s and since adopted in Victoria and WA (CALM), the system combines a visual quality classification of the landscape with an assessment of the extent to which the landscape is viewed from various vantage points such as travel routes and walk trails. The combination of scenic quality and 'sensitivity' to viewing produces Visual Management Zones, attached to which are Visual Management Objectives, which assist land use planning, and management.

Wetlands – for consistency with the Ramsar Convention and the *Wetlands Conservation Policy for Western Australia* wetlands are defined as: *areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres.*

Appendix 11 - List of Acronyms

BWCS	Busselton Wetlands Conservation Strategy
CALM	Department of Conservation and Land Management
DAWA	Department of Agriculture Western Australia
DEP	Department of Environmental Protection
DIA	Department of Indigenous Affairs
DoE	Department of Environment
DPI	Department for Planning and Infrastructure
DRF	Declared Rare Flora
EPA	Environmental Protection Authority
EPP	Environmental Protection Policy
ESD	Ecologically Sustainable Development
GeoCatch	Geographe Catchment Council
ICM	Integrated Catchment Management
LCDC	Land Conservation District Committee
LG	Local Government
LT	Long term
MfP	Ministry for Planning
MT	Medium term
NWQMS	National Water Quality Management Strategy
SCA	Special Control Area
SPP	Statement of Planning Policy
ST	Short term
SWQMS	State Water Quality Management Strategy
WAPC	Western Australian Planning Commission
WATC	Western Australian Tourism Commission
WC	Water Corporation

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Figures

Legend

- urban and future urban
- subject to further investigation for its urban development potential
- tourist
- rural residential
- conservation lots
- other reserves (conservation and recreation)
- agriculture
- waterway - unallocated crown land
- national park
- state forest
- rural and wetland amenity area
- public purposes
- heritage site
- New River and The Broadwater wetlands
- wetland amenity line
- local government boundary
- study area boundary

N

0 500 1000 1500

metres

Produced by Project Mapping Section, Mapping and GeoSpatial Data Branch, Department for Planning and Infrastructure, on behalf of the Western Australian Planning Commission, Perth, WA May 2005

map7\projects\strat_plan\environ\country\ busswet\ fpub05\buw_final_fig1.dgn

Cadastral data (May 2005), topographic data and local government boundary supplied by Department of Land Information, W.A.

GDA

Ocean

Indian

Geographe Bay

Busselton Jetty

SHIRE OF CAPEL

SHIRE OF BUSSELTON

Ludlow

Estuary

The Deadwater

Wonnerup Floodgates

Wonnerup Inlet

Vasse Floodgates

Wonnerup

Vasse

New River

The Broadwater

Abba

Sabina

Buayanyup

Drain

Diversion Drain

Green Gully

River

LUDLOW ROAD NORTH

DRIVE

TUART HIGHWAY

LUDLOW HITHERGREEN

RUABON ROAD

BUSSELL HIGHWAY

CAUSEWAY

FORD RD

LAYMAN ROAD

GEOGRAPHE BAY ROAD

QUEEN ST

CAVES ROAD

HWY

PRIES ROAD

FAIRWAY DR

AVE

CHAPMAN

VASSE

BYPASS

KOOKABURRA WAY

BUSSELTON

ELIZABETH

QUEEN

ROAD

HILL

HIGHWAY

SUES ROAD

SOUTH WONNERUP ROAD

PRINCEFIELD ROAD

BUSSELL ROAD

BOALLIA ROAD

RENDEZVOUS

Index to study area
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Mandurah
Bunbury
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Augusta
Albany
Denmark
PERTH
WHEATBELT
PEEL
SOUTH-WEST
GREAT SOUTHERN
Legend
Vasse-Wonnerup Ramsar Site
area nominated in February 1990
area: 750 ha
extension nominated in 2000
area: 365 ha
5m contour
local government boundary
locality boundary
study area boundary
N
0 500 1000 1500
metres
Produced by Project Mapping Section, Mapping and GeoSpatial Data Branch, Department for Planning and Infrastructure, on behalf of the Western Australian Planning Commission, Perth, WA May 2005
map7\projects\strat_plan\environ\country\busswet\ fpub05\buw_final_fig2.dgn
Cadastral data (May 2005), topographic data and local government boundary supplied by Department of Land Information, W.A.
Ramsar Site data supplied by Department of Conservation and Land Management, W.A.
GDA
Indian
Ocean
Geographe Bay
Busselton Jetty
Wonnerup Floodgates
Vasse Floodgates
Wonnerup Inlet
The Deadwater
SHIRE OF CAPEL
SHIRE OF BUSSELTON
FORREST BEACH
LUDLOW
WONNERUP
GEOGRAPHE
BUSSELTON
WEST BUSSELTON
REINSCOURT
SIESTA PARK
ABBEY
BROADWATER
KEALY
VASSE
BOVELL
YALYALUP
RUABON
ABBA RIVER
AMBERGATE
The Broadwater
New River
Vasse River
Vasse Estuary
Wonnerup Estuary
Ludlow River
Malbup Creek
Abba River
Sabina River
Vasse Diversion Drain
Buayanyup Drain
Green Gully Drain

Index to study area
Perth
Mandurah
Bunbury
Busselton
Augusta
Albany
Denmark
PEEL
WHEATBELT
SOUTH WEST
GREAT SOUTHERN
Legend
local government boundary
suburb boundary
study area boundary
N
0 1 2
kilometres
Produced by Project Mapping Section, Mapping and GeoSpatial Data Branch, Department for Planning and Infrastructure, on behalf of the Western Australian Planning Commission, Perth, WA May 2005
map7\projects\strat_plan\environ\country\ busswet\ fpub05\buw_final_fig3.dgn
1:25000 Dec.2003 Aerial Imagery supplied by Department of Land Information, W.A. and has a positional accuracy of + or - 10m
GDA
INDIAN
OCEAN
Geographe Bay
Busselton Jetty
SHIRE OF CAPEL
SHIRE OF BUSSELTON
FORREST BEACH
LUDLOW
WONNERUP
GEOGRAPHE
REINSCOURT
BUSSELTON
WEST BUSSELTON
BROADWATER
ABBEY
KEALY
SIESTA PARK
VASSE
AMBERGATE
BOVELL
YALYALUP
RUABON
ABBA RIVER
Busselton Regional Airport
The Broadwater
Vasse Estuary
Wonnerup Estuary
Ludlow River
New River
Vasse River
Diversion Drain
Abba River
Sabina River
Buayanyup Drain
Green Gully Drain

Produced by Project Mapping Section, Mapping and GeoSpatial Data Branch, Department for Planning and Infrastructure, on behalf of the Western Australian Planning Commission, Perth, WA May 2005

map7\projects\strat_plan\environ\country\busswet\ fpub05\buw_final_fig4.dgn

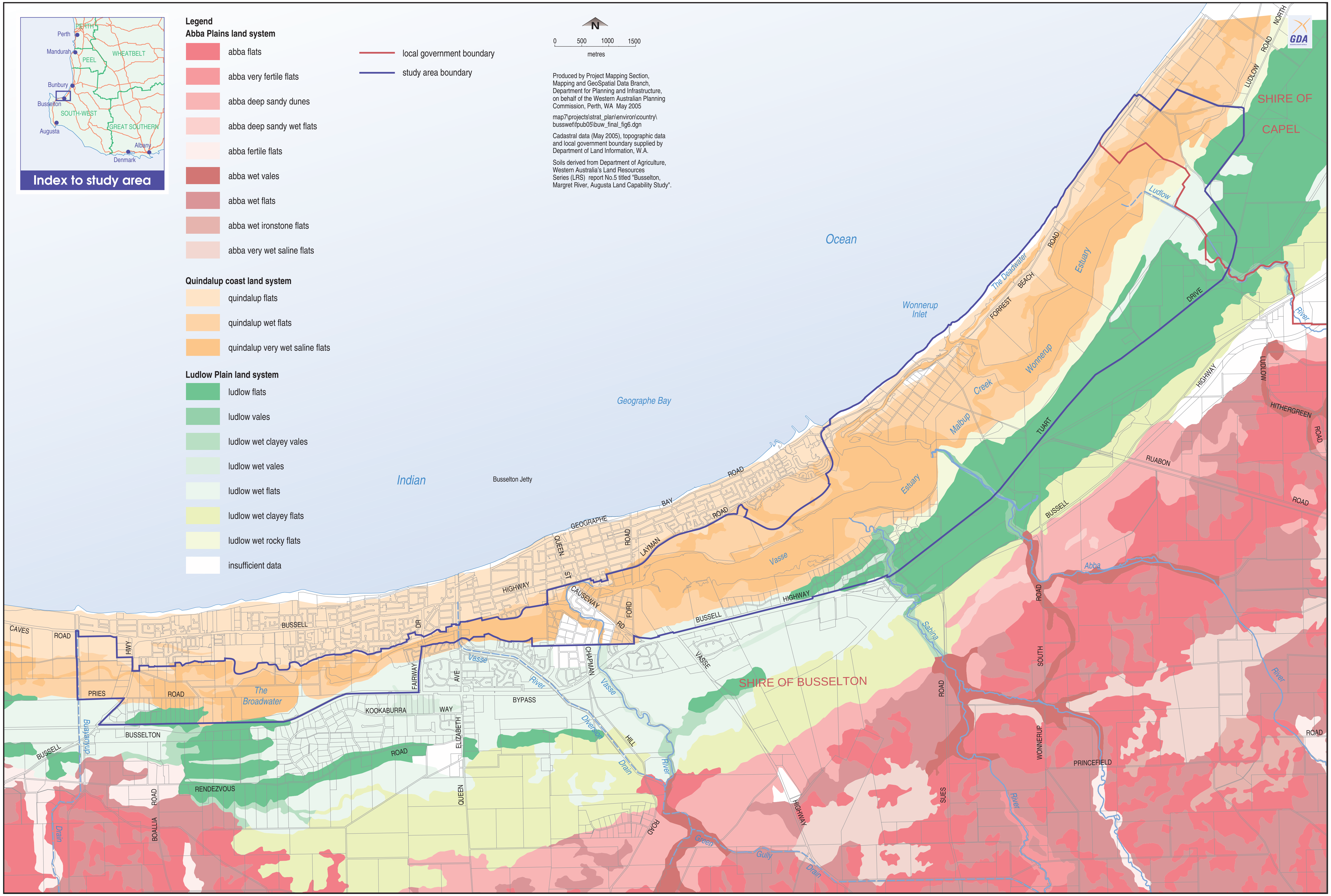
Topographic data and local government boundary supplied by Department of Land Information, Perth, WA

Feb. 2000 Landsat TM Imagery supplied by Remote Sensing Services, Department of Land Administration, Floreat, W.A.

Catchment boundary data supplied by Agriculture, W.A.

Figure 4 Landsat TM Image


Index to study area
Perth
Mandurah
Bunbury
Busselton
Augusta
Albany
Denmark
PERTH
PEEL
WHEATBELT
SOUTH-WEST
GREAT SOUTHERN
Legend
precinct area boundary
local government boundary
N
0 500 1000 1500
metres
Produced by Project Mapping Section, Mapping and GeoSpatial Data Branch, Department for Planning and Infrastructure, on behalf of the Western Australian Planning Commission, Perth, WA May 2005
map7\projects\strat_plan\environ\country\busswet\ fpub05\buw_final_fig5.dgn
Cadastral data (May 2005), topographic data and local government boundary supplied by Department of Land Information, W.A.
GDA
Wonnerup Estuary Precinct
Coastal Precinct
Vasse Estuary Precinct
Town Precinct
New River Precinct
Broadwater Precinct
Indian
Ocean
Geographe Bay
Busselton Jetty
Wonnerup Floodgates
Wonnerup Inlet
Vasse Floodgates
The Deadwater
Wonnerup Estuary
Vasse Estuary
The Broadwater
New River
Ludlow River
Abba River
Sabina River
Vasse River
Vasse Diversion Drain
Green Gully
Buayanyup Drain
Malbup Creek
SHIRE OF CAPEL
SHIRE OF BUSSELTON
CAVES ROAD
BUSSELL HIGHWAY
GEOGRAPHE BAY ROAD
LAYMAN ROAD
QUEEN ST
CAUSEWAY RD
FORD ROAD
CHAPMAN HILL ROAD
VASSE HIGHWAY
TUART DRIVE
RUABON ROAD
LUDLOW HITHERGREEN ROAD
LUDLOW NORTH ROAD
SUES ROAD
SOUTH WONNERUP ROAD
PRINCEFIELD ROAD
PRIES ROAD
BUSSELTON BYPASS
KOOKABURRA WAY
FAIRWAY DR
ELIZABETH AVE
RENDEZVOUS ROAD
BOALLIA ROAD
QUEEN


Index to study area
Perth
Mandurah
Bunbury
Busselton
Augusta
Albany
Denmark
PERTH
PEEL
WHEATBELT
SOUTH-WEST
GREAT SOUTHERN
Legend
Abba Plains land system
abba flats
abba very fertile flats
abba deep sandy dunes
abba deep sandy wet flats
abba fertile flats
abba wet vales
abba wet flats
abba wet ironstone flats
abba very wet saline flats
Quindalup coast land system
quindalup flats
quindalup wet flats
quindalup very wet saline flats
Ludlow Plain land system
ludlow flats
ludlow vales
ludlow wet clayey vales
ludlow wet vales
ludlow wet flats
ludlow wet clayey flats
ludlow wet rocky flats
insufficient data
local government boundary
study area boundary
N
0 500 1000 1500
metres
Produced by Project Mapping Section, Mapping and GeoSpatial Data Branch, Department for Planning and Infrastructure, on behalf of the Western Australian Planning Commission, Perth, WA May 2005
map7\projects\strat_plan\environ\country\busswet\fpub05\buw_final_fig6.dgn
Cadastral data (May 2005), topographic data and local government boundary supplied by Department of Land Information, W.A.
Soils derived from Department of Agriculture, Western Australia's Land Resources Series (LRS) report No.5 titled "Busselton, Margret River, Augusta Land Capability Study".
GDA
Indian
Ocean
Geographe Bay
Busselton Jetty
Wonnerup Inlet
SHIRE OF CAPEL
SHIRE OF BUSSELTON
The Broadwater
The Deadwater
Vasse Estuary
Wonnerup Estuary
Ludlow
Malbup Creek
Wonnerup
Sabina
Abba
Vasse River
Vasse Diversion Drain
Buayanyup Drain
Abba River
Sabina River
Ludlow River
Green Gully Drain
CAVES ROAD
BUSSELL HIGHWAY
GEOGRAPHE BAY ROAD
QUEEN ST
CAUSEWAY
LAYMAN ROAD
FORD RD
CHAPMAN HILL ROAD
VASSE HIGHWAY
BUSSELTON BYPASS
KOOKABURRA WAY
FAIRWAY DR
ELIZABETH AVE
QUEEN
RENDEZVOUS ROAD
BOALLIA ROAD
PRIES ROAD
HWY
BUSSELL
FORREST BEACH ROAD
TUART DRIVE
LUDLOW HITHERGREEN ROAD
RUABON ROAD
SOUTH WONNERUP ROAD
SUES ROAD
PRINCEFIELD ROAD
LUDLOW NORTH ROAD

N

0 2 4 6 8

kilometres

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map7\projects\strat_plan\environ\country\ busswet\ fpub05\buw_final_fig8.dgn

Topographic data and local government boundary supplied by Department of Land Information, Perth, WA

Vegetation classification from Feb. 2000 Landsat TM Imagery. Supplied by Remote Sensing Services, Department of Land Information, Floreat, W.A.

Catchment boundary data supplied by Agriculture, W.A.

Index to study area

Legend

landsat detail

- sparse vegetation
- medium vegetation
- dense vegetation
- water body

- Geographe Bay catchment boundary
- local government boundary
- study area boundary of Busselton wetlands conservation strategy

Legend

- public purposes
- recreation
- residential
- Vasse development zone
- deferred Vasse development zone
- business
- restricted business
- tourist
- special purposes
- industrial
- agriculture (rural in Shire of Capel)
- conservation
- rural residential

- landscape value area
- floodway area
- wetland area
- local government boundary
- study area boundary

tps zones detail is a simplification of Shire of Busselton District Town Planning Scheme no 20

N

0 1 2

kilometres

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map7\strat_plan\environ\country\busswet\busswet\ fpub05\buw_final_fig9.dgn

Cadastral data (May 2005), topographic data and local government boundary supplied by Department of Land Information, W.A.

Ramsar Site data supplied by Department of Conservation and Land Management, W.A.

Approved structure plans and development plans within or near the study area, as at May 2005

- Broadwater Structure Plan
- Old Broadwater Farm Structure Plan
- New River Structure Plan
- Country Road Structure Plan
- East Busselton Sandilands Structure Plan
- Vasse Estuary Structure Plan
- Busselton Airport Structure Plan
- Vasse Newtown Development Guide Plan
- Port Geographe Development Plan
- Kalgaritch Estate Subdivision Guide Plan
- Pt Lot 2 Fairway Drive Development Guide Plan

GDA

Ocean

Indian

Geographe Bay

Wonnerup Inlet

Wonnerup Townsite Boundary

Port Geographe Development Area

Busselton Jetty

SHIRE OF CAPEL

SHIRE OF BUSSELTON

Busselton Regional Airport

The Broadwater

The Deadwater

Estuary

Wonnerup

Creek

Malbup

Vasse

Ludlow

River

Abba

Sabina

Drain

Diversion

Green Gully

LUDLOW NORTH ROAD

FORREST BEACH ROAD

DRIVE

HIGHWAY

TUART

RUABON ROAD

BUSSELL HIGHWAY

GEOGRAPHE BAY ROAD

QUEEN ST

LAYMAN ROAD

CAUSEWAY

FORD RD

CHAPMAN HILL ROAD

VASSE BYPASS

CAVES ROAD

PRIES ROAD

KOOKABURRA WAY

FAIRWAY DR

ELIZABETH AVE

QUEEN

BUSSELTON BYPASS

BUSSELL HIGHWAY

RENDEZVOUS ROAD

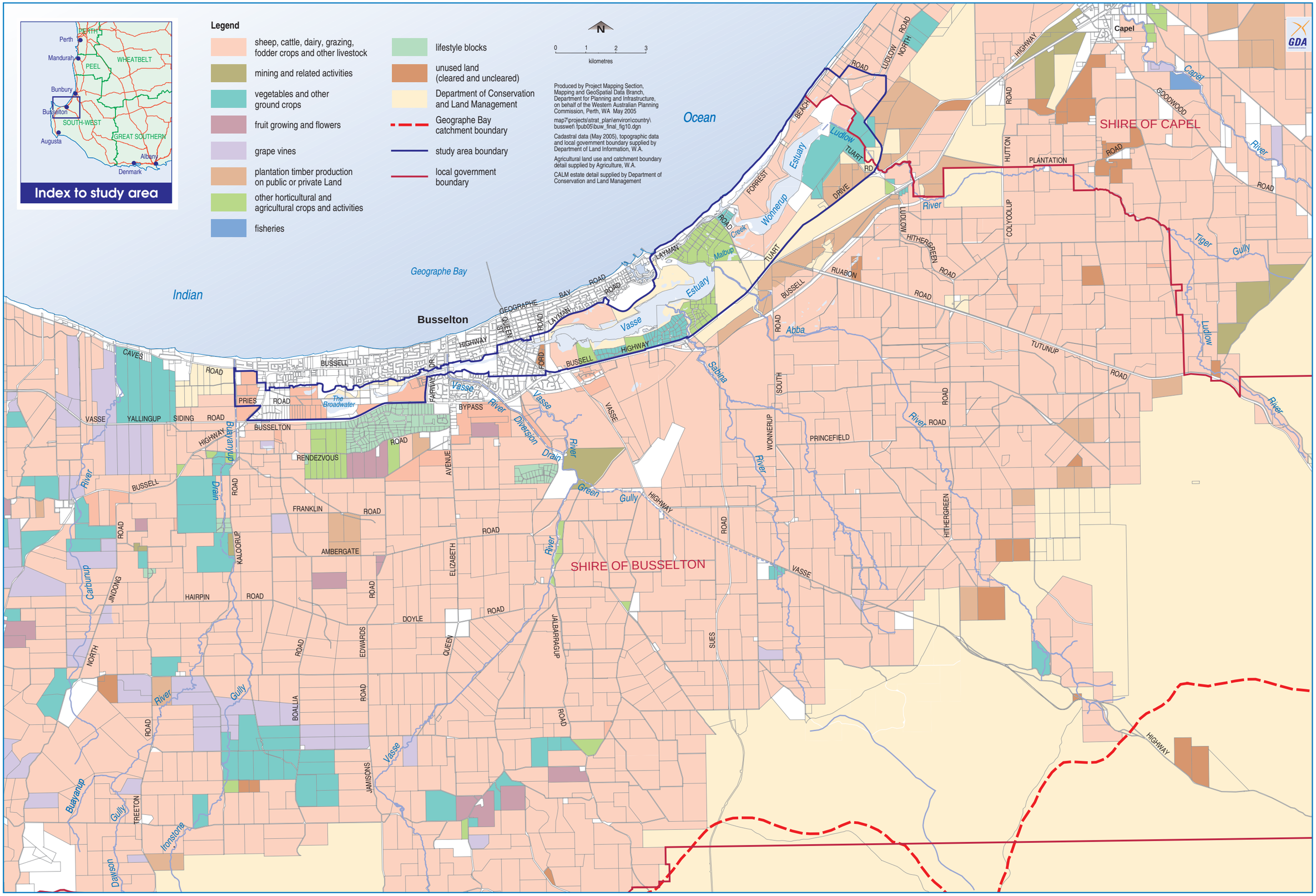
BOALLIA ROAD

SUES ROAD

SOUTH WONNERUP ROAD

PRINCEFIELD ROAD

LUDLOW HITHERGREEN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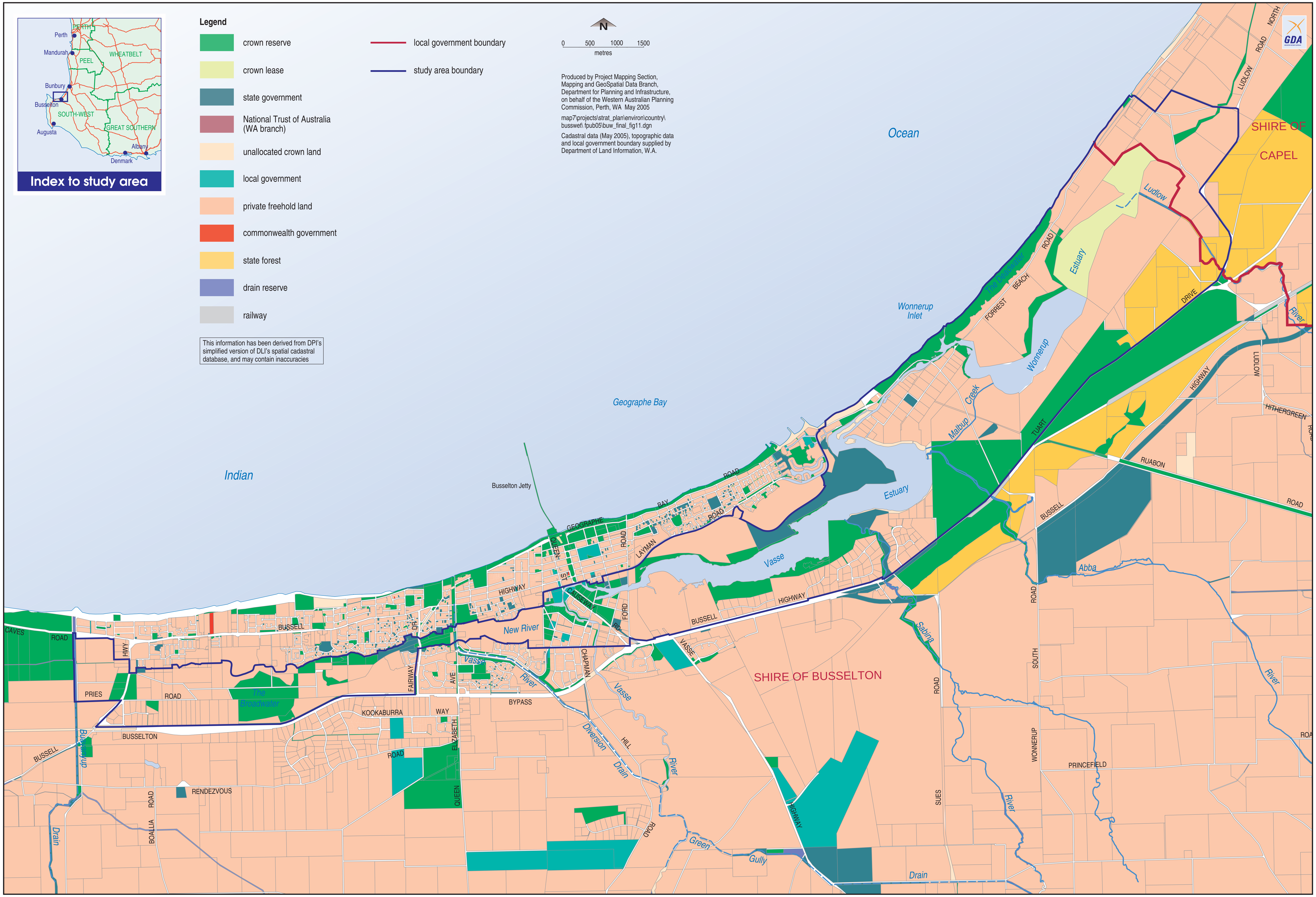
PERTH
WHEATBELT
PEEL
SOUTH-WEST
GREAT SOUTHERN
Legend
sheep, cattle, dairy, grazing, fodder crops and other livestock
mining and related activities
vegetables and other ground crops
fruit growing and flowers
grape vines
plantation timber production on public or private Land
other horticultural and agricultural crops and activities
fisheries
lifestyle blocks
unused land (cleared and uncleared)
Department of Conservation and Land Management
Geographe Bay catchment boundary
study area boundary
local government boundary
N
0 1 2 3
kilometres
Produced by Project Mapping Section, Mapping and GeoSpatial Data Branch, Department for Planning and Infrastructure, on behalf of the Western Australian Planning Commission, Perth, WA May 2005
map7\projects\strat_plan\environ\country\ busswet\ fpub05\buw_final_fig10.dgn
Cadastral data (May 2005), topographic data and local government boundary supplied by Department of Land Information, W.A.
Agricultural land use and catchment boundary detail supplied by Agriculture, W.A.
CALM estate detail supplied by Department of Conservation and Land Management
Ocean
Indian
Geographe Bay
Busselton
Capel
SHIRE OF CAPEL
SHIRE OF BUSSELTON
GDA
Vasse
Estuary
Wonnerup
Malbup
Ludlow
Tuart
Forrest
Beach
Drive
Road
Creek
Layman
Bay
Geographe
Channel
Peel
Ford
Bussell
Highway
Caves
Pries
Fairway
Dr
The Broadwater
Bypass
Vasse River
Diversion Drain
Vasse
Yallingup
Siding
Busselton
Bayanup
Rendezvous
Avenue
Franklin
Ambergate
Kaloorup
Carbunup
Jindong
Hairpin
North
Gully
Boallia
Edwards
Doyle
Queen
Elizabeth
Jalbarragup
Jamisons
Treeton
Ironstone
Dawson
Green
Gully
Sues
Abba
Sabina
Ruabon
Tutunup
Princefield
Wonnerup
South
Hithergreen
Ludlow
Colyoolup
Hutton
Plantation
Goodwood
Canal
Tiger
Gully
River
Highway



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Albany
Denmark
PERTH
PEEL
WHEATBELT
SOUTH-WEST
GREAT SOUTHERN
Legend
crown reserve
crown lease
state government
National Trust of Australia (WA branch)
unallocated crown land
local government
private freehold land
commonwealth government
state forest
drain reserve
railway
local government boundary
study area boundary
This information has been derived from DPI's simplified version of DLI's spatial cadastral database, and may contain inaccuracies
N
0 500 1000 1500
metres
Produced by Project Mapping Section, Mapping and GeoSpatial Data Branch, Department for Planning and Infrastructure, on behalf of the Western Australian Planning Commission, Perth, WA May 2005
map7\projects\strat_plan\environ\country\bussw\fpub05\buw_final_fig11.dgn
Cadastral data (May 2005), topographic data and local government boundary supplied by Department of Land Information, W.A.
GDA
Indian
Ocean
Geographe Bay
Busselton Jetty
Wonnerup Inlet
SHIRE OF CAPEL
SHIRE OF BUSSELTON
Vasse
Estuary
Wonnerup
Estuary
Ludlow
New River
The Broadwater
Abba
River
Sabina
Diversion Drain
Green Gully
Drain
GEOGRAPHE BAY ROAD
LAYMAN ROAD
BUSSELL HIGHWAY
CAVES ROAD
PRIES ROAD
BUSSELTON BYPASS
KOOKABURRA WAY
RENDEZVOUS ROAD
QUEEN ST
CAUSEWAY
CHAPMAN HILL ROAD
VASSE HIGHWAY
TUART DRIVE
FORREST BEACH ROAD
RUABON ROAD
HITHERGREEN ROAD
LUDLOW NORTH ROAD
PRINCEFIELD
WONNERUP SOUTH ROAD
SUES HIGHWAY

Legend

- 100 year flood level area
- designated 100 year flood level with inflow from Vasse River diversion
- floodway (DoE limit of development)
- 100 year flood level
- local government boundary
- locality boundary
- study area boundary

N

0 500 1000 1500 2000

metres

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map7\projects\strat_plan\environ\country\busswet\ fpub05\buw_final_fig12.dgn

Cadastral data (May 2005), topographic data and local government boundary supplied by Department of Land Information, W.A.

Flood management data supplied by Department of Environment, W.A.

GDA

Ocean
Indian
Geographe Bay
Busselton Jetty
FORREST BEACH
NORTH LUDLOW ROAD
SHIRE OF CAPEL
LUDLOW
Ludlow River
Wonnerup Floodgates
The Deadwater
FORREST BEACH ROAD
Estuary
WONNERUP
Wonnerup Inlet
Vasse Floodgates
Wonnerup Estuary
DRIVE
HIGHWAY
LUDLOW
HITHERGREEN ROAD
Creek
Makeup
TUART
RUABON ROAD
GEOGRAPHE BAY ROAD
GEOGRAPHE
BUSSELL HIGHWAY
Vasse Estuary
REINSCOURT
Abba River
RUABON
QUEEN ST
BUSSELL HIGHWAY
BUSSELL
CAVES ROAD
SIESTA PARK
ABBEY
BROADWATER
WEST BUSSELTON
New River
FAIRWAY DR
CHAPMAN ROAD
CAVES ROAD
PRIES ROAD
KEALY
The Broadwater
KOOKABURRA WAY
ELIZABETH AVE
Vasse River
BYPASS
BUSSELL HWY
BUSSELTON
BUSSELL
Buayanyup Drain
RENDEZVOUS
BOALLIA ROAD
VASSE
QUEEN ROAD
AMBERGATE
Diversion Drain
HILL ROAD
BOVELL
SHIRE OF BUSSELTON
VASSE HIGHWAY
YALYALUP
SUES ROAD
Green Gully Drain
Sabina River
SOUTH WONNERUP ROAD
ABBA RIVER
PRINCEFIELD ROAD