

Natural Resource Management  
**Strategy**

Cradle  
Coast

**2015  
–2020**





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## Foreword

In a changing world characterised by population growth, rising demand for agricultural commodities, and increasing political tensions linked to resource use, Tasmania's North West region is consistently well-positioned with its abundant natural resources, adequate water and productive soils. Our scenic landscapes, diversity of flora and fauna, availability of clean water and the cleanest air in the world provides natural capital and an enviable quality of life.

A key challenge for the region is to be able to conserve our resources for the benefit and enjoyment of future generations, while investing in activities that will protect and maintain our waterways, coasts, soils and natural landscapes. Natural Resource Management (NRM) provides a framework for the community, industry, land managers, stakeholders and government to work together in maintaining and improving our natural capital. This requires a shared 'game plan' or tactics on how to achieve shared goals. To facilitate this planning, Cradle Coast NRM invited regional stakeholders to have their say on NRM investment priorities; this Cradle Coast Natural Resource Management Strategy 2015 - 2020 is the result of that feedback and discussion.

The role of the region's NRM Strategy is to reflect the community values, aspirations and priorities over a rolling five-year period. To understand what the regional priorities are, Cradle Coast NRM conducted a regional community survey in proportion to municipal population size followed by a series of workshops across community, industry, and government (hereafter referred to as regional community feedback). In revising the Strategy for 2015 - 2020, two questions emerged from the community: 1) how can we improve habitat and manage our environmental services at a landscape scale? and 2) where should we place our efforts in the landscape to obtain best value from the region's NRM activities?

Regional priorities were determined by regional community feedback and are described in the focus for action statements for each landscape theme. The region's NRM Strategy aims to strike a balance between long-term strategic planning and short-term operational planning. To this end, we have included broad landscape strategies plus a focus for action for each environmental asset of land, water and coasts. New features of this strategy include a section on climate change adaptation opportunities for the region, a knowledge gateway section with links to key regional documents, and program logic for each landscape theme to provide a quick reference guide to the shared regional strategies.

We hope that the Cradle Coast Natural Resource Management Strategy 2015 - 2020 proves to be a useful document to assist both government planning and community efforts, and to capture the needs and aspirations of all landowners.

*Rick Rockliff AM*

**Chairman, Cradle Coast NRM Committee**



## Acknowledgements

The Cradle Coast Natural Resource Management Committee would like to thank all those who contributed to this Strategy, especially the Region's stakeholders from the community, industry and Government. In particular, we would like to thank the people and organisations who participated in the workshops and surveys; and the industries involved in the case studies to highlight examples of environmental management systems, environmental stewardship and adaptive management.

The Cradle Coast NRM employees who helped develop the Strategy were Ernst Kemmerer with editing by Amanda Wilson and Cheryl Gray from the Cradle Coast Authority. Map products were developed by Mark Wisniewski from Cradle Coast NRM.

The Cradle Coast NRM Committee who steered the Strategy development were Rick Rockliff (Chairman), Sue Jennings, Bill Walker and Peter Voller. This project is supported by Cradle Coast NRM, through funding from the Australian Government

## Natural Resource Management statement from the Tasmanian Aboriginal community

Aboriginal people have lived on the islands that make up lutruwita (lu-tru-wee-tah), now known as Tasmania for many thousands of years, living interdependently with the land throughout that time.

Many of the values Aboriginal people hold as important exist within and across the wider landscape: and respect, management and protection of those values is seen as a broad Tasmanian community responsibility.

The whole landscape is part of the story. All Aboriginal sites are important in that each one is an integral part of the country. In recent times, after a 200-year struggle, the Tasmanian Aboriginal community has progressed from being totally dispossessed of all lands to having a small amount of that land returned (in 1995 and 2005). Other areas of land have been purchased by the Aboriginal community. With the return of land a number of land management problems, resulting from historical European land management practices, have been inherited by the Aboriginal community.

Aboriginal land management knowledge and practices have been increasingly acknowledged by sections of the wider community. Aboriginal people have strong physical and spiritual links with the land and the land management techniques of the old people have survived. Combining the old practices with contemporary methods provides a rich resource for environmental sustainability. The aim of this Statement is to promote the views, needs and aspirations of Tasmanian Aborigines in relation to sustainable natural resource and land management practices that ensure protection and enhancement of Aboriginal culture and heritage values throughout Tasmania.



*Connecting with 'place' at Preminghana  
Photo: Ernst Kemmerer*

# About this Strategy

## Purpose of the Strategy

The purpose of the Natural Resource Management Strategy for Cradle Coast 2015–2020 (the Strategy) is to guide activity that will help manage and improve the natural resources in the north-west of Tasmania (the Cradle Coast region).

It is a whole-of-community Strategy that identifies the social, economic and environmental values of the region and outlines how the community can work together to manage and improve its condition. The Strategy does not have statutory power or replace any current mechanism or policy relating to natural resource management but encourages partnerships between community, industry and Government.

## Vision

The Vision for natural resource management in the Cradle Coast region is:

*To have proactive, vibrant communities who protect and advocate environmental, social and economic progress for a sustainable and bright future for our region.*

## How the Strategy supports this Vision

The Strategy supports this Vision by:

- > Providing a guide to anyone living or working in the region to engage in activities that promote and foster healthy natural resource management;
- > Outlining the current condition of the region's natural resources, so we can build on previous achievements and recognise key areas for future activities, increasing the community's awareness and capacity to manage natural resources;
- > Identifying the main threats and issues facing these resources, so we can plan preventative actions and implement restorative works where necessary;
- > Setting out what is known about the resources, so we are working from a common understanding and can help to fill any knowledge gaps and share knowledge from past experience;
- > Having focus areas for action so we know what we are working towards; and
- > Providing a summary of community priorities for the region based on state and regional surveys and workshops.

## How to use the Strategy

This Strategy is set out to help readers identify the issues and opportunities over the next five-year planning period to achieve this Vision.

The Strategy is divided into an Introduction and six key parts as illustrated below. This page can be used to help different users navigate the important elements for their involvement. We have also provided industry highlights to showcase and acknowledge best practice. These are featured on pages 41, 43 and 45.

Parts of the Strategy	Use this section
<ul style="list-style-type: none"><li>●</li><li>○</li><li>○</li><li>○</li><li>○</li><li>○</li></ul> <p><b>Part 1.</b> <b>Natural Resource Management in the Cradle Coast region:</b></p> <p>Provides context to the Strategy by describing natural resources of the Cradle Coast region.</p>	<p>To gain context for the Natural Resource Management Strategy for the Cradle Coast region 2015–2020.</p>
<ul style="list-style-type: none"><li>○</li><li>●</li><li>○</li><li>○</li><li>○</li><li>○</li></ul> <p><b>Part 2.</b> <b>Managing Landscapes in the Cradle Coast region:</b></p> <p>Outlines the landscape level strategies for participation, building connectivity and leveraging NRM investment opportunities.</p>	<p>If you are involved in the management of landscapes and are interested in how collective action can shape the region’s future.</p>
<ul style="list-style-type: none"><li>○</li><li>○</li><li>●</li><li>○</li><li>○</li><li>○</li></ul> <p><b>Part 3.</b> <b>Managing Natural Resource Assets and Priorities in the Cradle Coast region:</b></p> <p>It describes the attributes of each theme, the threats, priorities (focus for action), and climate change adaptation opportunities.</p>	<p>If you are interested to see more detail about the region’s assets and priorities; to better understand aspirations for a healthy environment; to identify issues, threats and opportunities; and understand actions that can be focused on in the region.</p>



Table 1: Key to reading the Strategy Program Logic

Key to Reading the Program Logic	
<b>Long-term outcomes =</b>	Changed conditions
<b>Medium-term outcomes =</b>	Changed practices
<b>Short-term outcomes =</b>	Change in knowledge & attitudes
<b>Outputs</b>	Activities contributing to change

The Strategy provides a basis for State and local planning processes and investment priorities. It does not aim to replace sub-regional or local assessment and management planning.

What is in this Strategy?

- > A Vision for the natural resources and community of the Cradle Coast region.
- > Descriptions of Cradle Coast region’s landscapes and aspirations for improvement.
- > Program Logic to give a snapshot of the regional priorities for each sub-theme.
- > Focus areas and adaptation opportunities.
- > How the Strategy will be implemented, assessed, evaluated and improved.

What is NOT in this Strategy?

- > The Cradle Coast NRM or Cradle Coast Authority corporate plans or operational strategies.
- > Comprehensive assessment of local-scale assets.
- > Detailed risk and feasibility assessments.
- > Detailed activity planning, budgeting and on-ground works assessment.

## Strategic context

The Strategy aims to achieve sustainable environmental, economic and social outcomes and requires all stakeholders (government, industry, community and non-government organisations) to contribute and participate. To transition towards a sustainable future requires a pathway of collective responsibility and maturity over the planning horizon (2015 to 2020) as shown below.

In the long term this can be achieved through strategic alignment of our goals, programs and activities. In the medium term this is achievable by each of the partners aiming for continuous improvement, and in the short term by commencing a range of environmental programs and initiatives.

The role of Cradle Coast NRM is to capture the regional aspirational goals and priorities into the Strategy and harness resources and investment in the short, medium and long term. Cradle Coast NRM and the Cradle Coast Authority is the home for regional activities and we achieve this through facilitation, coordination, and enablement through co-funding of NRM investments.

## Review of the Strategy

This Strategy will be reviewed during its five-year life. Learnings from the review will guide the development of future strategies. For more detail, see Part 4: *Implementation and Continuous Improvement*.

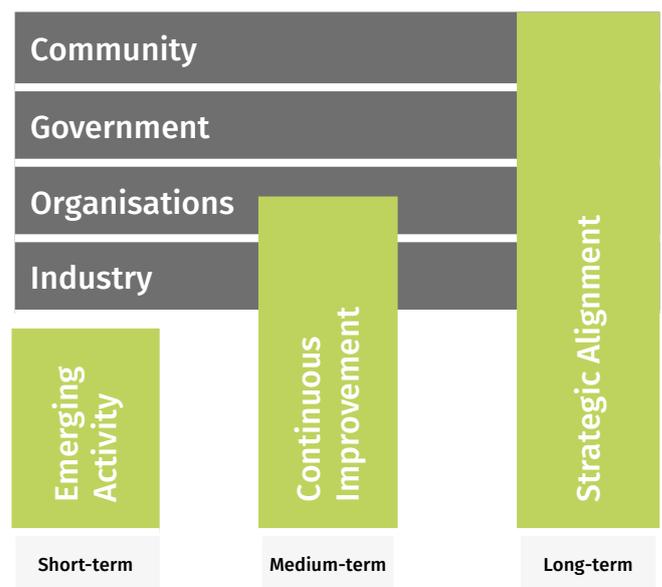


Figure 1: Planning horizon towards sustainability



*Gardiner Point - Edge of the World  
Photo: Tourism Tasmania / Jason Charles Hill*



# Natural Resource Management in the Cradle Coast region

## What is natural resource management?

Natural resource management is taking care of natural resources such as land, water and marine ecosystems, with a particular focus on how management affects quality of life for both present and future generations.

## What influences natural resource management

People influence how natural resources are managed and utilised in a particular place through their course of action (policy) and how natural resources are regulated (legislation). These influences can be categorised as historical, economic, social and technological (see Table 2).

*Table 2. Social and economic influences on natural resource management decisions in Australia (source: Stanley and Clouston 2005)*

Influence	Factors	Description
Historical influences	Early government policies	Tax concessions for clearing, acclimatisation societies to introduce British plants and animals, drought relief programs, bounties on native and exotic fauna.
	Failure to adapt	Rather than adapt to the landscape, farmers were encouraged by government and society to change the landscape.
Economic drivers and constraints	Externalities	Several of Australia's most pressing natural resource management problems are a result of externalities. These include: rising water tables from land clearing, nutrient run-off, salt leaching, chemical overspray, siltation from erosion and the spread of weeds and pests (Industry Commission, 1998).
	Market failure regarding externalities	When the market fails to supply public goods at levels which society as a whole might demand. For example, there is little incentive to mitigate actions that cause damage to public goods (eg clean water) if there is no private benefit. This leads to market failure in the form of externalities.



Influence	Factors	Description
<b>Social drivers and constraints</b>	<b>Social networks</b>	New ideas are more likely to be adopted when land managers are part of a strong communication network.
	<b>Collective action</b>	When people are engaged and have some form of ownership of a change process they are more likely to understand recommendations and to adopt new practices.
	<b>Access to advice</b>	The provision of reliable, rigorous information, training days, demonstrations, and field days is regarded as an important component of practice change.
<b>Technological drivers</b>	<b>Mechanisation</b>	Mechanisation has reduced labour costs and increased food production. However, it has also resulted in greater land clearing rates and contributed to issues such as dryland salinity.
	<b>Current trends</b>	Genetic engineering and crop sterilisation are significant trends likely to change the way we plant and harvest. Counter-trends are towards organic farming and use of natural selection to increased productivity and pest and disease resistance.

## What are the natural resources of the Cradle Coast region?

The Cradle Coast region of 2.2 million ha is home to over 114,000 people who enjoy the benefits of its abundant natural resources and landscapes. Our natural assets include our fertile soils, numerous rivers, coastal habitat for humans and wildlife, and wilderness areas containing the largest reserve of cool temperate rainforests in Australia. These assets are the foundation for our industries and give us clean water, fresh air and healthy lifestyles. The natural resources also have intrinsic values, which are recognised by their protection in the Tasmanian Wilderness World Heritage Area and many other State Reserves.

## Key contributors to natural resource management

The region's future depends on healthy ecosystems. As stewards of natural resources, we all have a stake in managing and protecting these assets for future generations. The people of the Cradle Coast region are vital to shaping a sustainable future for our natural resources. Many people are already actively managing and protecting the region's natural resources through their work as primary producers and land managers, and as volunteers.

Key contributing groups are:

- > Aboriginal community organisations
- > Australian, Tasmanian and local governments
- > Business
- > Community groups and volunteers
- > Cradle Coast NRM
- > Industry, and industry bodies
- > Land, sea and water managers

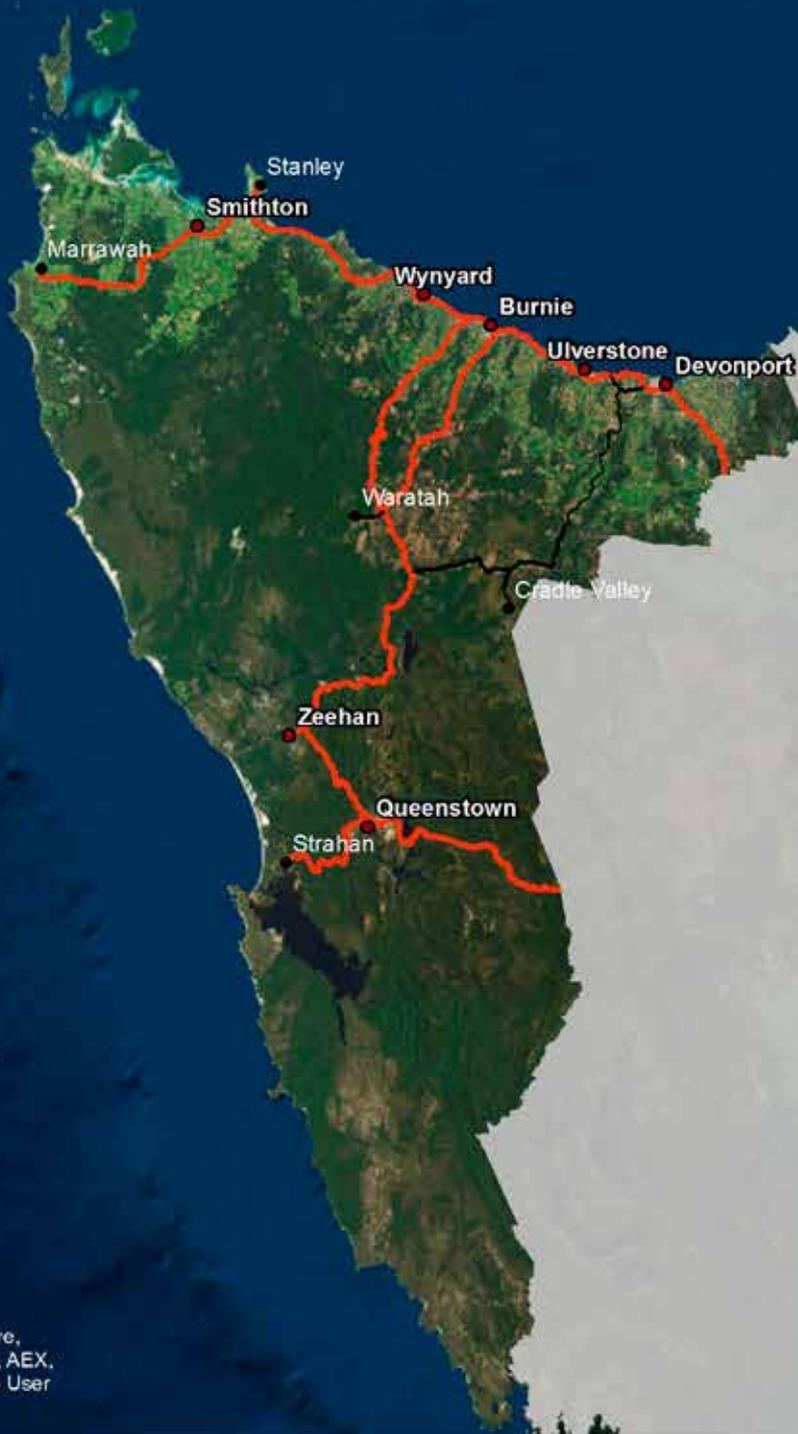
- > Non-government organisations (NGOs).
- > Research and education organisations

Community, government, industry and business are essential to implementing NRM in the region (see Part 4: *Implementation and continuous improvement*) and the Strategy builds on these activities and seeks to improve how we manage our natural resources.

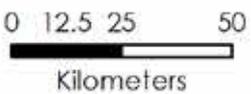
The role of Cradle Coast NRM is to support the whole community in guiding collaborative and outcome-focussed action. Cradle Coast NRM was established in January 2003 as the natural resource management division of the Cradle Coast Authority. This was in response to the Tasmanian Government's Natural Resource Management Framework and its enabling legislation, the Tasmanian *Natural Resource Management Act 2002*. A central piece of this Act is the formation of a Cradle Coast NRM Committee to engage with the community and determine priorities for NRM investment in the region (see Part 5: *Strategic Context*). Building on the achievements of the last twelve years, Cradle Coast NRM will continue to support the key contributing groups in working in the regional community priorities described in Part 4: *Implementation and continuous improvement*.



Map 1: The Cradle Coast Region



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



Created: 13/11/2015

Cradle Coast NRM does not warrant the accuracy and completeness of information on this map. Cradle Coast NRM shall not bear any responsibility or liability for errors or omissions in the information.

Base data from theLIST © State of Tasmania  
Projection MGA94 Zone 55



# Managing Landscapes in the Cradle Coast region

## A landscape management approach

The strategic framework for the region encompasses three main landscape themes of Land, Water and Coasts. All of the natural resource assets are strongly inter-related and are sub-divided for ease of defining the Strategy. In all three resource areas there are common components (in alphabetical order) of atmosphere, biodiversity, community, cultural heritage and geology.

## The three main landscape themes are:

### 1. Land

Our natural, productive and urban landscapes.



### 2. Water

Our rivers, wetlands and groundwater.



### 3. Coasts

Our coasts, estuaries and oceans.



- > **Atmosphere:** Our air and climate
- > **Biodiversity:** Our native plants and animals
- > **Community:** Our people
- > **Cultural heritage:** Our history
- > **Geology:** Our soils and geoheritage

## Collective action

To outline the primary NRM goals at a landscape scale, so that collective efforts of on-ground works can contribute to broader improvement programs. A key challenge of NRM activities is having sufficient uptake of on-ground works in an area so that NRM activities are both recognisable and sustainable. For example, weed management requires both a long-term commitment and sufficient co-operative effort at a regional and local scale to make an overall difference (Sammons and Gaines, 2014). Likewise, streamside revegetation works are likely to contribute to improved water quality if there are sufficient landholders along the length of the waterway involved in revegetation activities.

To achieve outcomes at the landscape scale over the next five years, the course of action for NRM investment in the region will follow four overarching investment policies. Priority will be given to:

- > Collective uptake of restoration programs or on-ground works in a catchment, in preference to landholders working in isolation to each other.
- > Programs where funding can be leveraged from co-contributions or via multi-agency programs; or where demonstrated high level volunteer participation rates are evident.
- > Maintenance programs that re-visit and maintain previous beneficial sites.
- > Secondary benefits (e.g. weed control) to achieve a primary goal such as improved habitat for threatened species, or vice versa.

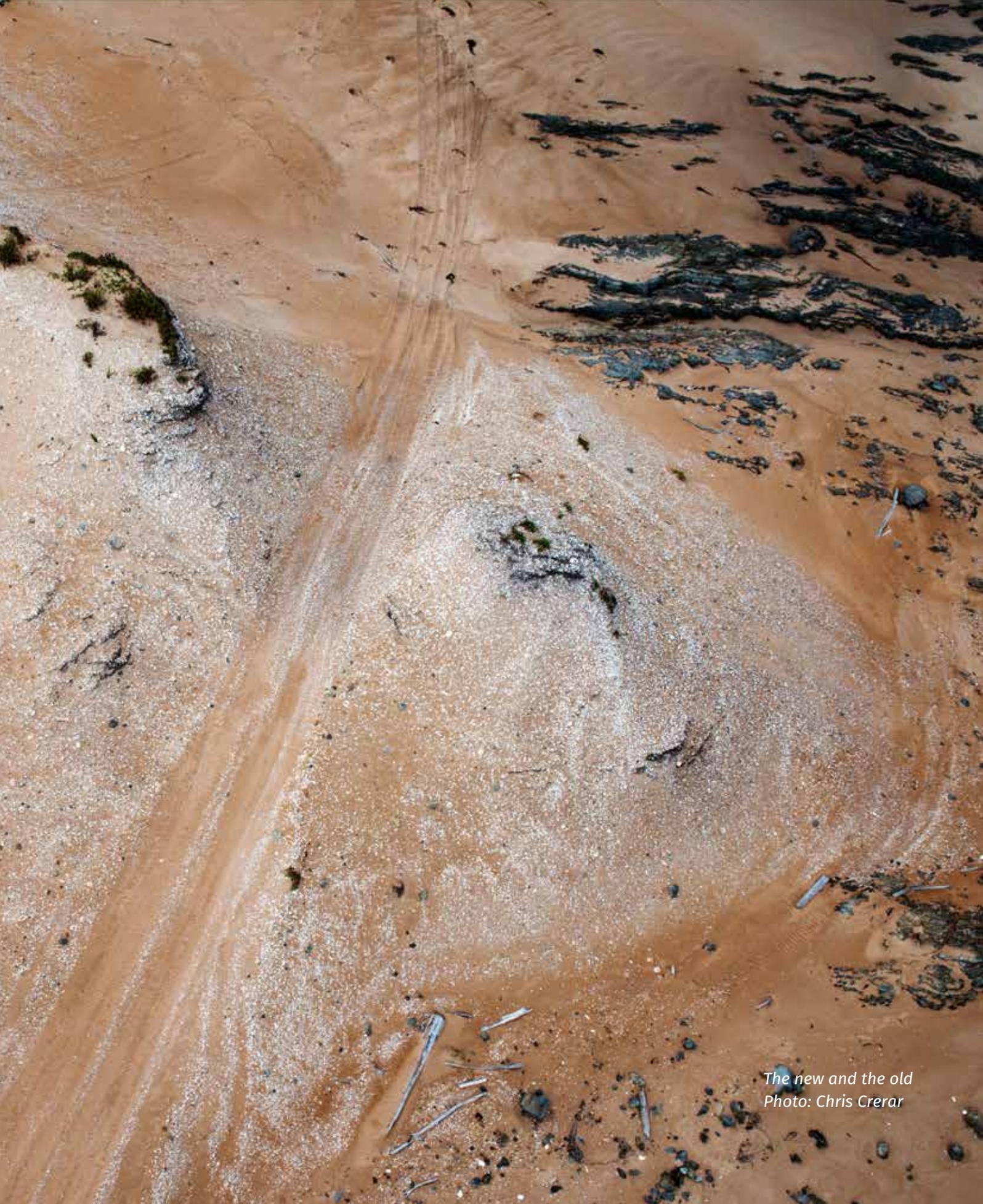
The NRM Strategy also recognises the Cradle Coast regional Land Use Strategy which states:

“Protection of natural resources equates to protection of economy and communities. Conserving and protecting the intrinsic value of healthy natural systems is the responsibility of many agencies and is a core principle underlying national, state, regional and local planning systems.” (Earle, 2010)

Primary goals and corresponding strategy for each of the landscape areas over the next five years are summarised into program logic diagrams. The diagrams outline the long-term outcomes that will lead to the desired changed condition, as well as medium-term outcomes (changed practices) and short-term outcomes (change in knowledge and attitudes). One of the challenges in reflecting the NRM objectives of the stakeholders in the region is the varying scales and themes for prioritisation. While a single overall goal may be seen as having too narrow a focus, the assumption in this strategy is that ecological systems can also benefit greatly from single actions that restore ecosystem function. A single action such as restoration of river habitat can also achieve multiple goals such as improving terrestrial and aquatic habitat, reducing stream bank erosion and acting as a sediment trap for land-based activities. Furthermore, the Strategy and program logic diagrams aim to provide some realistic goals and actions over the next five years rather than trying to cover all aspects of natural resource management.

<sup>1</sup> *Collective uptake here refers to spatial arrangement but may also be across an industry or sector.*

<sup>2</sup> *The case study of re-introducing the Wolf in Yellowstone National Park illustrates many positive benefits of the ecosystem outweighing any disadvantages.*



*The new and the old*  
Photo: Chris Crerar

# Managing Natural Resource Assets and Priorities in the Cradle Coast region

## 1. LAND

The natural resource of Land has been defined to include natural landscapes, urban landscapes, and productive landscapes, encompassing agriculture, forestry and mining. Outcomes have been compiled for the three landscape subthemes and detailed logic models have been developed to describe outcomes for each.

### Our Natural Landscapes

Natural landscapes are those with no direct human impact, but in this strategy it is generally defined as not used for productive purposes or urban development. Within the region, natural landscapes vary from alpine areas to coastal zones and terrestrial, aquatic and marine habitats.

Natural landscapes are valued for their vegetation communities, faunal habitat and geological history. The region's vegetation communities include rainforests, wet eucalypt forests, buttongrass plains, alpine moorlands, swamp forests, coastal heathland and salt marsh, all creating unique habitats for local animal and bird species.

Much of the region's natural vegetation is held in the three largest formal reserve areas of South West National Park, the Franklin-Gordon Wild Rivers National Park and the World Heritage Area of Cradle Mountain – Lake St Clair National Park. There are also three large conservation reserves of Arthur-Pieman Conservation Area, the South West Conservation Area and Granite Tor Conservation Area as well as Forest Reserves, State Reserves and Regional Reserves. Smaller reserves include Savage River National Park and Rocky Cape National Park. There are also significant amounts of remnant native forest and shrubland on unreserved public lands, and on private land in farming areas under varying management agreements.

Our natural landscapes are highly valued by the community for recreational activities and tourism ventures. The Aboriginal community's

strong relationship with the land is evidenced by their spiritual connection with it and their influence in shaping vegetation through the use of fire and different burning techniques.

### Components of healthy natural landscapes

Healthy natural landscapes have the ability to support natural processes and provide ecosystem services to the regional community. For a natural landscape to maintain key ecological processes it must be adequate in size to sustain vegetation communities and fauna populations; maintain links to other natural landscapes to enable exchange and dispersion of plant and animal life; have a diversity of flora, fauna and landforms; and be resilient to appropriate disturbance such as fire.

### Natural landscape threats

Primary natural landscape threats in the Cradle Coast region are:

- > **Physical threats:** Degradation of flora and fauna by inappropriate fire management; clearing of habitat; urban and semi-rural development; disturbance by recreational activities, vehicle access and stock access; mining or excavation of materials; and installation of infrastructure such as roads.
- > **Biological threats:** The extent, condition and composition of vegetation communities and fauna habitat may be impacted by the introduction of pests and diseases, non-native plants and animals.
- > **Climate change:** Opportunities for spread of pests and diseases, non-native plants and animals, are likely to increase with global warming.

Secondary threats which may impede the effective management of natural landscapes are organisational barriers such as lack of coordination between neighbouring land managers and inadequate community participation and engagement.



Table 3. Program Logic for Natural Landscapes.

Natural Landscapes			
<b>Long-term outcomes</b>	Natural landscapes are restored, maintained or protected to ensure a sustainable ecosystem		
	Landscape connectivity	Fire management	Biosecurity
<b>Medium-term outcomes</b>	<ul style="list-style-type: none"> <li>&gt; A landscape approach is adopted for regional planning and natural connections</li> </ul>	<ul style="list-style-type: none"> <li>&gt; Biodiversity and cultural values are included in fire management planning</li> </ul>	<ul style="list-style-type: none"> <li>&gt; A regional biosecurity system is developed to include plant and animal pests, diseases and weeds, and is recognised as a shared responsibility</li> </ul>
<b>Short-term outcomes</b>	<ul style="list-style-type: none"> <li>&gt; Remnant patches of native vegetation are maintained as part of the landscape</li> <li>&gt; Priority is given to riparian buffers in revegetation programs</li> </ul>	<ul style="list-style-type: none"> <li>&gt; Fire management decision support systems for public land are implemented</li> <li>&gt; Communities become involved in fire management decision making for flora and fauna values</li> </ul>	<ul style="list-style-type: none"> <li>&gt; Weeds are controlled to improve habitat for species at risk</li> <li>&gt; Feral animal eradication is sought in key locations where there is local community support.</li> </ul>
<b>Outputs</b>	<ul style="list-style-type: none"> <li>&gt; Regional stakeholders and community are proactive in landscape planning for environmental improvement</li> </ul>		

### Focus for action

At the theme level, the regional community feedback identified improving our waterways as the highest priority for the region. Consistent with this priority, the focus for action will be to improve landscape connectivity through riparian revegetation. For natural landscapes, three main priorities identified from regional community feedback were environmental weeds, fire management and feral animal control.

Controlling Declared Weeds in Tasmania will be mostly focussed on maintaining areas in good condition. However, improving landscapes in poor condition will be considered where there is a prospect of complete weed eradication, and efforts are sustainable. This strategy is in support of multi-agency programs to prevent spread of Declared Weeds into World Heritage Areas and existing management plans and regional containment zones for prioritising weed control.

Feral animal control will be a priority for action in areas where complete eradication is possible with the support of the community (for example, feral cats on King Island),

where species in decline are at risk (for example, coastal penguin habitat close to urban areas), or to improve areas of public land with endemic species at risk (for example, the eastern barred bandicoot).

Fire management will be a focus for action because of the increased risks associated with climate change and to enable strategic planning at the landscape level. The aim is to improve fire management in natural landscapes using decision support systems to foster biological diversity in plants and animals. Opportunities for community involvement are in the areas of monitoring pre and post-fire population levels and fuel levels, and improved collaboration with the Aboriginal community on fire management within public lands. An added benefit of improved fire management may also be increased protection of people and their assets.

To improve education and awareness of natural areas, another focus for action will be promoting scientific exploration, tourism, and an understanding of natural values of the region by encouraging promotional activities from both government and private sectors.

## Adaption opportunities for natural landscapes

In general, ecological impacts due to climate change will be less severe in Tasmania than other parts of Australia. At a regional scale, the broader valleys in the alpine regions are projected to show an increase in the area of suitable habitat for a range of species, while higher losses are expected in the agricultural regions of the North West. For example, the distribution of the yellow-throated honeyeater is projected to diminish from the north-west agricultural areas in favour of higher altitude areas in the south west (Johnson and Beeton, 2015).

Opportunities for improving the landscape condition can be achieved through fire management compatible with the local flora and fauna. Decision support systems used in combination with citizen science offer the most practical means of adapting to climate change by building the monitoring and feedback cycle into everyday activities of the key fire management agencies.

Preventing the introduction of pests and diseases through biosecurity will continue to be an important aspect of conserving the island's biodiversity and productivity (see productive landscapes section) in the face of climate change. This is followed by eradication and containment and then asset-based protection such as managing spread into alpine areas. Cool temperate species such as gorse, broom and blackberry are all likely to expand their range in Tasmania under climate change (OEH, 2008; DPI, 2008; WONS, 2009) generally due to a projected southern shift in distribution for most species on the east coast of Australia (Scott et al 2014).

## Our productive landscapes

Productive landscapes are those where the natural resources of the land are directly used to provide food, fibre or minerals.

Farming, forestry and mining are mainstays of the regional economy and can have positive and negative consequences for the

natural environment depending on how they are managed. Our fertile soil resource is significant to the agricultural productivity of the region. Primary production also plays a role in the active management of remnant vegetation and paddock trees on farms; in informal reserve areas with production forests; and in site management and rehabilitation of mines. The management of productive landscapes can have off-site effects, especially on waterways, groundwater and estuaries.

In regard to mining, the region is one of the most heavily mineralised locations in Australia and contains an arc of high-grade iron, lead, gold, copper, silver, zinc, tin and nickel ore deposits extending across the west coast into the far north west and King Island. Other extractive resources across the region include silica flour, limestone (cement), construction aggregates and specialist stone. Many mineral deposits, although highly valuable, are small and occur in areas difficult to access.

Agriculture is a significant part of the lifestyle and comprises 17% of the economy of the region because of the landscape's high fertility. The region has a diversity of agricultural activities including pyrethrum, poppies, tulips and a variety of vegetables such as potatoes, peas and carrots. There is also a strong animal production sector with dairy, beef and sheep as well as specialist farms with goats, alpacas and deer. The majority of the land suitable for farming has been developed to create highly productive cropping and grazing systems, livestock and plantation forestry. This land occurs along the low elevation ridges and valleys of the northern coast from Cape Grim to Sassafras, and on King Island.

There is an extremely limited capacity to expand the area of land available to agriculture due to constraints of elevation, topography and conservation reserves. Any increases in productivity will therefore have to be generated from the existing land resource. The importance of the land for agriculture and the intensity of farming may increase as climate change effects mainland production zones and as



irrigation investment is increased to offset the expected variation in local rainfall.

Within agricultural landscapes, native vegetation and areas where land is not intensively used are essential for the wellbeing of the overall land resource, its productivity and its communities (social value of landscapes). These areas throughout the landscape are important for biodiversity and the natural control of crop pests and diseases.

### Components of healthy productive landscapes

Healthy productive landscapes are determined by sustainable resource management; the condition of components such as soil, water and vegetation; and interactions with the natural environment.

When interacting with the natural environment, a healthy productive landscape is one which does not cause negative off-site impacts; maintains the biological, chemical and physical well-being of the landscape; and protects plant and animal productivity and diversity.

Healthy soil is able to sustain biological functioning, maintain environmental quality, and promote plant and animal health. It should have the ability to continue functioning during stress or disturbance and to recover after such occurrences. The natural landscapes and water sections of this Strategy provide guidance on healthy vegetation and water assets.

### Productive landscape threats

Productive landscape threats in the Cradle Coast region:

- > **Physical threats:** Degradation of soils and terrain by accelerated erosion; soil structure decline; urban and other development encroachment; disturbance by recreational activities and vehicle access; and inappropriate excavation of materials. Acid sulfate soils can also

be created from conversion of swamp land into livestock pasture exposing the land to oxidisation (for example through 'hump and hollow' developments).

- > **Biological threats:** Degradation of soil biology and structure, paddock trees, remnant stands of vegetation and vegetation in native production and plantation forests may be caused by inappropriate fire management; introduction of weeds, non-native plants, feral and native pest animals and diseases; improper or inappropriate application of insecticides and herbicides; and disturbance by recreational activities and vehicle access. Island biosecurity is of extreme importance to the agricultural economy and for natural landscapes and needs the cooperation of the community and support from all levels of government.
- > **Economic threats:** Globalisation of markets can place economic pressure on local growers leaving less time and resources for environmental investments or "lead to the compromise of best practice."

Secondary threats which may impede the effective management of productive landscapes are organisational barriers such as lack of coordination between neighbouring land managers and inadequate community participation and engagement.

If not managed well, productive landscapes can also affect natural landscapes, communities and businesses. Examples include contamination of waterways, estuaries or coastlines; and loss of or changes to habitat. Specific issues, threats and target areas for the region are related to the potential for agricultural production to intensify (see Appendix 1 for details).

Table 4. Program Logic for Productive Landscapes.

Productive Landscapes			
<b>Long-term outcomes</b>	Productive landscapes are managed to ensure sustainable and viable industries		
	Impacts on water	Soil condition	Vegetation/groundcover
<b>Medium-term outcomes</b>	<ul style="list-style-type: none"> <li>&gt; Quality of water leaving productive land is maintained below environmental threshold</li> </ul>	<ul style="list-style-type: none"> <li>&gt; Soil structure, fertility and organic carbon is improved – indicator trends are stable or improving</li> <li>&gt; Soil erosion risks are managed and soil loss is reduced</li> <li>&gt; Mine sites are rehabilitated suitable for plant growth</li> </ul>	<ul style="list-style-type: none"> <li>&gt; Perennial vegetation cover, ground cover in pastures is maintained or improved</li> <li>&gt; Fallow periods in cropping is reduced in duration and better timed</li> <li>&gt; Environmental weeds in the landscape are reduced</li> </ul>
<b>Short-term outcomes</b>	<ul style="list-style-type: none"> <li>&gt; Collective riparian vegetation protection, fencing regeneration and/or planting is increased</li> <li>&gt; Effluent and stock management practices protect waterways</li> <li>&gt; Stream bank and river mouth erosion risks are controlled</li> <li>&gt; Best practices nutrient management is adopted in all farming systems</li> </ul>	<ul style="list-style-type: none"> <li>&gt; Knowledge and use of precision agriculture and best practices is encouraged to maintain soil health</li> <li>&gt; Farmers' capacity and knowledge is built on contemporary science with workshops and field days</li> <li>&gt; Soil condition evaluation and monitoring is promoted and soil erosion risk factors managed</li> </ul>	<ul style="list-style-type: none"> <li>&gt; Vegetation is protected, regenerated and planted</li> <li>&gt; Green crops and residue retention is used in cropping</li> <li>&gt; Ground cover % improved in pastures via grazing and pasture species management</li> <li>&gt; Weeds of national significance are controlled</li> <li>&gt; Fire management planning is improved</li> </ul>
<b>Outputs</b>	<ul style="list-style-type: none"> <li>&gt; Land managers are participating in capacity building, property management planning, and environmental improvement program to improve soil conditions and groundcover and reduce impacts of land and livestock management on waterways.</li> <li>&gt; Others who influence how productive land is managed support land managers in learning and using good practices</li> <li>&gt; Objective information on the win-win of sustainable land management practices is available for landholders</li> </ul>		

### Focus for action

The focus for action is to encourage practice change where required in the agricultural sector through communication, education (workshops, field days, school education), farm demonstration trials and support of property management planning. A key strategy will be the use of local leadership groups or champions to incorporate current knowledge and best practice and showcase local examples of improved practice and subsequent benefits.

Soil health and planting of riparian buffers were identified by agricultural advisors as the highest priority, while results of regional community feedback indicated soil erosion and water quality to be the priorities for productive landscapes.

Priority catchments are identified where investment can be realised and improvements can be recognised at the landscape level (see landscape management strategies above).



These are often catchments in moderate to good condition compared to highly modified rivers or catchments. For 2015-2020 period, the focus catchments will be:

- > Streambank erosion control in the Inglis
- > Management of erosion from paddock and fields in the Emu catchments

- > Excess nitrate and sedimentation management in Emu, Duck, Montagu, Inglis, and Rubicon
- > Planting of stream buffers on the Mersey, Inglis, and King Island catchments
- > Salinity management of areas affected on King Island.

Figure 2: Summary of key issues identified by Norton et al (2007) and agricultural expert workshop

	Rubicon	Inglis	Duck	Montagu	Welcome	Forth-Wilmot	King Island	King-Henty	Blythe	Emu	Mersey
<b>Stream bank erosion</b>		●									
<b>Soil erosion from paddocks</b>	●					●				●	
<b>Sedimentation and turbidity</b>	●	●	●	●	●			●			
<b>Nitrates</b>	●	●	●	●	●			●			
<b>Stream buffers (revegetation)</b>	●	●					●				●
<b>Salinity</b>							●				
<b>Expanding irrigation</b>	●		●	●	●	●			●		

## Productive landscape adaptation opportunities

The Cradle Coast region is one of Australia's most productive landscapes and will continue to be a provider of a variety of agricultural products under climate change, with some adaptation over time. A range of regional adaptation opportunities for the major agricultural activities were evaluated under climate change impacts and are summarised in Figure 3. More specific information on the adaptation options for each agricultural activity can be sourced at:

[www.cradlecoastnrm.com/our-work-climate-change](http://www.cradlecoastnrm.com/our-work-climate-change)

Figure 3 indicates land use change as an adaptation option for climate change and this is likely to be coupled with current trends in agricultural change. This includes expansion of industries such as pyrethrum and poppies, intensification of land use, expansion of irrigation and greater competition for the use of agricultural land for purposes such as rural development (Williams 2013).

The expansion of irrigation is a popular option and it will be a major challenge in the near term to maintain environmental flows, aquatic diversity and minimise downstream impacts on other producers. A self-regulating, collective farming approach to water use may be a more effective way of managing water use in catchments, and assist in minimising impacts while helping the regional producers maintain a 'social licence' to operate.

Another key risk with climate change in the North West is increasing intensity of rainfall events. If this coincides with recent cropping activities when there is no ground cover, it can cause significant erosion events. Coupled with soil loss is loss of organic matter or soil carbon, and as a mitigation response the suggested future carbon planting initiatives in the region focus on lower catchments with very low riparian vegetation (see Appendix 2).

Figure 3. Climate change adaptation opportunities applicable to agricultural activities in the region

Agricultural activity	Beef and sheep*	Berries	Canola	Cereals	Dairy*	Horticulture	Legumes	Nuts	Olives	Pome	Poppies	Potatoes	Pyrethrum	Stone Fruit	Vegetables	Viticulture
Adapt planting/sowing times							●				●	●			●	
Adapt to loss of chilling (eg artificial dormancy breakers)		●				●		●		●				●		
Adjust stocking / breeding	●				●											
Alternative pasture species mix	●				●											
Crop protection structures		●				●		●	●	●				●	●	
Explore new varieties/cultivars/crops or breeding programs	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Forage conservation	●				●											
Frost management		●	●	●		●		●	●	●	●			●		●
Investment in irrigation	●															
Monitor pest and disease, and consider resistant strains		●	●	●			●	●	●	●	●	●	●	●		●
Potential for landuse change	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●
Precision agriculture			●	●								●			●	
Prepare for increased nutrient demand	●				●											
Provision of paddock trees, shelterbelts and windbreaks	●	●			●	●		●	●	●			●	●	●	
Soil conservation practices	●	●	●	●	●	●	●				●	●	●		●	
Water management & use/reuse	●		●	●	●	●	●				●	●	●		●	

\* Based on pasture production and therefore includes adaptation on pasture species mix, planting/sowing times. see <http://www.cradlecoastnrm.com/our-work-climate-change>

### Our Urban Landscapes

Urban landscapes include the region’s towns and cities where structural development has occurred and residential and commercial communities exist. Devonport and Burnie are the largest urban centres in the region with Smithton, Queenstown and Currie being significant towns relative to their local areas. Except for the West Coast towns which rely on mining and tourism, urban centres generally service rural industries.

With many of the region’s towns located on the coast or estuaries and containing significant areas of remnant vegetation, the urban community has strong connections with its natural assets, particularly through recreational and social activities.

### Components of healthy urban landscapes

Healthy urban landscapes as centres of human population and industry should reflect the needs of a healthy population.

Healthy urban landscapes have sufficient open space and natural areas to provide opportunities for recreation, support social activities and contribute to the well-being of the community. Ambient air quality is clean and naturally refreshed and the general environment free of litter and other pollutants.

## Urban landscape threats

Urban landscape threats in the Cradle Coast region:

- > **Physical threats:** Degradation of natural and open spaces by unsuitable recreational activities; inappropriate development or land use; and incorrect disposal of waste, litter and pollutants.
- > **Biological threats:** Degradation of natural areas through vegetation clearance; introduction of weeds, non-native plants, pests and diseases; disturbance by recreational activities and vehicle access; and illegal or mismanaged fires.
- > **Atmospheric threats:** Decline in ambient air quality through local industrial, commercial or domestic pollution such as wood-fire smoke; or pollution from near-by primary production activities such as spray drift and smoke from burn-offs.

Secondary threats which may impede the effective management of urban landscapes are organisational barriers such as lack of coordination between neighbouring land managers and inadequate community participation and engagement.

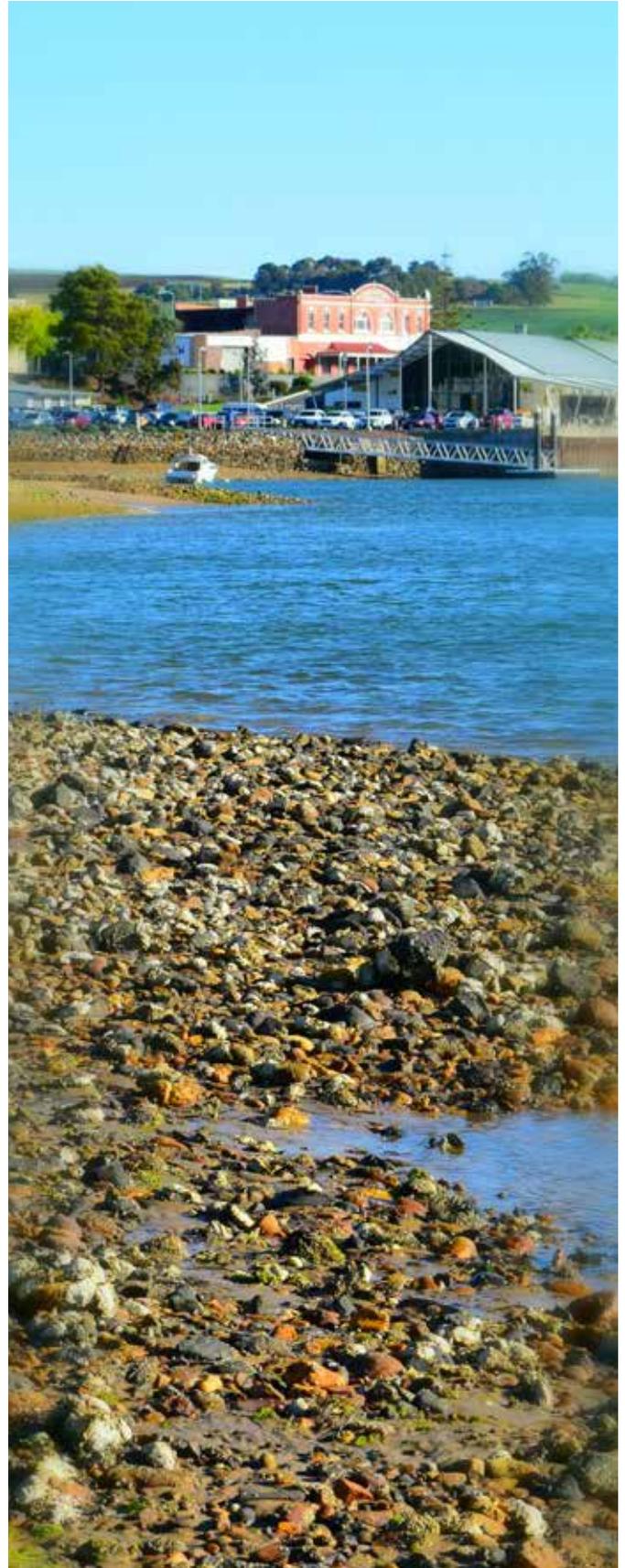


Table 5. Program Logic for Urban Landscapes.

Urban Landscapes			
<b>Long-term outcomes</b>	Urban landscapes are designed and managed to provide healthy living space and access to natural ecosystems		
	Nature is valued	Waterways are protected	Habitat is improved
<b>Medium-term outcomes</b>	<ul style="list-style-type: none"> <li>&gt; Natural areas and open spaces within urban landscapes are valued and protected</li> </ul>	<ul style="list-style-type: none"> <li>&gt; Waterways are protected as valuable community assets that enhance liveability and support natural ecosystems</li> </ul>	<ul style="list-style-type: none"> <li>&gt; Communities are actively involved in improving natural habitat within urban areas</li> </ul>
<b>Short-term outcomes</b>	<ul style="list-style-type: none"> <li>&gt; Riparian buffers and landscape connectivity is considered in rural and urban planning and development</li> <li>&gt; Threatened species such as Burrowing Crayfish are given adequate protection from urban development and activities</li> </ul>	<ul style="list-style-type: none"> <li>&gt; Litter levels from urban stormwater runoff is reduced and prevented from entering waterways and estuaries</li> <li>&gt; Water sensitive urban design is trialled and implemented</li> </ul>	<ul style="list-style-type: none"> <li>&gt; Weeds are controlled to improve habitat for species at risk</li> <li>&gt; Targeted feral animal eradication is sought in locations where there is local community support</li> </ul>
<b>Outputs</b>	<ul style="list-style-type: none"> <li>&gt; Local government, community and developers are proactive in improving urban design and development</li> </ul>		

### Focus for action

Regional community feedback identified litter control and improved water sensitive urban design as the highest priorities for the region. Activities such as weed control, replanting and feral animal control were also considered important for natural areas, coasts and waterways within and adjacent to urban areas.

The focus for action for the region is to implement a pilot project for improved water sensitive urban design to reduce litter, sedimentation and improve water quality and aquatic life.

Programs for litter, weed and feral animal control will continue with the support of local government, industry, schools and the broader community.

### Adaptation opportunities urban landscapes

With the largest population centres occurring along the coast, sea level rise is becoming a major issue for coastal towns such as Turners Beach. The regional community feedback indicated greater support for maintaining habitat, or improved urban planning than building infrastructure against rising sea levels.

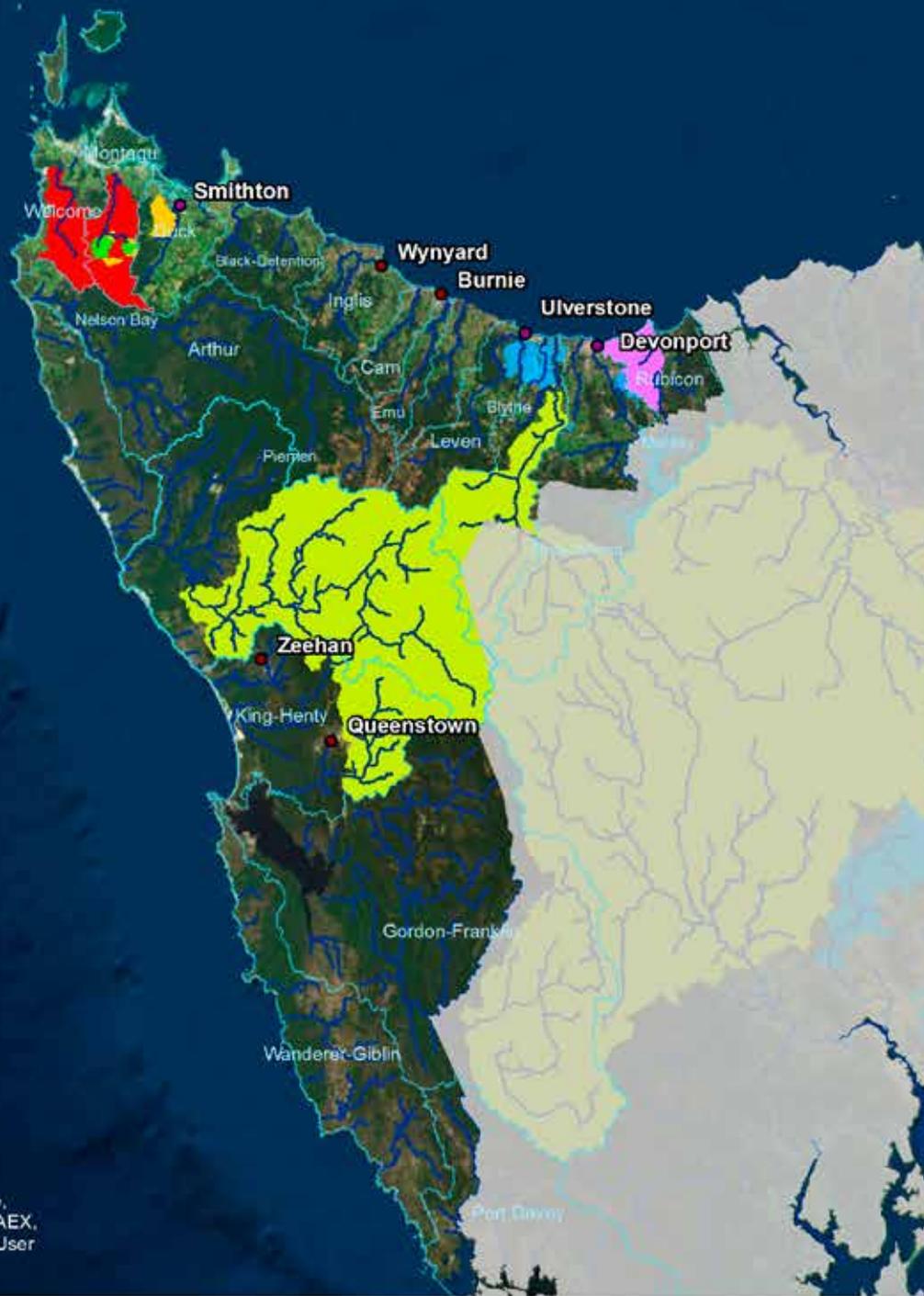
Opportunities exist for identifying areas where maintaining zones of natural habitat should take priority over the need for barriers and vice-versa, particularly for coastal zones that are densely filled with railways, roads, paths, exotic gardens and a close urban interface.

Education and awareness on the use of these coastal zones adjacent to our population centres is also required, particularly where they are illegally treated as an extension of private land and in some cases extend into National Park, or coastal and marine reserves.



*Milkshake Hills Forest Reserve  
Photo: Brendan Turriff*

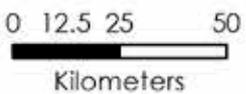
Map 2: Regional Catchments and Water Districts



### Water Districts

-  Hydro Electric District
-  Riverworks District
-  Drainage District
-  Irrigation District
-  Water Supply District
-  Groundwater Area

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



Created: 13/11/2015

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Base data from theLIST © State of Tasmania  
Projection MGA94 Zone 55



## 2. WATER

The natural resource of water has been defined to include rivers, wetlands and groundwater. Like all natural resources, one asset's condition is connected to the condition of others. In the case of the region's water, its health is reflective of the health of the drainage systems in the catchment areas and land use management practices.

The topography of the landscape and its underlying geology provide the foundation for our waterways to collect, direct, transport and store water. Water also shapes the landscape through erosion and surface deposits, within waterways and below the ground. The variety of habitats and niche environments created by water across the landscape increases the opportunities for enrichment and evolution of the region's unique biodiversity.

There is limited and fragmented understanding of the historical Aboriginal cultural links to our region's waters. Some insight into the Aboriginal community's connection with the region's waterways comes from knowledge passed down, such as stories featuring shell collecting in the Robbins Passage/ Boullanger Bay wetlands.

The community's dependence on waterways for freshwater drinking supplies, irrigation and transport shaped European settlement patterns in the region. While these needs continue to be important, our relationship with the region's water has broadened to encompass social and environmental values, as well as economic benefits.

### Our Rivers

Rivers include the region's flowing surface waters, which are primarily fresh and do not experience tidal influences. They range from temporary headwater streams to permanent river systems running through natural, rural and urban landscapes.

The south west part of the region has 25% of the wild rivers of Australia while other

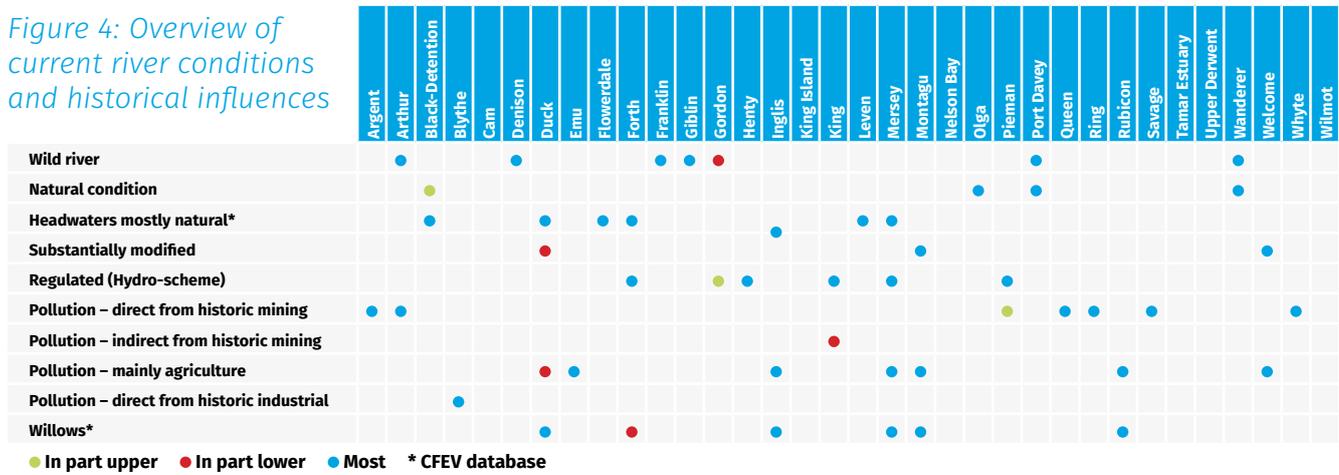
rugged catchments such as the Pieman, Forth and Wilmot are managed for hydro-electricity (refer to Catchment map on left). The northern part of the region is dominated by agricultural production which has in some cases modified river courses or resulted in high levels of sedimentation or nutrient levels (see Figure 4). Historic mining activities have polluted the Queen, Arthur and lower King, as well as the Argent, Ring, Savage and Whyte Rivers as summarised in Figure 4.

The Welcome, Montagu and Duck catchments have gentle gradients where the lowland streams once branched through swamp forests. Large areas of these catchments have been highly modified through agricultural development with channels straightened, riparian vegetation cleared and in-stream habitat removed.

The Cam, Emu, Blythe, Leven and Forth-Wilmot catchments have steeper gradients and are narrower than the lowland catchments. Although there has been significant agricultural and urban development in the lower ends of these catchments, large connected areas of riparian vegetation also remain. In the upper catchments National Parks and native and plantation forestry assist in protecting the condition of headwater streams.

The modified, north-flowing catchments have benefited from improved management practices and rehabilitation efforts which are expected to lead to long-term condition improvements. Examples include revegetation of riparian zones in the Leven catchment; improving measuring, monitoring and management of water extraction; adoption of sustainable farm practices to reduce erosion from intensive cropping areas; and improved management of dairy effluent on farms in the Duck and Montagu catchments (refer to Catchment map on left).

Figure 4: Overview of current river conditions and historical influences



### Components of healthy rivers

Healthy rivers have a structure which is created by, and suited to, their local environment.

Although highly variable in their structure, rivers can be characterised by hydrology (flow regime); water quality; geomorphology (landforms); riparian zones, and in-stream plant and animal life. In a healthy river these components will be sufficiently similar to natural conditions to maintain key ecological processes, provide a suitable variety of habitats and environmental conditions to support diverse in-stream and streamside life, and to provide adequate connectivity to floodplains, wetlands, estuaries and groundwater systems.

### River threats

Cradle Coast rivers are exposed to a range of threats resulting from direct actions on the waterway, broad-scale catchment activities, indirect specific actions, transference of impacts from up or down-stream, or from conditions occurring beyond the catchment. Some threats are also directly caused by the adoption of social and economic values we associate with our region’s waters.

River threats in the Cradle Coast region:

- > **Physical threats:** The physical environment of the river may be impacted by bed and bank erosion, modification of the channel, removal or modification of in-stream habitat structures, sedimentation, extraction of sand and gravel, and installation of infrastructure.

- > **Flow threats:** Modification of natural flows (magnitude, duration and frequency) via extraction and harvesting of water, regulation of flows, changes to catchment yields and to the exchanges between floodplains, groundwater and wetlands.
- > **Water quality threats:** Exceeding or trends toward exceeding recommended ranges of chemical, physical and biological water quality parameters including: salinity, electrical conductivity, dissolved oxygen, acidity/alkalinity, nutrients, heavy metals, pesticide pollutants, temperature, light, turbidity, suspended sediments, gross litter pollutants, faecal coliforms and viral and biological pollutants.
- > **Biological threats:** The condition and composition of plant and animal communities may be impacted by degradation and/or removal of riparian vegetation; the presence of introduced flora and fauna; growth of nuisance aquatic plants; pests and diseases; barriers to movement (especially fish migration), and unsustainable and illegal fishing.

Secondary threats which may impede the effective management of rivers are organisational barriers such as lack of coordination between neighbouring land managers and inadequate community participation and engagement.



Table 6: Program Logic for Rivers.

Rivers			
<b>Long-term outcomes</b>	Streams and rivers are managed to ensure functional aquatic ecosystems		
	Landscape connectivity	Waterways are protected	Flow is maintained
<b>Medium-term outcomes</b>	<ul style="list-style-type: none"> <li>&gt; Existing riparian buffers are maintained and improved and associated landscape connectivity is enhanced</li> </ul>	<ul style="list-style-type: none"> <li>&gt; Rivers and creeks are managed to improve water quality and aquatic environments</li> </ul>	<ul style="list-style-type: none"> <li>&gt; Environmental flows are maintained within current and proposed irrigation, mining and hydro catchments</li> </ul>
<b>Short-term outcomes</b>	<ul style="list-style-type: none"> <li>&gt; Increased landholder participation in riparian corridor planning projects</li> <li>&gt; Projects and investment are targeted towards consolidation of riparian vegetation</li> <li>&gt; Riparian revegetation is encouraged with staged weed removal and replacement programs</li> </ul>	<ul style="list-style-type: none"> <li>&gt; Agricultural practices are improved to minimise soil erosion, sedimentation and nitrification</li> <li>&gt; Stock access to riparian zones is minimised</li> <li>&gt; No further loss of aquatic species diversity</li> </ul>	<ul style="list-style-type: none"> <li>&gt; Environmental flows are maintained to ensure sufficient water to support the needs of the entire riverine ecosystem</li> </ul>
<b>Outputs</b>	<ul style="list-style-type: none"> <li>&gt; Landholders and communities are actively improving riparian zones and monitoring environmental flows</li> </ul>		

### Focus for action

Improving the quality of our waterways was identified from regional community feedback as the highest priority as many values and activities are associated with the availability and use of clean rivers.

Prevention of soil erosion and the vegetation condition along streams were identified as the highest priority issues in the region. To prevent soil erosion, the focus for action in the 2015-2020 period is to plant buffers along waterways and minimise stock access to creeks and streams while improving landscape connectivity.

Priority catchments for these activities are the Rubicon, Inglis and Mersey or in combination with other water quality improvements identified in the productive landscapes section (see Figure 2 page 19). The strategy is to consolidate the outcomes of past investments on riparian corridors, and promote collective uptake of preventative activities at the landscape scale (see Collective Action page 12).

### Adaptation opportunities for rivers

A key issue under climate change is reduced summer flow of the region's rivers particularly in conjunction with intensified agriculture and a reliance on irrigation. The expansion of irrigation schemes with climate change also poses significant threats to environmental flows for rivers within agricultural zones in North West Tasmania, and also affects farmers downstream.

An effective approach to ensure equity in water use and maintain environmental flows is the use of collective water management models where farmers and stakeholders (including regulators) jointly decide on water usage levels across farms within the catchment. This approach allows for seasonal flexibility, adaptation to climate change and local monitoring by the collective group to ensure sustainable use and maintenance of the ecosystems.

Riparian planting for shade offers the most cost-effective adaptation option for restoring river health and aquatic life (Barmuta et al, 2013) under climate change. This action is consistent with the priority in this Strategy on revegetation of riparian buffers.

## Our Wetlands

Wetlands include standing surface waters which may be fresh, saline or brackish and may be estuary, river or groundwater dependent. The region's wetlands can be found from the alpine areas to the coastal zone in permanent, seasonal or occasional states.

Such a diversity of wetland types provides for a diversity of habitats and species. This dependence is evident in many migratory bird species and the specially-adapted cave fauna found in the region's karst systems.

The Lavinia State Reserve on King Island, incorporating the Sea Elephant River estuary, features a perched (groundwater) lake and extensive *Melaleuca ericifolia* swamps acknowledged as a wetland of international significance through its nomination as a Ramsar site.

On the far north-west coast the Robbins Passage and Boullanger Bay wetlands combine saltmarshes, paperbark swamps, intertidal flats and subtidal areas. These wetlands are considered an internationally important site for migratory birds and provide shoreline and seabed stability, maintain water quality, and contribute to carbon sequestration.

In the west of the region there are blanket bogs formed by peat soils of buttongrass moorlands, unique permanently stratified lakes along the Gordon River and glacial lakes on the Sticht and Tyndall Ranges.

Subterranean karst wetlands are also present in the region at Dismal Swamp in the far north-west and the Vale of Belvoir in the alpine area north of the Cradle Mountain- Lake St Clair National Park.

Of all the vegetation groups within the Cradle Coast NRM region, wetlands are the least protected in formal reserves in the King and Northern Slopes Bioregions (<10%), and the future of wetlands in these bioregions relies mostly on private landholders. Adjacent paperbark (*Melaleuca ericifolia*) swamp forests

are also important wet forest ecosystems in the north-western tip of Tasmania which are listed as threatened native vegetation communities under the *Nature Conservation Act 2002*.

## Components of healthy wetlands

A healthy wetland, as for a healthy river, is one in which key components of flow regime, geomorphology, water quality, wetland vegetation and supported life remain near to natural in order to maintain core ecosystem functions.

A healthy wetland has the capacity to maintain a balanced ecological system, is resilient to enable condition recovery after disturbance, and can continue to provide environmental, economic and social benefits.

## Wetland threats

Wetland threats in the Cradle Coast region:

- > **Physical threats:** Modification of the wetland through land reclamation, urban development or other activities to convert the wetland or surrounding areas to other uses; physical disturbance by recreational activities, fire or stock access; excavation of materials; and installation of water harvesting infrastructure such as bores and dams. Grazing and clearing of coastal *Melaleuca* forest on the fringes of farms can also contribute to coastal erosion and sea inundation.
- > **Water regime threats:** Extraction of water for stock and domestic purposes; drainage of wetlands to convert to other land uses; construction of dams in the wetland or in streams and rivers flowing into the wetland.
- > **Water quality threats:** Pollution from catchment activities and upstream sources including industrial discharges, agricultural and forestry run-off and urban development; sedimentation from upstream and catchment erosion, and faecal pollution from direct stock access.



> **Biological threats:** Degradation of vegetation communities through clearance of wetland margins; harvesting of vegetation; introduction of weeds and other nuisance plant growth; trampling and consumption of vegetation by stock; and destruction of vegetation by fire, recreational activities and vehicle access. Plant and animal life dependent on a wetland may be impacted by wetland threats

described above or directly by introduced species, pests and diseases, hunting and destruction of habitat and breeding sites.

Secondary threats which may impede the effective management of wetlands are organisational barriers such as lack of coordination between neighbouring land managers and inadequate community participation and engagement.

Table 7: Program Logic for Wetlands.

Wetlands			
<b>Long-term outcomes</b>	Wetlands are valued and protected on both public and private land		
	<b>Wetlands are valued</b>	<b>International significance</b>	<b>Adjacent practices improved</b>
<b>Medium-term outcomes</b>	> Landholders understand and appreciate the value of ecosystem services provided by wetlands	> Greater awareness of the national and international value of wetlands	> Impacts from adjacent land use are minimised
<b>Short-term outcomes</b>	> Wetlands are valued for their habitat, diversity of flora and fauna, flood mitigation and water filtration benefits	> The community has a better understanding of the important wetlands in the region for migratory birds	> Stock access to wetlands is minimised > Vegetation clearing and disturbance to wetlands is avoided > Natural flows into wetlands are maintained
<b>Outputs</b>	> Landholders and communities are actively protecting wetlands from grazing and human impacts		

### Focus for action

Regional community feedback indicates that working with private landholders to protect wetlands is a high priority for the region and raising awareness of the value of wetlands is needed.

In a review of wetlands in the region (Dunn, 2005), a large proportion of private wetlands in poor condition were identified on King Island (for example Lake Flannigan) and the focus for action will be to improve the condition of wetland surrounds in cooperation with landholders and land managers.

### Adaptation opportunities for wetlands

Wetlands are at risk of drying with increasing temperature and reduced rainfall, particularly when combined with reduced inflows caused by agricultural demand for water. Some wetlands naturally experience dry periods, but greater consideration of water flows for permanent wetlands is needed.

Opportunities exist to conserve and improve existing wetlands and monitor water inflows so that their rich biodiversity can be retained. Conserving vegetation on the banks and adjacent areas provides a more resilient environment to reduce evaporation, maintain groundwater flow and assist in improving water quality.

## Our Groundwater

Groundwater is water located and sourced from below the earth's surface, but has close links with surface rivers and wetlands. The connectivity of surface and ground waters is determined by the relative levels of the aquifer and stream bed and the permeability of materials between the two.

Evidence of surface and groundwater connectivity can be seen in Groundwater Dependent Ecosystems (GDEs). These are unique ecological systems which are dependent on specific groundwater flows, fluctuations in level or pressure, or on water quality such as mineral content.

The major types of Groundwater Dependent Ecosystems found in the Cradle Coast region are:

- > Terrestrial vegetation communities such as Paperbark swamps
- > River base flow systems where the flow in a stream is only fed by groundwater during low rainfall periods, such as with King Island streams
- > Aquifer and cave systems including karst aquifers in which water dissolves the relatively soft rock increasing the size of the fracture and creating underground cave systems, and karst water springs found around Smithton and Gunns Plains
- > Wetlands and lakes
- > Estuarine and near-shore marine ecosystems.

## Components of healthy groundwater

Limited understanding of the region's groundwater warrants a precautionary approach to describing a healthy groundwater system. For the purposes of this Strategy a healthy groundwater system is defined as one which is able to maintain the natural balance between recharge and discharge water flow.

Factors contributing to net natural flow are the volume and quality of water entering by

rainfall; flow in from surface water systems or water rising from aquifers below; the volume of water extracted by irrigation or by evapotranspiration; and the flow out to surface waters or into deeper aquifers.

## Groundwater threats

Groundwater threats in the Cradle Coast region:

- > **Physical threats:** Modification of the groundwater systems through installation of groundwater bores; physical disturbance by recreational activities; and disturbance of surface-based groundwater dependent ecosystems by urban development, agriculture or recreational activities.
- > **Land use and water use changes:** Over-allocation and extraction of water for irrigation purposes, both directly and via connected surface water systems; or change in land use such as regrowth forests which result in reduced groundwater replenishment.
- > **Water quality threats:** Pollution leakage from surface waters and catchment discharges including domestic, industrial, urban and agricultural land uses.
- > **Biological threats:** Plant and animal life dependent on groundwater may be impacted by the other groundwater threats such as poor water quality or reduced water availability.

Secondary threats which may impede the effective management of groundwater are organisational barriers such as lack of coordination between neighbouring land managers and inadequate community participation and engagement.



Table 8: Program Logic for Groundwater.

Groundwater		
<b>Long-term outcomes</b>	Use of groundwater for agriculture is sustainable	
	Monitoring	Improved management
<b>Medium-term outcomes</b>	> Groundwater levels and quality are monitored	> Water use efficiency is optimised, and irrigation salinity is minimised
<b>Short-term outcomes</b>	<ul style="list-style-type: none"> <li>&gt; Water quality improvement plans are adopted in irrigation lands</li> <li>&gt; Project investment is secured for groundwater and water use monitoring</li> </ul>	<ul style="list-style-type: none"> <li>&gt; Awareness of irrigation driven salinity processes is increased</li> <li>&gt; Role of vegetation in managing salinity is well understood</li> <li>&gt; Irrigators are managing soil moisture levels</li> </ul>
<b>Outputs</b>	> Landholders and communities are collectively managing groundwater and river extraction rates	

### Focus for action

Actions to manage salinity were identified in the regional community feedback as a high priority for groundwater, followed by improved water allocation planning.

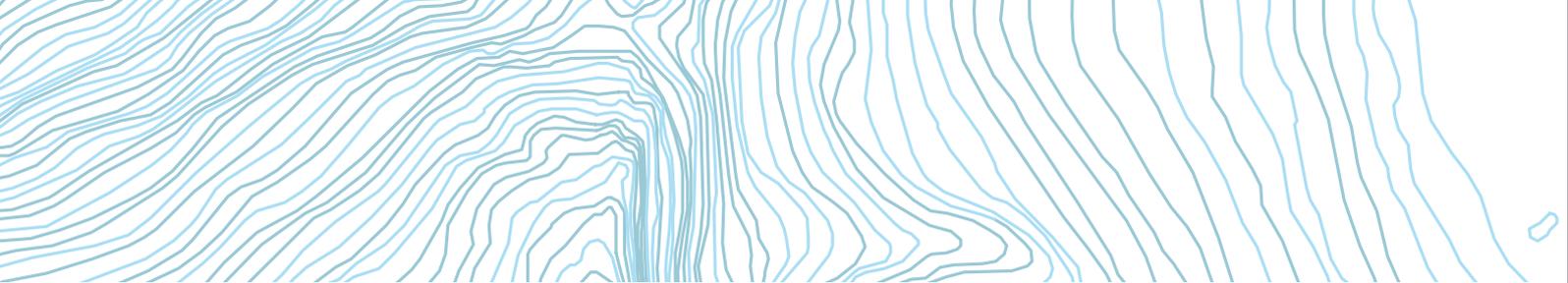
Priorities for managing salinity are King Island, Robbins Island and parts of the Rubicon catchment. These areas require cooperative efforts with landholders to increase the area under vegetation cover and assist with evapotranspiration control, and quantitative monitoring of water recharge when irrigating.

Improved water allocation planning was an issue for landowners located in lower parts of the catchment (for example Lower Barrington), and the focus for action requires both a regulatory and participatory approach as described in the next section.

### Adaptation opportunities for groundwater landscapes

Climate changes are expected to create an increased dependence on groundwater across the region as seasonally fluctuating water sources such as rivers are impacted.

Collective water management models can again be deployed to assist in adapting to these changes. Collaborative decision making between different interest groups should be encouraged on water usage levels across catchments. This shared-monitoring approach promotes sustainable water use and will be more likely to deliver long-term groundwater ecosystem health.



Coastal geology at Somerset  
Photo: Ernst Kemmerer



### 3. COASTS

The natural resource of coasts has been defined to include coastlines, estuaries and oceans. The region's coasts are a focus for communities with the majority of towns being established close to these assets.

Coastal landscapes vary from exposed, rocky shorelines in the south-west and west to extensive sandy beaches and dunes north of Cape Sorell. The sheltered coast of the far north-west includes broad intertidal flats and salt marshes. Eastwards from Circular Head, coastal development has significantly modified landscapes with increasing town sizes traveling from Wynyard to Devonport.

There is extensive evidence of the strong historical connection of the Aboriginal community to the coast ranging from small scattered artefacts left from skin preparation, hut building and spear making, to large middens spanning thousands of years of food gathering and living on the coast. Aboriginal places also include rock shelters with painted walls, hut depressions and rock carvings. Some of these sites are considered sacred as they were used for handing down tradition, such as initiation ceremonies, corroboree and storytelling. Aboriginal community groups today help preserve the knowledge and connection to their ancestors for future generations.

#### Our Coastlines

Coastlines mark the boundary between the region's marine environment and land environment and their reach inland varies with the vegetation communities and land formations that they contain.

The region's coastlines support important vegetation including coastal heath, grasslands, wetlands, salt marshes, dry and wet sclerophyll forest and rainforest. Significant fauna communities are also dependent on the region's coastlines such as seal, penguin and resident and migratory seabird colonies.

#### Components of healthy coastlines

Healthy coastlines are naturally dynamic

systems whose landforms are moulded by the wind and waves, and whose vegetation communities are uniquely designed for such challenging environments.

While each coastal environment will have its own specific requirements, in general, healthy coastal ecosystems maintain natural rates of deposition, erosion and sediment transport mechanisms; native vegetation cover of similar composition, structure and extent as naturally occurs; sufficient protection of fauna habitat including breeding sites; and the integrity of cultural heritage sites.

#### Coastline threats

Coastline threats in the Cradle Coast region:

- **Physical threats:** Damage to coastal landforms, including acceleration of erosion processes, may be caused by livestock disturbance; recreational activities and vehicles; modification of landforms for agricultural development; and installation of infrastructure for industrial or urban development. Grazing and clearing of coastal Melaleuca forest on the fringes of farms can also contribute to coastal erosion and sea inundation.
- **Biological threats:** Vegetation communities may be degraded through clearance; introduction of weeds and non-native plants; trampling and consumption of vegetation by stock; and destruction of vegetation by fire, recreational activities and vehicle access.
- **Climatic threats:** Sea level rise, increased storm events and alterations to tidal movements are expected to change current sediment transport patterns.

Secondary threats which may impede the effective management of coastlines are organisational barriers such as lack of coordination between neighbouring land managers and inadequate community participation and engagement.

The coastline threats identified may also have a negative impact on the integrity of cultural heritage sites.

Table 9: Program Logic for Coasts.

Coasts			
<b>Long-term outcomes</b>	Coastal landscapes are well managed for natural values and other compatible uses		
	Impacts are managed	Shorebirds are respected	Habitat is improved
<b>Medium-term outcomes</b>	<ul style="list-style-type: none"> <li>&gt; Impacts and encroachment on coastal areas is minimised</li> </ul>	<ul style="list-style-type: none"> <li>&gt; Shorebird populations are protected and maintained</li> </ul>	<ul style="list-style-type: none"> <li>&gt; Coastal habitat is maintained for species diversity and viability</li> </ul>
<b>Short-term outcomes</b>	<ul style="list-style-type: none"> <li>&gt; Access to coastal ecosystems is managed as a shared resource</li> <li>&gt; Litter from ground based sources and marine activities is reduced through increased education and awareness</li> </ul>	<ul style="list-style-type: none"> <li>&gt; Communities are involved in containing domestic animals from penguin and shorebird breeding areas</li> <li>&gt; Feral predators are controlled in key breeding areas</li> </ul>	<ul style="list-style-type: none"> <li>&gt; Coastal weeds are actively managed with sustainable actions and funding</li> <li>&gt; Coastal erosion is minimised and managed</li> </ul>
<b>Outputs</b>	<ul style="list-style-type: none"> <li>&gt; Communities are actively engaged in improving habitat of coastal landscapes and reducing litter levels</li> </ul>		

## Focus for action

The regional community feedback identified the coastal priorities to be litter control, feral animal control and weed control. Preference for these activities was given to improve habitat for species in decline and areas of public land that are in poor condition. Habitat improvement and extension were also identified as priorities in community workshops.

Focus for action areas include:

- > Prevention of coastal litter through improved urban drainage and design (trap litter)
- > Penguin habitat improvement projects at Port Sorell, Lillico Beach, Sulphur Creek, Doctors Rocks and Wynyard
- > Improved protection of coastal habitat from uncontrolled traffic through a combination of education, signage, patrol and licencing
- > Proactive fire management to maintain biodiversity values and protect fire sensitive vegetation
- > Mapping and protection of Aboriginal heritage sites and Places of Significance.

## Adaptation opportunities for coastal landscapes

Coastal areas are likely to be impacted by climate change with rising sea levels, and the regional community feedback emphasised maintenance of natural habitat rather than building infrastructure against sea level rise. This option provides the best opportunity for ecosystems to adapt to climate change. Areas with a natural interface to the oceans and estuaries need to be maintained and protected to allow for natural change to occur.



## Our Estuaries

Estuaries are the transitional zones between rivers or streams and the marine environment and are one of the most productive ecosystems. They are important places where fish, birds and animals of all varieties feed, find refuge, grow to adulthood and stage migrations.

There are 38 estuaries in the Cradle Coast region. The variation in the shape of the coastline, climate, types of rivers and different stages of land evolution results in the formation of different types of estuary. Many of the region's towns are located on estuaries and as a result they are a focal point for community cultural and recreational activities, tourism and marine-based industries. The Mersey estuary at Devonport hosts a large commercial port and is the transit point for the Spirit of Tasmania, the main non-aerial passenger transport route into the State.

Aquaculture is important in the region with oyster farms well established in the Rubicon estuary, Duck Bay and Robbins Passage and a successful salmon farming industry based in Macquarie Harbour.

## Components of healthy estuaries

A healthy estuary, as for a healthy river, is one in which key components of flow regime, geomorphology, water quality, wetland vegetation and supported life remain near to natural in order to maintain core ecological processes.

A healthy estuary has the capacity to protect saltwater-freshwater exchanges, provide a suitable variety of habitats and environmental conditions to support a diversity of in-stream and streamside life, and to provide adequate connectivity to rivers, wetlands, oceans and groundwater systems.

## Estuary threats

Estuary threats in the Cradle Coast region:

- > **Physical threats:** Modification of the estuary through urban foreshore development and dredging; infrastructure to support marine farming operations; infrastructure such as boat ramps to support recreational and tourism activities; and accelerated bed and bank erosion.
- > **Water quality threats:** Increased siltation resulting from land clearance and urban and rural runoff; increased nutrients resulting from sewage and agricultural use of fertilisers; urban and rural effluent discharges; and acidification of rivers and heavy metal pollution from mines.
- > **Flow threats:** Regulation of water flow through dams and weirs; and upstream extraction of freshwater for stock and domestic purposes.
- > **Biological threats:** Clearance of vegetation; the introduction of weeds or non-native plants; and the destruction of vegetation by fire, recreational activities and vehicle access.
- > **Climatic threats:** Sea level rise, increased storm events and alterations to tidal movements are expected to change current sediment transport patterns.

Secondary threats which may impede the effective management of estuaries are organisational barriers such as lack of coordination between neighbouring land managers and inadequate community participation and engagement.

Table 10: Program Logic for Estuaries

Estuaries		
<b>Long-term outcomes</b>	Estuaries are recognised for their biological values and economic importance for fisheries, tourism and recreation	
	Estuaries are valued	Improved water quality
<b>Medium-term outcomes</b>	> Community understanding of the value of ecosystem services provided by estuaries is increased	> Estuary health is improved through whole of catchment water quality improvement plans
<b>Short-term outcomes</b>	> Participation and education in estuarine monitoring programs is increased	> Cost-effective water quality monitoring is adopted to assess the ongoing health of estuaries
<b>Outputs</b>	> Communities and governments are working together to assess catchment health through monitoring of estuarine condition	

## Focus for action

The regional community feedback showed that raising awareness on the value of estuaries and encouraging responsible enjoyment of estuaries were the highest priorities for estuaries in the region. The regional community showed a preference towards improved urban planning and maintaining habitat rather than building infrastructure against sea level rise.

Estuary health and management starts at the headwaters, so the focus for actions are linked to actions for whole-of-catchment improvement.

Focus for action areas include:

- > Involving the community in whole of catchment water quality improvement planning;
- > Local evaluation of key estuarine habitats for protection, conservation and adaptation to changing sea levels; as well as maintenance of habitat in estuaries subject to sea level rise ;
- > Limiting infrastructure development to existing developed estuaries and protecting natural estuaries

from further encroachments;

- > Strategic protection of critical habitat for rice grass control in the Port Sorell, Rubicon and Duck estuaries;
- > Minimising litter entry from ground based sources through improved water sensitive urban design (as per rivers and urban landscapes); and
- > Supporting ongoing monitoring of salt marsh and other critical habitats to sustain fishing/aquaculture industry and biological diversity.

## Adaptation opportunities for estuaries

Ecosystem concepts of resilience to change and adaptation apply well to estuaries which are constantly undergoing change, particularly tidal estuaries. Of equal importance is the concept of thresholds or limits to change such as excess sedimentation or pollution events which can devastate industries reliant on healthy estuarine systems such as oyster farming.

The Duck River exceeds all nutrient thresholds in the mid to lower parts of the catchment for an estuary and this has a direct impact on oyster farming. The twofold industries of dairy and oysters creates an opportunity for improved river health as an economic value is now placed on effluent and nutrient loads. Where there is a lack of direct economic benefit, monitoring for estuarine health will continue to be an important aspect to the sustainability of our region's estuaries and fishing industry.



## Our Oceans

Oceans are the marine environment beyond the region's coastlines. The Cradle Coast region is bounded by Bass Strait to the north and the Southern Ocean to the west. The major current acting on the region is the Zeehan Current which flows across the Great Australian Bight from Western Australia and down the west coast of Tasmania.

Mapping of inshore marine habitats across the region's north coast from West Head to Robbins Passage has shown that although sand is the chief habitat, rocky reefs, cobble and seagrass beds also make up significant proportions. Less is known of the marine environment surrounding King Island and off the West Coast.

The region's marine waters are rich in diversity and support a variety of commercial fishing industries. Rock lobsters and abalone are harvested along the west coast, off the far north-west part of the region and around King Island. There are over 50 species commercially fished in the region including garfish, Australian salmon, flounder, warehou, mullet and flathead and King Island and the West Coast also have well established local kelp collection and processing operations.

Marine resources were historically important to the Aboriginal community and early European settlers. Near-shore fish traps on the north coast and extensive middens of the west coast are indicative of the strong connection the Aboriginal community had, and continues to maintain, with the marine environment. European cultural heritage is also linked to the sea as evidenced by stories of sealers and the shipwrecks found along the coast.

## Components of healthy oceans

Healthy oceans are able to balance the economic and social benefits that they provide with their environmental condition. In healthy marine environments natural levels of complexity, biodiversity, water quality and population age structures are maintained with opportunities for sheltering and growing marine species such as invertebrates, fish, algae and seagrasses.

In healthy environments, marine water characteristics of temperature, light, nutrients and acidity/alkalinity also remain within ranges suitable for the survival and reproduction of local marine species.

## Ocean threats

Ocean threats in the Cradle Coast region:

- > **Physical threats:** Habitat damage caused by recreational and commercial fishing; marine-based industrial activities; coastal infrastructure development; and extreme weather events.
- > **Biological threats:** Establishment of non-native or pest species; unsustainable commercial and recreational fishing and harvesting.
- > **Climatic threats:** Changes to light and temperature regimes and nutrient cycling caused by climate change impacts on regional ocean currents.
- > **Water quality threats:** Pollution from agricultural lands, urban development, industrial and urban discharges, oil and gas extraction, aquaculture, shipping, tourism and fishing.

Secondary threats which may impede the effective management of marine environments are organisational barriers such as lack of coordination between neighbouring land managers and inadequate community participation and engagement.

Table 11: Program Logic for Oceans

Oceans		
<b>Long-term outcomes</b>	Oceans are a valued ecosystem and sustainably managed for multiple uses	
	Reduced pollution	Increased awareness
<b>Medium-term outcomes</b>	> Local Government, State Government, industry and NRM are working together to reduce flow of land based pollutants and debris to marine environments	> Deep ocean and marine research programs are adequately funded and focussed on sustainable management of ocean values
<b>Short-term outcomes</b>	> Land based pollution flow into ocean environments is minimised	> Programs for education and raising awareness of the value of Tasmanian marine life are continued
<b>Outputs</b>	> Communities and governments are working together to reduce sources of marine debris.	

## Focus for action

The regional community feedback showed that raising awareness of Tasmanian marine life and marine science research were the highest priorities followed by litter reduction and managing urban water runoff. Cradle Coast NRM will continue to focus on education and awareness, while the Institute of Marine and Arctic Studies (IMAS) and CSIRO are the major players in ocean research. DPIPW regulate the fishing industry in Tasmania.

## Adaptation opportunities for oceans

Acidification of oceans with increasing CO<sub>2</sub> levels represents one of the key threats to marine life in oceans, and the opportunity for change requires national and international cooperation to curb emission levels. Warming temperatures will also impact on species distribution, breeding times, growth rates, unwanted species incursions, damage to sea coral and coral bleaching.

Ocean warming is already showing evidence of impacting giant kelp forests (*Macrocystis*

*pyrifera*) with southward movement of warmer currents likely to affect a range of species across very large areas (Wernberg, 2011). One species on the rise is the sea urchin which grazes on kelp, and is typically controlled by predators such as abalone. Adaptation opportunities involve more active management for sustainable abalone fisheries and proactive sedimentation management to aid the survival of our kelp forests.

Marine debris from shipping and land-based runoff represents a serious threat to marine life and is one aspect where regional human activities can influence change. Litter reduction incentives, control and regulation were shown to be a high priority for the regional community and are particularly needed with the increased use of packaging in food delivery and consumption.



Coastal view of Stanley  
Photo: Ernst Kemmerer

# Implementation and Continuous Improvement

## Implementation

There are a significant number of government and non-government organisations and industries that depend on the healthy condition of the ecosystem for ongoing prosperity. These stakeholders include agriculture, aquaculture, fisheries, forestry and tourism.

Often, dual or competing industries such as tourism and forestry or dairy and oyster farming are discussed in the environmental arena with a view to shutting down one industry in favour of the other ('polarisation' of the debate). A mature understanding of natural resource management recognises that NRM is a collaborative approach across all sectors for the economic, social and environmental health of the region. Four pillars of effective NRM in the region are the notions of participation, responsibility, stewardship and duty of care towards the environment (generally termed 'social licence' to operate).

The future of the region depends on understanding differing scales and intensity of industries and how they can impact on the natural resources of the region. For example, intensification of the dairy industry needs to go hand-in-hand with improved effluent and riparian vegetation management, or even recognising limits to production - to ensure the sustainability of the oyster industry. Similarly, there are many industries such as fishing, aquaculture, forestry and so forth that can improve short-term economic performance at the risk of long-term detriment to the environment.

Water quality improvement plans are an example of government, industries and the community working together to share the responsibility for river health and these types of collaborative arrangements will be the main focus of NRM bodies over the next five years.

## Community partnerships

Levels of volunteer workers in the region are above the national average and contribute significantly to the economy of the region (Muller, 2014). The region has over 35 volunteer groups that regularly participate in NRM activities and are often recipients of Australian Government funding from Cradle Coast NRM.

To work better with volunteer groups, the 2015-2020 strategy is to develop three-way partnerships in NRM with local government or industry working with community groups to leverage funding and maximise the use of NRM investment in the region.

## Government

All three levels of government (local, state and federal) play an active role in supporting the effective delivery of natural resource management actions within the Region.

Local government can play a major role through land use planning that recognises natural values (for example as described by State and Federal biodiversity legislation) and approving development that is compatible with the wise use of natural assets. Within the region, local councils also fund local projects, and support community focused activities, and initiate programs to address local needs. Collaborative approaches with local government, other agencies, NRM groups, business and industry enable return for investments in natural resource management to be maximised through the more efficient use of project resources.

The Australian Government contributes to the management of the Region's natural assets by ensuring the protection of areas of national significance, administration of national environment legislation, and allocation of national funding schemes.

The actions identified in this Strategy seek to consolidate the links between government agencies and non-government bodies in

**AIR  
ENERGY  
NOISE  
RECYCLING  
WATER  
WASTE**

## CASE STUDY A

### Fonterra Australia Wynyard



Fonterra employs 110 people at its Wynyard cheese making plant. This site was established in 1892 as the Table Cape Butter Factory. Annually over 34 000 tonnes of cheese and 2 200 tonnes of whey protein concentrate is produced from this factory.

Fonterra is committed to continuous environmental improvement and is ISO 14001 certified. Having an EMS yields long-term cost savings in energy, water and waste across the entire supply chain.

#### KEY INITIATIVES

- > Energy efficiency and recapture – investment in gas-fired electricity and recapture of excess heat for cheese processing (co-generation plant)

- > Minimising waste through value added products such as organic fertilisers
- > Noise reduction with acoustic barriers, smart timing and plant upgrades
- > 24/7 monitoring of inputs and outputs (loss monitoring)
- > Towards 100% recycling of waste
- > Planned tertiary treatment of water

*"I care for the environment. I want to make sure our kids have a great place to live."*

**Greg O'Rourke**

*Regional Environment Manager*



Photo from left:  
Noise reduction barriers  
Co-generation plant  
Waste Treatment

Photo top right:  
The former Table Cape  
Butter Factory was submitted for  
listing by Fonterra in 2012 and is  
now part of Tasmanian Heritage

order to increase community returns from natural resource management investment. In addition, the Strategy contains explicit actions designed to engage non-traditional government agencies (e.g. tourism) in future natural resource management activities.

## Industry and Business

There are many industries in the region that rely on natural resources to be in a healthy condition for continued prosperity. These groups include agriculture, aquaculture, fisheries, forestry and tourism. The Strategy for the next five years is to encourage industry to embrace the use of environmental management systems (EMS) to optimise environmental performance (see EMS page 41). EMS also involves assessment of internal and external risks to the industry, and this strategy includes climate change adaptation opportunities as a necessary step in risk assessment and management.

Industry and Business can contribute significantly to natural resource management and sustainable growth of the region through environmental stewardship and adaptive management as shown in the examples on pages 43 and 44.

All organisations in the region are encouraged to identify areas where their plans and programs align with this Strategy. Service providers can also play an active role in natural resource management stewardship and promotion of best practice in the application of pesticides, weedicides, and fertilisers.

An important role of the private sector is through the voluntary private land conservation program. This program is managed by DPI/PWE as the Protected Areas on Private Land Program under the *Nature Conservation Act 2002*. Private organisations such as The Tasmanian Land Conservancy offer to work

with landholders to identify irreplaceable habitats for protection, manage permanent reserves, or identify parts of land parcels that provide unique benefits for conservation.

## Continuous Improvement

### Monitoring, evaluation, reporting and improvement framework

Natural resource management is a process of continuous improvement towards regional aspirations, and this requires tracking progress towards targets and measuring the 'before and after' condition of our natural resource assets.

The Monitoring, Evaluation, Reporting and Improvement (MERI) framework is a formalised approach to the traditional *Plan, Do, Review* cycle to measure the performance of projects in achieving environmental targets for change or improvement. It can be applied to activities arising from this Strategy undertaken by individuals or groups, and provides accountability and information to funding bodies and the community on progress of the Strategy.

*Monitoring* is the deliberate collection of data about the activities undertaken and the state of natural assets. Constant monitoring against benchmarks will provide the data needed to understand long-term improvements or practice change.

*Evaluation* is the regular review of the appropriateness, effectiveness, efficiency and continuing impact of the actions undertaken. Evaluation can help to adapt plans and activities based on the knowledge gained.

*Reporting* is communicating the results of the activities, monitoring and evaluation in a transparent manner.

*Improvement* is ensuring that the monitoring and evaluation of activities is incorporated into current and future activity design and implementation.

# INNOVATION ADAPTATION TRANSPARENCY

## CASE STUDY B

### Tassal Macquarie Harbour



Tassal is a leader in production of Atlantic Salmon for domestic and international markets with ASC certification. Tassal employs over 1100 people and it has a strong organisational drive for environmental performance, product quality, and innovation.

Precision monitoring systems with data capture, feedback control and business intelligence are a prominent feature of its operations from hatchery through to feeding, harvesting and preparation.

#### KEY INITIATIVES

##### INNOVATION

- > Tough kikko nets to minimise interaction with wildlife (seals and birds)
- > Colour coded rope to quantify Tassal sourced rope during ocean and shoreline clean-ups
- > Development of semi-automated mechanical net cleaning replacing the need for copper anti-fouling agents

##### ADAPTATION

- > Selective breeding program to optimise salmon quality and growth for Macquarie Harbour
- > Constant monitoring and analysis of output data to improve production and environmental performance
- > Embedded organisational culture for quality and environmental improvement
- > Precision nutrient feed systems adapted to salmon growth stage and sea conditions to minimise environmental impacts

##### TRANSPARENCY

- > Independent DPIPW water quality monitoring stations
- > Annual sustainability reports
- > Website and dashboard on incidents and controls
- > Community forums to address issues and drive change



Photo from left:  
Quality control and testing  
Feed monitoring station  
Constant water quality  
monitoring at depth.

Photo top right:  
Smolt being transported into  
Macquarie Harbour after one  
year in the hatchery.

Cradle Coast NRM applies the MERI framework to evaluate individual projects for improvements or practice change and encourages the development of a consistent state-wide MERI system for government, industry and the community.

## Adaptation pathways

The landscape in which we live is constantly changing. Adaptive management is required to ensure we are able to adapt and respond to these changes. Environmental stressors such as climate change are important drivers for practice change as people, industries and economies adjust to cope.

In regard to practice change, this Strategy focusses on the agricultural sector and provides a range of adaptation opportunities or pathways for individuals or industries to consider. These include exploring new varieties or breeding strategies, developing pest and disease resistant strains, considering land use changes, and implementing soil and water conservation practices.

Our waterways and water quality are the highest priority for the region, so an important focus over the 2015 - 2020 period will be on adaptation options for rivers and monitoring of threshold levels for water quality in lower catchments.

With climate change, the region is projected to have warmer temperatures and higher rainfall events, so agricultural regions will need to have greater cover protection, soil erosion mitigation measures and riparian buffers to withstand periodic flooding and allow for water filtration. Key adaptation options are improving the width and quality of riparian revegetation, keeping stock out of rivers and adoption of best practice for cropping and soil erosion mitigation.

The mining industry will also need to play a part in ensuring adequate sized settlement ponds and pollution traps to accommodate larger rainfall events and to help protect our waterways.

## Lead agencies and partnerships

The Department of Primary Industries Parks Water and Environment (DPIPWE) is a key player in the regulation and management of natural resources, our natural landscapes and coastal areas, and for the sustainable growth and development of productive agricultural land.

DPIPWE's natural heritage conservation strategy outlines its priorities in the areas of conservation of flora and fauna; effective biosecurity; sustainable use of ecosystem resources and services; climate change adaptation and impact mitigation measures; and strengthening of partnerships. Key areas of activities over the 2015 – 2020 period, from a range of State Government initiatives, are as follows:

- Natural values assessment in World Heritage Areas to continue, with identifying research gaps and priorities (DPIPWE). This will be coupled with improved desktop management of Natural Values Atlas (NVA), fire history and species recovery plans to enable public access to the NVA and Australian Living Atlas.
- The Natural Heritage Strategy includes geodiversity and geo-conservation programs to better understand, protect and promote the importance of Tasmania's unique geodiversity including the geology, geomorphology, soils and processes forming or maintaining these features (DPIPWE). This means that our scenic values and foundation for living organisms can be conserved for current and future generations to enjoy.
- Coastal hazard, inundation and erosion assessment work to continue to support local and state government planning for climate change. Extensions to this work will include coastal values mapping for community benefit (DPAC).
- Land use, soils and vegetation mapping to improve extent and capability to underpin regional planning including enterprise suitability mapping, soil vulnerability, protected agricultural lands and compatible irrigation expansion opportunities (DPIPWE).

# CONSERVE SOIL HEALTH PRACTICE CHANGE DIVERSIFICATION

## CASE STUDY C

### Van Diemen Quality Bulbs Table Cape



Table Cape is an ancient volcanic plug with a basalt plateau that gives rise to its fertile soils. The Robert-Thompson's settled on Table Cape in 1910 and cleared the area for agriculture. In 1984 the family switched from stud farmed cattle and sheep to tulip bulb production.

Growing bulbs requires adapting equipment to improve productivity and to market conditions to match changing circumstances and consumer demand.

#### ADAPTIVE MEASURES

##### ADAPTIVE SOIL MANAGEMENT

- > Conversion from animal to 100% crop rotations to enhance soil nitrogen availability and simplify business practices
- > Changing cultivation from multiple passes to two machinery passes which has been shown to increase friable soil depth, enhance bulb productivity and reduce energy costs

- > Recovery of root-bound soil when harvesting liliuim crops

##### ADAPTIVE MARKETING

- > Switching from international to domestic markets during high Australian dollar
- > Combining tourism with agricultural production to enhance customer experience and expand marketing opportunities
- > Growing more variety in bulbs in lower volume to meet changing consumer preferences and current trends

##### NEW INITIATIVES AND RESEARCH

- > Future experiments with mixed cover crops
- > Explore methods to conserve soil organic matter and improve available nitrogen
- > Experimentation with soil microbes and crop rotations



Photo from left: Second cultivation pass using power harrow.

Product diversification with over 100 bulb varieties.

Two pass system gives 40cm friable depth

Photo top right: Soil health is essential to bulb production which requires 20cm of well drained fertile soil.

- Biosecurity is a top priority for all relevant departments in managing invasive species, border protection and quarantine. Consideration of climate change impacts, emergency response and updating legislation to be relevant to enable responsive action (DPIPWE).

Threatened species management unit to evaluate priorities, update recovery plans and provide reserve estate report cards. Flora management to continue at the community level to assist planning, while managing conservation issues for endemic species. Vegetation impact scenarios from sea level rise are also planned to be developed with contingency plans, for example identification of freshwater wetlands which are likely to transition to saline wetlands (DPIPWE).

- Monitoring of water quality continuously on six sites and periodically on 88 stream gauge stations on average five times per year with five key parameters of pH, turbidity, electrical conductivity, dissolved oxygen and temperature (DPIPWE).
- Fuel reduction burning with a staged implementation from 27,000 ha up to 60,000 ha per annum by year three. This will consist of strategic burning for asset protection and development of burn plans that consider flora, fauna and landscape assets (TFS and DPIPWE).

Local government has a key role in strategic land use planning for sustainable outcomes and work with communities to create an environment that guides the use of land to balance economic, environmental and social values. In achieving this, local government and urban growth development activities are required to comply with the *Environment Protection and Biodiversity Conservation Act 1999* and the *Threatened Species Protection Act 1995*.





# Strategic Context

## Our approach to developing the Strategy

This Strategy has been informed by:

1. Learnings from two previous NRM strategies
2. A regional community survey (276 participants)
3. Six regional community and interest group workshops (46 participants)
4. A State-wide workshop (26 participants)
5. Feedback and input from local government planning staff (7 participants)

The regional community survey shaped the NRM priorities while the regional workshops provided the detail around the priorities. The State-wide workshop identified strategic priorities regarding alignment of policies and programs, while local government identified opportunities for alignment.



## NRM planning Framework

Natural resource management is the sustainable management of our natural resources. The planning framework is designed to help the community, industry and government work together for a sustainable future. The roles and responsibilities within NRM are legislated under the *Natural Resources Management Act 2002*. There are a number of key organisations involved in the implementation of this Act.

The three Tasmanian NRM regions were created under the *Natural Resource Management Act 2002* as part of an integrated natural resource management framework for the State. The Cradle Coast NRM Committee was established as a committee of the Cradle Coast Authority in 2003 and comprises up to 15 members selected in accordance with the Act. The Committee has no regulatory role or powers but is responsible for a number of key functions including the development of a regional NRM strategy and to facilitate, monitor and report on its implementation.

The Cradle Coast regional Strategy reflects both the national priorities defined by the Federal Government, the requirements defined by the State Government's Natural Resource Management Act and the unique conditions, opportunities and challenges present or emerging in our region.

This Strategy document is based on a review of the goals and five-year actions identified in the 2010-2015 Cradle Coast Natural Resource Management Strategy.

The 2015-2020 Strategy builds on current natural resource management activities already underway in the region and recognises the positive contributions being made by landholders, land managers, Local, State and Federal Governments and community members and groups.

The Strategy is based on extensive input from community, industry, government and other stakeholders in both formal and

informal channels. The content reflects the continual engagement between Cradle Coast NRM and the region's natural resource managers. Feedback and input to the Strategy is an ongoing process and will shape the next strategy revision to be undertaken in 2020.

Cradle Coast NRM staff and Committee members will also continue to use this regional NRM Strategy to guide development of their own operational plans reflective of their available resources. An example process for developing an operational plan can be found on the Cradle Coast NRM website ([www.cradlecoastnrm.com](http://www.cradlecoastnrm.com)).

## Legislative and policy framework

The current *Natural Resource Management Act 2002* promotes a collaborative and participatory approach to environmental management in Tasmania. For this reason, there are no regulations or compliance features under the Act. This firstly serves the purpose of building community capacity by imparting knowledge, skills and education regarding environmental management, and secondly by administering funding or resources to community and landholders for environmental improvement programs.

A spectrum of legislation exists from compliance, planning and regulation, through to collaboration approaches. *The Natural Resource Management Act* is one of the few pieces of legislation designed to promote collaborative work across landscape and tenure. Where a regulatory or compliance approach is required, other legislation is designed for those specific areas of resource management; for example the *Environmental Management and Pollution Control Act 1994*. Both approaches are essential for effective overall environmental management and improvement.

The NRM bodies provide a means to link on-ground community and landholder activities and are guided by the regional NRM priorities, funding specifications, and state and national legislative and policy frameworks. The

Department of Primary Industries, Parks, Water and Environment (DPIPWE) is a key State agency that promotes appropriate development and conservation of resources through its programs and policies. For this reason the Strategy provides links to important national and state-wide policies and strategies often located within the DPIPWE website (refer to the knowledge gateway section for each asset theme).

## Principles of NRM

### Recognition of ongoing change

Change occurs due to natural processes and human intervention (anthropogenic). An example of short-term natural change in the region is the movement of estuaries and coastal sand dunes from wind and water. A long-term change has been seen in the variation of vegetation types such as cool-temperate rainforests replacing grasslands in the absence of fire. The region is also expected to have slightly warmer temperatures and rising sea levels as a result of climate change due to both natural and anthropogenic reasons. The role of the NRM Strategy is to outline community and government directions which mitigate accelerated change resulting from poor management practices. An example is increased soil loss caused from lack of ground cover, leading to loss of organic matter and carbon content, and having no mitigation measures in place such as mulching techniques.

### Adaptive

A change in management practice is needed when new information or techniques offer more cost-effective or efficient ways to carry out an activity, or when environmental or economic circumstances prevail against existing methods. For example, minimum tillage is known to increase yields by conserving soil moisture and organic matter. This practice is now becoming widely accepted for the agricultural landscape in this region, minimising the number of machinery passes to conserve soil structure.



The role of the NRM Strategy is to highlight key practice change through sustainable agriculture programs. In addition, the regional NRM Strategy provides detailed climate change adaptation options for 16 agricultural sectors to cope with increasing temperatures, greater variability in rainfall, and variation in frost frequency.

## Resilient

A resilient environment or natural system is able to survive, adapt and grow with changes in circumstances. It also describes a system's ability to return to equilibrium after a temporary disturbance. Many ecological examples show resilience built into natural systems and issues only arise when systems are taken beyond their normal thresholds or tipping points. For example, Southern Ocean acidity levels are expected to reach a tipping point beyond normal thresholds resulting in poor development of calcifying plankton and subsequent disruption to the marine ecosystem (McNeil and Matear, 2008). The flow-on effects of climate change will also impact industries such as rock lobster harvesting as temperature increases also increase the numbers of damaging sea urchins (Pecl et al, 2009).

Regional stakeholders across industry, community and government benefit from an awareness of landscapes and systems that are resilient to change or impacts (for example, fire adapted ecosystems), and others which are not so resilient to temporary change or impacts (for example, toxic waste in our streams) so that best management practices can be applied.

## Diversified

Diversification in natural systems provides greater resilience to change or catastrophic change. Product diversity for example between livestock production and cropping enables farmers to better manage risk with changing market prices. A key strength of the Cradle Coast region is its diversified agricultural base and presence of mixed farming. The role of the NRM Strategy is to encourage

diversity in ecosystems and economies to enable long-term sustainability for the region. A key challenge for the region is to manage global market forces which tend to encourage over-production in a single sector, without farmers necessarily realising long-term increases in revenue at the farm-gate.

## Principles of Natural Resource Management

The following principles of natural resource management identified in the *Tasmanian Natural Resource Management Framework* have been adopted in the creation of this Strategy:

- **Ecosystem approach** – Natural resource management should be based on an understanding of the relationship between natural resources and the ecosystems they support and upon careful monitoring of change over time.
- **Balanced decisions** – Natural resource management decisions should take proper account of the range of environmental, social and economic benefits, values and costs in accordance with the objectives of the Tasmanian Resource Management and Planning System.
- **Integrated management** – The management of natural resources should be integrated within regions and catchments, as well as across industry sectors, government agencies and specific issues.
- **Priority-based** – Natural resource management actions are to be undertaken according to priorities that are based on the best available science and information, and relevant experience, as well as on assessment of the relative cost-effectiveness of various options.
- **Prevention is better than cure** – It is often more efficient to prevent damage than to repair it. Therefore, 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.

- > **Partnerships** – To be effective, natural resource management requires the establishment of partnerships between all levels of government and the community, including the Aboriginal community, industry, landholders and individuals, with agreed roles and responsibilities.
- > **We are all responsible** – All Tasmanians receive benefits from the use, development and conservation of natural resources; they share responsibility for managing natural resources sustainably and for providing economic resources to do so.

## Regional Achievements

Two strategies have been developed for the Cradle Coast region since the introduction of the *Natural Resource Management Act 2002*. The first strategy (2005-2010) contained specific priorities, actions and targets for each of the asset groups. The second strategy (2010-2015) generalised the activities into 'focus for action' areas and knowledge gaps.

Under both strategies Cradle Coast NRM has worked with community and industry partners to deliver projects focussed on improving the way people consider and manage our natural resources. Over 10,000 people in the region have participated in organised NRM programs or activities. Hundreds of farm businesses, schools, community groups and other organisations have undertaken NRM related on-ground works or participated in education programs to progress best practice NRM across a range of areas.

- > Over 200 land managers have tested or implemented improved soil health and soil conservation monitoring and management practices.
- > Over 250 field days, workshops and training events have been conducted in partnership with community or industry

groups to encourage knowledge sharing and to assist in best practice adoption.

- > Over 50 major NRM partnerships have been created for the region to improve and deliver NRM education packages, improve protection for our region's unique biodiversity and forge opportunities for growth of sustainable agricultural systems.
- > More than 5000 ha of native habitat have been voluntarily restored or protected on private land ranging from alpine grasslands to riparian and coastal habitats.
- > More than 2500 ha of agricultural lands have been better managed for soil conservation. Partnerships with industry and research bodies have delivered trials of ripper mulchers and controlled traffic farming, and the introduction of dung beetles and stubble retention has improved the understanding of soil management for sustainable farming.
- > Approximately 100 ha of native vegetation has been planted for shelterbelts to improve farm productivity and biodiversity.
- > 1200 ha of wetlands have been improved or protected by community awareness, signage, weed control and managing access.
- > Over 3000 ha of Weeds of National Significance have been controlled, including 500 ha of boneseed resulting in enhancement of native heath, woodlands and forests.
- > Over 100 property management plans and/or reserve management plans were completed by Cradle Coast NRM or its regional partners.
- > Over 200 ha of habitat improvement works and fauna monitoring for threatened species have been completed such as the Tasmanian Devil, the Giant Freshwater Lobster and King Island Scrubtit.



- > Over 80 schools and 5000 students have participated in educational workshops and hands-on activities such as planting and weeding.
- > Over 10 management plans have been developed supporting community groups to protect and improve penguin habitat and native vegetation.

As shown above, programs have varied from riparian revegetation, weed and fire management, improving soil health and condition, improving coastal habitat for iconic species, and community education and capacity building. In order to continue working with communities, industries, government and non-government organisations, the 2015-2020 Strategy maintains a general approach of outlining focus for action areas. In addition, program logic has been developed for each theme and a section on adaptation-mitigation opportunities has been included. The 2015-2020 Strategy also clearly states the priorities for action, enabling collaborative efforts across the region to be both targeted and sustainable relative to local community priorities.



*"Inspiring our kids"*  
Photo: Belinda Colson

# Knowledge Gateway

## Natural Landscapes

Key Document	Weblink
> Natural Heritage Strategy for Tasmania 2013-2030	<a href="http://dipwwe.tas.gov.au/Documents/NaturalHeritageStrategy2013.pdf">http://dipwwe.tas.gov.au/Documents/NaturalHeritageStrategy2013.pdf</a>
> Draft Tasmanian Wilderness World Heritage Area Management Plan	<a href="http://dipwwe.tas.gov.au/conservation/tasmanian-wilderness-world-heritage-area/new-tasmanian-wilderness-world-heritage-area-management-plan">http://dipwwe.tas.gov.au/conservation/tasmanian-wilderness-world-heritage-area/new-tasmanian-wilderness-world-heritage-area-management-plan</a>
> <i>Tasmanian Vegetation Map</i>	<a href="http://dipwwe.tas.gov.au/conservation/flora-of-tasmania/monitoring-and-mapping-tasmanias-vegetation-(tasveg)/tasveg-the-digital-vegetation-map-of-tasmania">http://dipwwe.tas.gov.au/conservation/flora-of-tasmania/monitoring-and-mapping-tasmanias-vegetation-(tasveg)/tasveg-the-digital-vegetation-map-of-tasmania</a>
> <i>Lists of Threatened Species for Tasmania</i>	<a href="http://dipwwe.tas.gov.au/conservation/threatened-species/lists-of-threatened-species/threatened-species-invertebrates">http://dipwwe.tas.gov.au/conservation/threatened-species/lists-of-threatened-species/threatened-species-invertebrates</a>
> <i>List of Invasive Species for Tasmania</i>	<a href="http://dipwwe.tas.gov.au/invasive-species">http://dipwwe.tas.gov.au/invasive-species</a>
> <i>Native Vegetation Monitoring Strategy</i>	<a href="http://dipwwe.tas.gov.au/Documents/Native-Vegetation-Monitoring-Strategy.pdf">http://dipwwe.tas.gov.au/Documents/Native-Vegetation-Monitoring-Strategy.pdf</a>
> <i>Healthy Country Plans</i>	<a href="http://tacinc.com.au/programs/land-management/">http://tacinc.com.au/programs/land-management/</a>

## Productive Landscapes

Key Document	Weblink
> Land capability maps	<a href="http://dipwwe.tas.gov.au/agriculture/land-management-soils/land-and-soil-resource-assessment/land-capability/index-map-of-available-land-capability-maps">http://dipwwe.tas.gov.au/agriculture/land-management-soils/land-and-soil-resource-assessment/land-capability/index-map-of-available-land-capability-maps</a>
> <i>Salinity strategy for Tasmania</i>	<a href="http://dipwwe.tas.gov.au/agriculture/land-management-soils/salinity/tasmanian-salinity-strategy">http://dipwwe.tas.gov.au/agriculture/land-management-soils/salinity/tasmanian-salinity-strategy</a>
> <i>National guidelines for the management of acid sulfate soils</i>	<a href="http://www.environment.gov.au/water/publications/quality/guidance-for-management-of-acid-sulfate-soils">http://www.environment.gov.au/water/publications/quality/guidance-for-management-of-acid-sulfate-soils</a>
> <i>Adaptation opportunities for agricultural activities</i>	<a href="http://www.cradlecoastnrm.com/our-work-climate-change">http://www.cradlecoastnrm.com/our-work-climate-change</a>
> <i>Making cents of carbon and emissions on-farm</i>	<a href="http://dipwwe.tas.gov.au/Documents/Making%20cents%20booklet.PDF">http://dipwwe.tas.gov.au/Documents/Making%20cents%20booklet.PDF</a>
> <i>What is carbon farming – a farmer's perspective</i>	<a href="http://www.carbonfarmersofaustralia.com.au/About/what-is-carbon-farming">http://www.carbonfarmersofaustralia.com.au/About/what-is-carbon-farming</a>



## Urban Landscapes

Key Document	Weblink
> The Cradle Coast Regional Land Use Planning Framework	<a href="http://www.cradlecoast.com/literature/news/DeclaredCradleCoastRegionalLandUseStrategy-27October2011.pdf">http://www.cradlecoast.com/literature/news/DeclaredCradleCoastRegionalLandUseStrategy-27October2011.pdf</a>
> Regional Planning Initiative	<a href="http://www.cradlecoast.com/planning_reform.html">http://www.cradlecoast.com/planning_reform.html</a>
> Waste Management	<a href="http://www.cradlecoast.com/waste_management.html">http://www.cradlecoast.com/waste_management.html</a>
> Planning for sea-level rise and coastal hazards	<a href="http://www.dpac.tas.gov.au/divisions/climatechange/adapting/adaptation_tools">http://www.dpac.tas.gov.au/divisions/climatechange/adapting/adaptation_tools</a>
> Burnie Burrowing Crayfish	<a href="http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=66781">http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=66781</a>
> Central North Burrowing Crayfish	<a href="http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=78959">http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=78959</a>

## Rivers

Key Document	Weblink
> Conservation of Freshwater Ecosystem Values	<a href="http://dipw.tas.gov.au/water/water-monitoring-and-assessment/cfev-program/cfev-resources">http://dipw.tas.gov.au/water/water-monitoring-and-assessment/cfev-program/cfev-resources</a>
> Montague and Welcome River Catchments CFEV study	<a href="http://dipw.tas.gov.au/Documents/AGWF_CFEV_Montagu_Welcome_catchment%20report.pdf">http://dipw.tas.gov.au/Documents/AGWF_CFEV_Montagu_Welcome_catchment%20report.pdf</a>

## Wetlands

Key Document	Weblink
> Wetlands Strategy for Tasmania	<a href="http://dipw.tas.gov.au/Documents/Wetland-Strategy.pdf">http://dipw.tas.gov.au/Documents/Wetland-Strategy.pdf</a>
> Tasmanian Wetlands	<a href="http://dipw.tas.gov.au/conservation/flora-of-tasmania/tasmanian-vegetation-types/about-tasmanias-wetlands">http://dipw.tas.gov.au/conservation/flora-of-tasmania/tasmanian-vegetation-types/about-tasmanias-wetlands</a>
> Best practice guidelines for protecting wetlands and waterways	<a href="http://dipw.tas.gov.au/conservation/flora-of-tasmania/tasmanian-vegetation-types/about-tasmanias-wetlands/wetlands-waterways-works-manual">http://dipw.tas.gov.au/conservation/flora-of-tasmania/tasmanian-vegetation-types/about-tasmanias-wetlands/wetlands-waterways-works-manual</a>
> Assessing the condition and status of Tasmania's wetlands and riparian vegetation	<a href="http://dipw.tas.gov.au/Documents/National-Land-and-Water-Audit-March-2005.pdf">http://dipw.tas.gov.au/Documents/National-Land-and-Water-Audit-March-2005.pdf</a>

## Groundwater

Key Document	Weblink
> Tasmanian Salinity Strategy 2007	<a href="http://dipwe.tas.gov.au/Documents/Tas-Salinity-Strategy-May07-v2.pdf">http://dipwe.tas.gov.au/Documents/Tas-Salinity-Strategy-May07-v2.pdf</a>
> <i>Land systems containing areas of salinity 2003</i>	<a href="http://dipwe.tas.gov.au/Documents/salinity-mapA0-web.pdf">http://dipwe.tas.gov.au/Documents/salinity-mapA0-web.pdf</a>
> <i>Salinity and Waterlogging control manual for King Island's farmland</i>	<a href="http://www.kingisland.tas.gov.au/webdata/resources/files/4__KIC_Appendix_4_KINRM_Salinity_and_Waterlogging_ManualDec9.pdf">http://www.kingisland.tas.gov.au/webdata/resources/files/4__KIC_Appendix_4_KINRM_Salinity_and_Waterlogging_ManualDec9.pdf</a>
> <i>Identifying and managing soil salinity at multiple spatial scales on King Island, Tasmania</i>	<a href="http://eprints.utas.edu.au/9728/">http://eprints.utas.edu.au/9728/</a>

## Coasts

Key Document	Weblink
> Conservation of Freshwater Ecosystem Values	<a href="http://dipwe.tas.gov.au/water/water-monitoring-and-assessment/cfev-program/cfev-resources">http://dipwe.tas.gov.au/water/water-monitoring-and-assessment/cfev-program/cfev-resources</a>
> <i>Montague and Welcome River Catchments CFEV study</i>	<a href="http://dipwe.tas.gov.au/Documents/AGWF_CFEV_Montagu_Welcome_catchment%20report.pdf">http://dipwe.tas.gov.au/Documents/AGWF_CFEV_Montagu_Welcome_catchment%20report.pdf</a>

## Estuaries

Key Document	Weblink
> A classification of Tasmanian estuaries	<a href="http://www.imas.utas.edu.au/__data/assets/pdf_file/0007/68434/TechnicalReport_2.pdf">http://www.imas.utas.edu.au/__data/assets/pdf_file/0007/68434/TechnicalReport_2.pdf</a>
> <i>Determining the ecological health of estuaries in North West Tasmania</i>	<a href="http://eprints.utas.edu.au/5847/1/NW_estuaries_final_report_2007.pdf">http://eprints.utas.edu.au/5847/1/NW_estuaries_final_report_2007.pdf</a>
> <i>Habitat Mapping Boullanger Bay &amp; Four NW Coast Estuaries</i>	<a href="http://eprints.utas.edu.au/6639/1/NW_Key_Estuaries_Internal_report_PDF.pdf">http://eprints.utas.edu.au/6639/1/NW_Key_Estuaries_Internal_report_PDF.pdf</a>
> <i>Circular Head region coastal foreshore habitats: sea level rise vulnerability assessment</i>	<a href="http://ecite.utas.edu.au/64973/1/Circular">http://ecite.utas.edu.au/64973/1/Circular</a>



## Oceans

Key Document	Weblink
> Impacts of climate change on Australian marine life	<a href="https://www.cmar.csiro.au/climateimpacts/documents/Impacts-of-Climate-Change-on-Australian-Marine-Life-PartA.pdf">https://www.cmar.csiro.au/climateimpacts/documents/Impacts-of-Climate-Change-on-Australian-Marine-Life-PartA.pdf</a>
> <i>Conservation, monitoring &amp; recovery of threatened Giant Kelp beds in Tasmania</i>	<a href="http://www.environment.gov.au/system/files/pages/f250cead-de41-4b9d-9a52-91d5cb66f6b1/files/co01kelp.pdf">http://www.environment.gov.au/system/files/pages/f250cead-de41-4b9d-9a52-91d5cb66f6b1/files/co01kelp.pdf</a>
> <i>Institute for Marine and Arctic Studies</i>	<a href="http://www.imas.utas.edu.au/research">http://www.imas.utas.edu.au/research</a>
> <i>CSIRO Marine and Atmospheric Research</i>	<a href="http://www.cmar.csiro.au/">http://www.cmar.csiro.au/</a>
> <i>DPIPWE Sea Fishing &amp; Aquaculture</i>	<a href="http://dipwwe.tas.gov.au/sea-fishing-aquaculture">http://dipwwe.tas.gov.au/sea-fishing-aquaculture</a>

# Glossary and Abbreviations

## Glossary

<b>Adaptation</b>	The ability to adjust to a changing environment. It is applied to ecological systems and human social systems. For example, how well an organisations planning and management approaches can adjust to cope with environmental change or market situations.
<b>Biodiversity</b>	The variety of different types of life and a measure of the variety of organisms present in an ecosystem.
<b>Bioregion</b>	An area of land that shares similar environmental, physical and climatic conditions and contains characteristic ecosystems of plants and animals. Tasmania is divided into nine land bioregions and nine coastal and marine bioregions.
<b>Capacity</b>	Ability of an ecosystem to hold, maintain or sustain the level of activity demanded. Community capacity is the knowledge, skills, attitudes and resources needed to address natural resource management challenges.
<b>Capacity building</b>	Enhancing the abilities of a group to achieve measurable and sustainable results for natural resource management. This includes providing stakeholders with access to data and information; enhancing knowledge, skills and abilities; research and development; and market-based approaches.
<b>Carbon sequestration</b>	The removal and storage of carbon from the atmosphere in carbon sinks (such as oceans, forests or soils) through physical or biological processes.
<b>Catchment</b>	The land area that drains into a particular watercourse (river, stream or creek) and is a natural topographic division of the landscape.



## Glossary

<b>Climate change adaptation</b>	An activity, plan or response to global warming to reduce the vulnerability of natural or human systems against current or future climate change effects.
<b>Coastal</b>	The land along or near the sea. Also areas potentially affected by coastal flooding or sea level rise. The 'coastal zone' will therefore vary, depending on local topography. (In the draft State Coastal Policy 2010, the coastal zone is defined as state waters and all land to a distance of 1km inland from the high water mark.)
<b>Community</b>	An inclusive term to include everyone in the region whether in public or private capacity. "Community groups" refer to a collection of people who share an interest in natural resource management.
<b>Declared Weeds</b>	Weeds that have been 'declared' under the <i>Tasmanian Weed Management Act 1999</i> . Determination is by the invasive species branch of DPIPW based on scientific assessment and public consultation.
<b>Ecological processes</b>	The biological, chemical and physical processes that take place within an ecosystem (for example, the Nitrogen Cycle).
<b>Ecosystem</b>	A dynamic complex of plant, animal and microorganism communities and their non-living environment interacting as a functional unit.
<b>Endemic</b>	Confined to a location. A Tasmanian endemic species is found only in Tasmania.

## Glossary

<b>Estuarine</b>	A semi-enclosed or periodically closed coastal body of water in which the aquatic environment is affected by freshwater and saltwater movement.
<b>Evaluation</b>	The periodic review of a program or activity to determine its effectiveness in meeting program goals and recommend adjustments to the program or activity.
<b>Fragmentation</b>	Partitioning the natural landscape into smaller parts resulting in reduced ecological function or value.
<b>Geodiversity</b>	The range or diversity of geological (bedrock), geomorphological (landform) and soil features, assemblages, systems and processes.
<b>Integrated natural resource management</b>	Coordination of natural resource management activities across community, industry and government for the purpose of having similar goals and aspirations and more effective and efficient delivery.
<b>Land use</b>	Land use describes the activities that occur on land, such as agriculture, energy production, human settlements, transport, forestry, mining and conservation.
<b>Landscapes</b>	Areas on the earth's surface that have similar physical or geographical attributes. This strategy has categorised land into land water and coast with sub-themes under each.
<b>Management actions</b>	Activities to be undertaken to improve the condition of the regions natural resources.



## Glossary

<b>Marine</b>	Relating to the sea or plants and animals that live in the sea.
<b>Mitigation</b>	Measures taken to minimise the effects of an activity on the natural environment.
<b>Monitoring</b>	Regular gathering of information in a consistent manner to observe the progress of an activity or condition of a natural resource..
<b>Natural resources</b>	The earth's resources including air, water, land (including minerals and soils), plants and animals as well as the functioning systems.
<b>Natural resource management</b>	The appropriate management of an activity to conserve natural resources for present and future generations.
<b>North West</b>	Equivalent to or delineated by the Cradle Coast NRM region.
<b>north-west</b>	General north-west compass direction
<b>Participation</b>	The number of people actively engaged in natural resource management activities or events (e.g. public meetings, workshops and field days, governance, volunteer or employed).

## Glossary

<b>Ramsar</b>	The Ramsar Convention is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.
<b>Reserves</b>	Areas of protected landscapes or ecosystems. Reserves can be marine or terrestrial, informal or formal (dedicated statutory reserves).
<b>Resilience</b>	The ability of an ecosystem to withstand environmental or human impacts and recover or return to equilibrium.
<b>Salinity</b>	Excess salt that affects soil, native vegetation, biodiversity, crops and water quality. Irrigation salinity causes the rise of water table bringing salts to the root zone of plants. Dryland salinity can occur from an imbalance in water use and recharge. For example, clearing of native vegetation causes less evapotranspiration and a rise in water table containing salts.
<b>Sector</b>	An area of the economy such as primary production (eg mining or agriculture).
<b>Stakeholders</b>	Groups or organisation with a vested interest or responsibility in natural resource management.
<b>Tasmanian Natural Resource Management Council</b>	A Council established under the Tasmanian Natural Resource Management Act 2002 to advise the Minister on natural resource management issues (such as priorities, accreditation of the regional strategy, consistency and coordination matters). See <a href="http://www.austlii.edu.au/au/legis/tas/consol_act/nрма2002280/">www.austlii.edu.au/au/legis/tas/consol_act/nрма2002280/</a>
<b>Threatened species</b>	Flora or fauna that is listed in the <i>Tasmanian Threatened Species Protection Act 1995</i> or the Australian Government's <i>Environment Protection and Biodiversity Conservation Act 1999</i> . The status of the species may be listed as extinct, endangered, vulnerable or rare.



## Glossary

Thresholds	The point at which a relatively small change in external conditions causes a rapid change in an ecosystem. When an ecological threshold has been passed, the ecosystem may no longer be able to return to its previous state. Thresholds for water quality describe the maximum concentration of a substance (e.g. nitrates) acceptable for human consumption or recreational use.
Weeds of National Significance (WONS)	Weeds declared by the Australian Weeds Committee to be of national threat to agriculture and/or the environment, based on their invasiveness, potential for spread and environmental, social and economic impacts.

## Abbreviations

AdaptNRM	Joint CSIRO and NCCARF project to investigate climate change adaptation implications for regional NRM planning
CFEV	Conservation Fresh Water Ecosystem Values (a database managed by DPIPWE)
Cradle Coast NRM	Cradle Coast Natural Resource Management is the organisation responsible for implementing the <i>Natural Resource Management Act 2002</i> in North West Tasmania (the Cradle Coast region)
Cradle Coast region	The area covered by Cradle Coast NRM (see map 1 page 10)
CSIRO	The Commonwealth Scientific and Industry Research Organisation
DPAC	Tasmanian Department of Premier and Cabinet
DPIPWE	Tasmanian Department of Primary Industries, Parks, Water and the Environment

## Abbreviations

EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
IMAS	Institute of Marine and Arctic Studies housed within the University of Tasmania
MERI	Monitoring, Evaluation, Reporting and Improvement
NCCARF	National Climate Change Adaptation Research Facility
NRM	Natural Resource Management
UTAS	University of Tasmania

# Appendices

## Appendix 1. Issues, threats & focus areas or catchments for strategic action in productive landscapes.

Issue Highlighted	Associated Threats	Focus area or catchment
<b>FUNDAMENTAL / ECONOMIC / SOCIAL</b>		
<p><b>Costs and benefits of environmental stewardship are not taken in to account (no natural values accounting)</b></p>	<p>Lack of environmental stewardship affecting all assets negatively, potentially leading to loss of ecosystem services<sup>5</sup></p>	<p>Entire region</p>
<p><b>Poor public awareness of farmer contribution to public good and cost of farming</b></p> <p><b>Access to land for agriculture needs Protection of Agriculture Land Policy</b></p> <p><b>Urban encroachment / subdivisions on good farming land</b></p>	<p>Threat to 'social licence to farm'; increased production pressure on remaining farming land</p> <p>Small landholdings run by inexperienced people causing multiple off-site effects such as weeds spread and other NRM or biosecurity issues</p>	<p>Entire region with priorities shown in the Cradle Coast regional Land Use Strategy 2010 – 2030</p>
<p><b>Tasmanian Agri Growth Policy</b></p>	<p>Intensification of land use</p>	<p>Entire region</p>
<p><b>Community / council partnership and support for practice change desirable</b></p> <p><b>All of catchment or all of industry participation desirable</b></p> <p><b>Cross organisational cooperation desirable with those organisations who have similar goals</b></p>	<p>Lack of cooperation and coordination reduces effectiveness of actions and waste funds</p> <p>'Diluted benefits' of NRM activities</p>	<p>Entire region, especially focus areas</p>



Issue Highlighted	Associated Threats	Focus area or catchment
<b>CLIMATE CHANGE</b>		
<b>Climate change not seen as an imminent issue by many and therefore risks are not understood and action taken</b>	Lack of adaptation will affect all soil assets and this will have off site consequences (water, coasts) in the longer term	Entire region
<b>Increase in rainfall intensity and water runoff (and sea level rise)</b>	River mouth erosion	Forth-Wilmot , Leven Rubicon Rivers

Issue Highlighted	Associated Threats	Focus area or catchment
<b>VEGETATION</b>		
<b>High percentage of area subject to woody vegetation decrease (forest harvesting in upper catchments and agricultural activity in middle and lower sections)</b>	Increased erosion potential	Emu, Cam, Leven, Blythe, Mersey and Forth-Wilmot catchments
<b>Competing land use, move of production to higher altitudes e.g. for chilling of fruit crops</b>	Reduction in area or decline of native vegetation and its benefits,	Forth-Wilmot , Leven Rubicon Rivers
<b>Expansion of irrigation, in particular pivots</b>	Loss of native vegetation and established shelterbelts/windbreaks	Irrigation schemes (catchments):  Circular Head (Welcome, Montague, Duck), Dial Blythe, Kindred / North Motton (Forth-Wilmont, Leven), Sassafras / Wesley Vale (Rubicon)



Issue Highlighted	Associated Threats	Focus area or catchment
<b>VEGETATION</b>		
<b>Intensification of agricultural production due to economic pressures on farmers (eroding margins)</b>	Loss of native vegetation due to land clearing	Entire region, focus on new irrigation schemes
<b>Spread of environmental and agricultural weeds, especially in forested areas</b>	Change / loss of habitat for native flora and fauna, loss of natural pest and disease control, loss of productive area, competition with crops for resources and inputs	Entire region
<b>Biosecurity, incursions of pests, weeds and diseases</b>	Vegetation decline, loss of groundcover, weed spread, side effects from use of pesticides	Entire region

Issue Highlighted	Associated Threats	Focus area or catchment
<b>WATER</b>		
<b>Increase in irrigation water applied per hectare (irrigation intensity) and hectares irrigated (area) due to intensification of agricultural production</b>	Changes to groundwater refill, movement and quality (nutrient leaching)  Increased runoff / leaching of nutrients, more runoff of soil particles (erosion), and potentially of pathogens, into waterways and marine environments	New irrigation schemes Catchments with intensive dairy production and or intensification / expansion of dairying
<b>Riparian vegetation removal</b>	Stream bank erosion leading to silting issues and poor water quality	Welcome, Montague, Duck, Inglis



Issue Highlighted	Associated Threats	Focus area or catchment
<b>WATER</b>		
<b>Mine sites</b>	Downstream impacts from mine runoff / dewatering	All mine sites

Issue Highlighted	Associated Threats	Focus area or catchment
<b>LAND</b>		
<b>High percentage of land under modified land cover classes (experiencing woody vegetation change at the same time)</b>	Degradation of soil condition (structure decline / compaction, erosion, loss of organic matter, reduced water infiltration and nutrient holding capacity)	Cam, Blythe, Rubicon, Leven, Montagu King Island and Inglis
<b>Pressure to increase productivity (use of heavier equipment, closer rotations of higher value, intensive crops, increase in tillage, higher pest and disease pressure and potentially intensity of pesticide use, higher fertiliser inputs)</b>	Degradation of soil condition including loss of organic matter (see above)  Nutrient losses to waterways  Increase in crop health / weed issues intensification and potentially increased reliance on pesticides	Entire region with focus on new irrigation schemes
<b>Increase in irrigation intensity and area</b>	Waterlogging (soil structure decline, nitrous oxide losses), erosion	New irrigation schemes Catchments with intensive dairy production and or intensification / expansion of dairying



Issue Highlighted	Associated Threats	Focus area or catchment
<b>LAND</b>		
<b>Excess water from rain or irrigation not infiltrating soil (due to soil condition and or lack of vegetation cover, slope)</b>	Runoff from land leading to high levels of turbidity and nitrates	Rubicon, Mersey, Forth-Wilmot, Leven, Emu, Inglis, Duck, Montague, King Island, King-Henty <sup>17</sup> Welcome
<b>Land use change from perennial native or planted vegetation to annual crops, fruit crops or pasture</b>	Loss in native vegetation and its benefits to land  Soil loss to erosion  Organic carbon loss due to tillage and or reduction in carbon capture	Entire region
<b>High erosion risks already existing in many catchments and risk of this increasing (“Land in Water”) – see above</b>	Degradation of soil condition (see above)	Cropping areas with focus on Rubicon, Forth Wilmot and Emu catchments <sup>17</sup>
<b>Increase in salinity</b>	Loss of productive land and potential damage to native vegetation	King Island
<b>Lack of mine rehabilitation</b>	Off-site impacts, erosion, leaching	Mine sites

<sup>5</sup>Williams, J. 2009; *Ecosystem services mapping: Stage 1 - Project scoping and data reconnaissance. A report to Cradle Coast NRM, funded through the Australian Government’s Natural Heritage Trust.*

<sup>6</sup>Central Coast Council, *Tasmanian Climate Change Office, June 2014; Turners Beach – Leith Coastal Adaptation Pathways, – Report, Tasmanian Coastal Climate Adaptation Pathways Project.*

<sup>7</sup>Not covered by *Adaptation Pathways Project*; Leven included as target catchment during stakeholder workshop

<sup>8</sup>Port Sorell Council, *Tasmanian Climate Change Office, July 2012; Tasmanian Coastal Adaptation Pathways Project, Port Sorell – Report, Tasmanian Coastal Climate Adaptation Pathways Project.*

<sup>9</sup>Norton, T., Shaddick, J. and Cotching, B. 2007 *Interpreting Regional Datasets for NRM Investment Decision Making. A report to Cradle Coast NRM from Tasmanian Institute of Agriculture.*



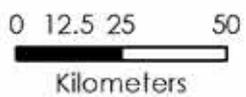
APPENDIX 2. Carbon planting focus areas



**Focus Areas**

- High Existing Value
- Existing Value
- Marginal
- Opportunity for Change
- High Opportunity for Change

Service Layer Credits: Sources: Esri, USGS, NOAA



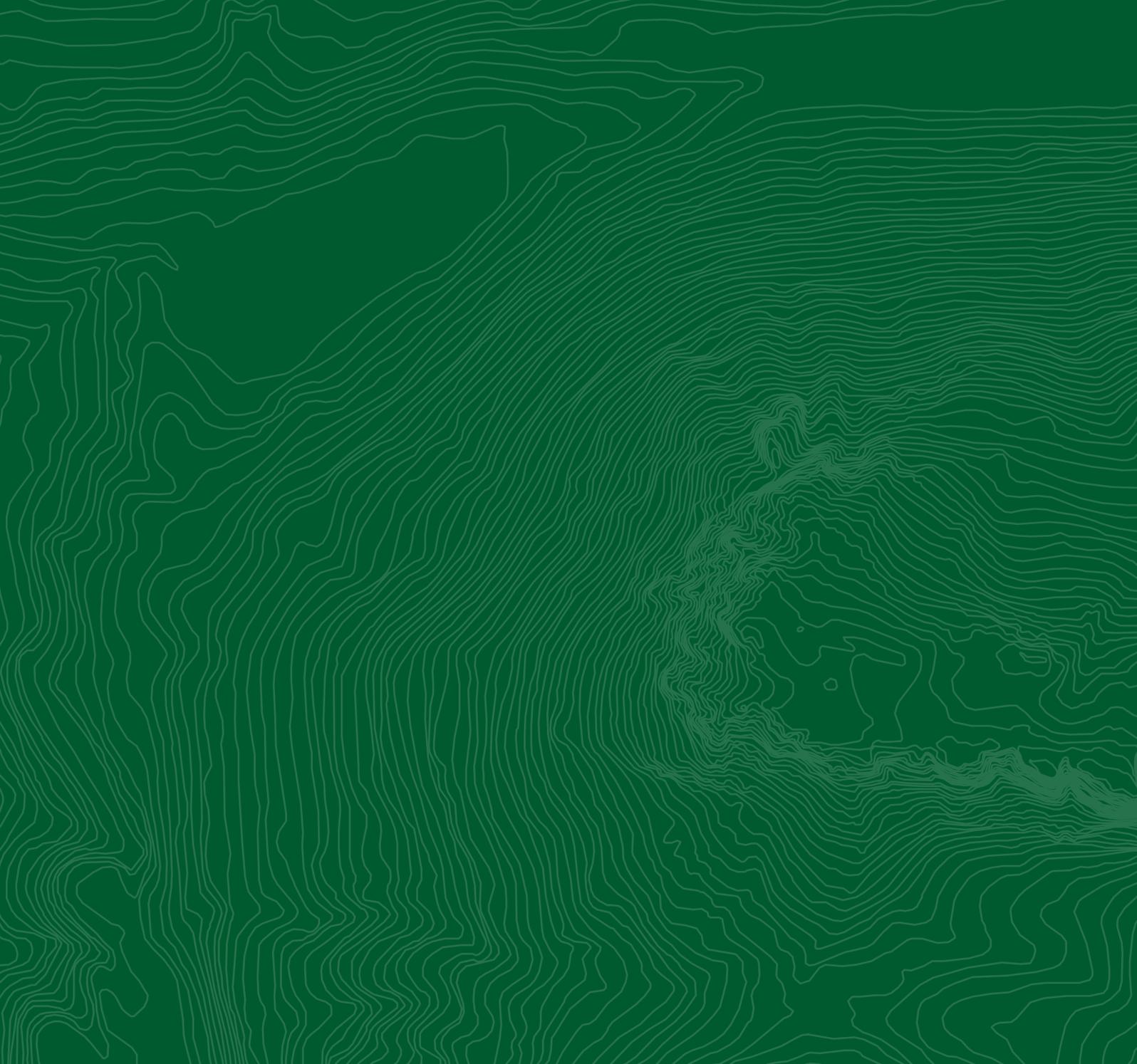
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Base data from theLIST © State of Tasmania  
Projection MGA94 Zone 55

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