Gippsland Lakes Ramsar Site Management Plan: Summary Report

EAST GIPPSLAND CATCHMENT MANAGEMENT AUTHORITY

Acknowledgement of Country

We acknowledge the Gunaikurnai people, traditional owners and custodians of the land and waters of the Gippsland Lakes region, and pay our respects to their Elders past and present. In particular, we pay tribute to the Brayakaulung, Brabralung and Tatungalung clans, whose custodianship is a vital part of the heritage, knowledge and future management of the Gippsland Lakes.

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Gippsland Lakes Ramsar Site Management Plan

FOREWORD

The Gippsland Lakes are one of Victoria's most important natural assets. The health of the lakes is critical to the sustainability of the Gippsland region.

The Gippsland Lakes are recognised internationally as a Ramsar site for their very significant environmental values. Protecting these values underpins the recreational benefits of the lakes, that so many Victorians enjoy, as well as economic values such as tourism and fishing that help support the economy of the Gippsland region.

Managing such a large and complex natural system requires a strategic approach to direct government and community resources. This plan provides the framework to protect the environmental values of the Gippsland Lakes over the next eight years, in order to maintain the ecological character of the Ramsar site, as required under the Ramsar Convention on Wetlands.

The Gippsland Lakes Ramsar Site is a priority for investment in the *East Gippsland Waterway Strategy* and the *West Gippsland Waterway Strategy*. The plan complements these strategies by providing further detailed management direction for waterways within the Ramsar site. The plan provides clear direction for future investment by the Victorian Government and other investors to maintain or improve the health of the Gippsland Lakes Ramsar Site.

Through the process of developing the management plan, the East and West Gippsland catchment management authorities, other agencies, traditional owners and the community, demonstrated their willingness to work together to set the management direction for the Ramsar site. This provides a strong foundation for continuing to work together to implement the plan and achieve real outcomes over the next eight years.

We encourage you to read the plan and get involved in local activities protecting the ecological character of the Gippsland Lakes Ramsar Site.

Dr Peter Veenker FCPA
Chairman
East Gippsland Catchment Management Authority

Angus Hume
Chairman
West Gippsland Catchment Management Authority

This report was prepared by the East Gippsland Catchment Management Authority on behalf of the Department of Environment, Land, Water and Planning

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Acronyms

AMMCF	Australian Marine Mammal Conservation Foundation
DEDJTR	Department of Economic Development, Jobs, Transport and Resources
DELWP	Department of Environment, Land, Water and Planning, *formerly* Department of Environment and Primary Industries
DoE	Department of Environment (Australian Government)
East Gippsland CMA	East Gippsland Catchment Management Authority
ECD	Ecological Character Description
EPA	Environment Protection Authority, Victoria
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
IUCN	International Union for Conservation of Nature
GLaWAC	Gunaikurnai Land and Waters Aboriginal Corporation
GLEF	Gippsland Lakes Environment Fund
GLES	*Gippsland Lakes Environmental Strategy*
GLMAC	Gippsland Lakes Ministerial Advisory Committee
GP	Gippsland Ports Committee of Management Incorporated
LAC	Limits of Acceptable Change
MID	Macalister Irrigation District
MER	Monitoring, evaluation and reporting
PSC	Project Steering Committee
RIS	Ramsar Information Sheet
RCT	Resource Condition Target
TAG	Technical Advisory Group
TOLMB	Traditional Owner Land Management Board
VWMS	*Victorian Waterway Management Strategy*
West Gippsland CMA	West Gippsland Catchment Management Authority
WET Trust	Wetland Environmental Taskforce Trust

1 Introduction

The Gippsland Lakes Ramsar Site Strategic Management Plan (Department of Sustainability and Environment 2003) established the framework for the maintenance of ecological character through conservation and wise use. The plan is now over a decade old and there has been significant progress in both our understanding of the ecological character of the Gippsland Lakes Ramsar Site and strategic direction in management of the site and Ramsar wetlands in Australia. A consultative and collaborative process was undertaken to review and update the Ramsar site management plan. The outputs of this review process are documented in two products:

1. A revised Gippsland Lakes Ramsar Site Management Plan, including a full description of the plan's development and technical appendices, and
2. A Gippsland Lakes Ramsar Site Strategic Management Plan summary document (**this document**) for a general audience that briefly outlines the process, and details the management strategies and responsibilities

1.1 Purpose of the management plan

1.1.1 Ecological character

Ramsar sites are wetlands that have international importance under the 'Ramsar Convention on Wetlands', with Australia one of the first countries to sign in Ramsar, Iran in 1971. There are now 168 countries with over 2000 wetlands listed globally. Listing a wetland as a Ramsar site carries with it certain obligations, including managing the site to maintain its 'ecological character' and to have procedures in place to detect if any threatening processes are likely to, or have altered the 'ecological character'. The Ramsar Convention has defined "ecological character" and "change in ecological character" as (Ramsar Convention 2005):

"*Ecological character is the combination of the ecosystem components, processes and benefits/services [CPS] that characterise the wetlands at a given point in time*" and "*…change in ecological character is the human induced adverse alteration of any ecosystem component, process and or ecosystem benefit/service*."

This Ramsar site management plan sits within a framework for the management of aquatic ecosystems in Australia and the State of Victoria. At the national level, the *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* establishes the basis for managing Ramsar sites; and a set of Australian Government guidelines for describing ecological character and developing management plans has been developed. In Victoria the *Victorian Waterway Management Strategy* (VWMS) guides the management of rivers, estuaries and wetlands. How this management plan fits in to the broader framework is illustrated in Figure 1.

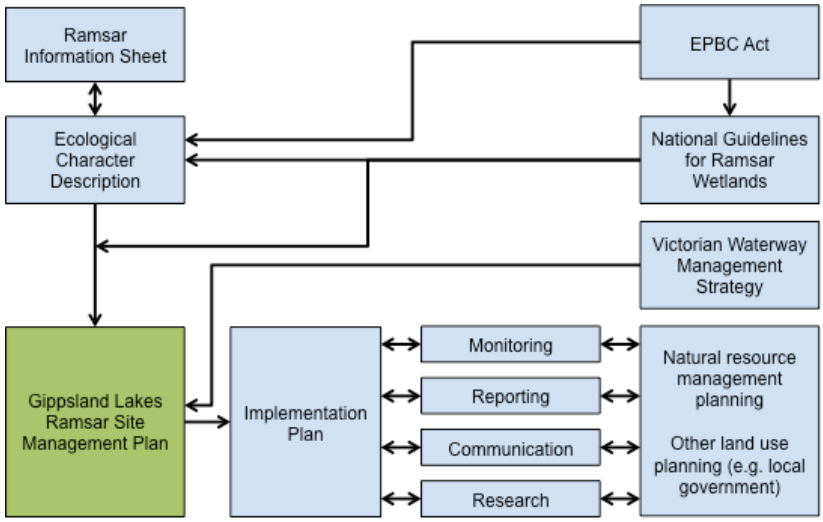


Figure 1: The Gippsland Lakes Ramsar Site Management Plan in context of other requirements for the management of Ramsar sites (adapted from DEWHA 2008).

Ramsar: A network of sites

There is a network of over 2000 Ramsar wetlands across the globe that is dedicated to sustaining biodiversity and wise use. One of the important functions, and a primary purpose for the establishment of the Convention, is to protect sites in different countries that are important for migratory birds.

The migratory birds that visit Australia are part of the East Asian-Australasian Flyway and most of them migrate from breeding grounds in North-east Asia and Alaska to non-breeding grounds in Australia and New Zealand, covering the journey of 10 000 kilometres twice in a single year.

The lifecycle of most international migratory shorebirds involves (Bamford et al. 2008):

- breeding in May to August (northern hemisphere);
- southward migration to the southern hemisphere (August to November);
- feeding and foraging in the southern hemisphere (August to April); and
- northward migration to breeding grounds (March to May).

During both northward and southward migration, birds may stop at areas on route to rest and feed. These stopovers are referred to as “staging” areas and are important for the birds’ survival. In addition, birds on their first southward migration that have not yet reached breeding maturity and may remain in Australia over the southern winter period.

The Gippsland Lakes Ramsar Site supports over 20 species that are international migrants and listed under migratory agreements with China Japan and the Republic of South Korea. Important habitats within the site include intertidal mudflats and saltmarsh such as those at Lake Reeve, where migratory waders feed. High tide roosting sites, where waders can rest are also important.

Migratory waders in Australia need to build up their energy reserves for the homeward journey. This means that they not only require abundant food sources, but they need to minimise their activity. Disturbance of waders when roosting or feeding may result in a significant loss of energy. This may even compromise their ability to build up enough reserves to complete the return journey to breeding grounds. Disturbance of migratory shorebirds may occur as a result of recreational fishing (in some instances), four wheel driving on beaches or in saltmarsh and intertidal areas, unleashed dogs; boating and jet skiing and any activity in the intertidal zone that causes significant noise or light. Migratory waders are also susceptible to predation by foxes and cats.

Populations of many migratory wader species are in decline, primarily through loss of habitat in breeding and staging areas outside Australia. This makes them more vulnerable while in Australia and increases the importance of doing everything in our power to maintain habitat and conditions at winter sites. Residents and visitors to the Gippsland Lakes need to work together to help protect and conserve these important species.

1.1.2 Objectives of the management plan

The primary purpose of the Gippsland Lakes Ramsar Site Management Plan is to maintain ecological character and promote wise use of the site. That is, the site is not managed for conservation only, but sustainable use is encouraged and supported.

The Gippsland Lakes Ramsar Site supports a number of ecological, socio-economic and cultural values. This plan has adopted the principle that by maintaining (or improving) ecological character, the socio-economic and cultural values associated with the Ramsar site will also be conserved, within the concept of wise use. Therefore, the primary objective of the Gippsland Lakes Ramsar Site Management Plan is:

"***To maintain, and where necessary improve, the ecological character of the Gippsland Lakes Ramsar Site and promote wise use***".

1.2 Development of the plan

The Gippsland Lakes Ramsar Site Management Plan was developed through a comprehensive consultative process that involved a large number of stakeholders with an interest in the Gippsland Lakes. A detailed description of the plan's development and all the steps involved is provided in the full Gippsland Lakes Ramsar Site Management Plan.

The guiding principles for the development of the Gippsland Lakes Ramsar Site Management Plan were:

Stakeholder involvement – this plan has been developed with the input of a broad range of stakeholders through every phase.

Evidence-based approach – best available knowledge has been used to underpin the development of this plan including the risk assessment and prioritisation of values and threats.

Precautionary principle – lack of full scientific certainty shall be not used as a reason for postponing cost-effective measures to prevent environmental degradation.

Building on existing activities – there are a large number of activities already being implemented within the catchment and the Gippsland Lakes to maintain and improve condition and ecosystem services. This plan seeks to build on these existing activities rather than duplicate effort.

Adaptive management – the plan life is for eight years, with a mid-term review after four years. A monitoring program has been included and the principles of monitor, evaluate, report and improve have been adopted.

2 Gippsland Lakes Ramsar Site

A complete description of the ecological character of the Gippsland Lakes Ramsar Site is contained in the Ecological Character Description (ECD) (BMT WBM 2010a). A summary of this information relevant to the management plan for the site is provided below.

2.1 Location

The Gippsland Lakes Ramsar Site is located approximately 300 kilometres east of Melbourne in the State of Victoria in south-east Australia. The site extends from Sale Common east to Lake Tyers covering an area of approximately 60 000 hectares (Figure 3). The Ramsar site comprises a series of coastal lagoons formed behind a barrier dune system, however, the ocean beaches and dunes of the Gippsland Coast are outside the site boundary.

The Gippsland Lakes have been connected to the Southern Ocean (Bass Strait) by an artificially maintained channel at Lakes Entrance since 1889 and receive freshwater inflows from seven major river systems (Tilleard et al. 2009). Prior to 1889 the Gippsland Lakes was periodically connected to the Southern Ocean and active commercial shipping was in place. The major waterbodies comprising the Gippsland Lakes are Lake Wellington, Lake Victoria and Lake King, which are all large and shallow and occur along a salinity gradient. Lake Reeve is a narrow, shallow water body lying along the coastal dune barrier and has an area of 50 square kilometres. It is usually dry, except for times of high rainfall (Webster et al. 2001) and salinity is generally classified as hypersaline (Tilleard et al. 2009). A number of wetlands that fringe the main lakes are within the site boundary and these range from fresh (Sale Common and Macleod Morass), through brackish to hypersaline.

The Gippsland Lakes Ramsar Site was listed in 1982, and the boundary most likely established on the basis of land tenure and management responsibilities. However, this has meant that a number of wetlands are partially inside the Ramsar site. The most obvious example of this is Lake Coleman, which is essentially bisected by the Ramsar site boundary (Figure 2). However, there are a number of other instances where the boundary cuts through fringing wetlands. Similarly, the estuarine reaches of some of the inflowing rivers, such as the Nicholson River are within the Ramsar boundary, but not all. Parts of the estuaries of the Avon, Mitchell and Latrobe Rivers are outside the site boundary. In terms of this management plan, a more holistic approach has been adopted whereby all of the fringing wetlands and estuarine reaches of the inflowing rivers have been included in the management planning process.

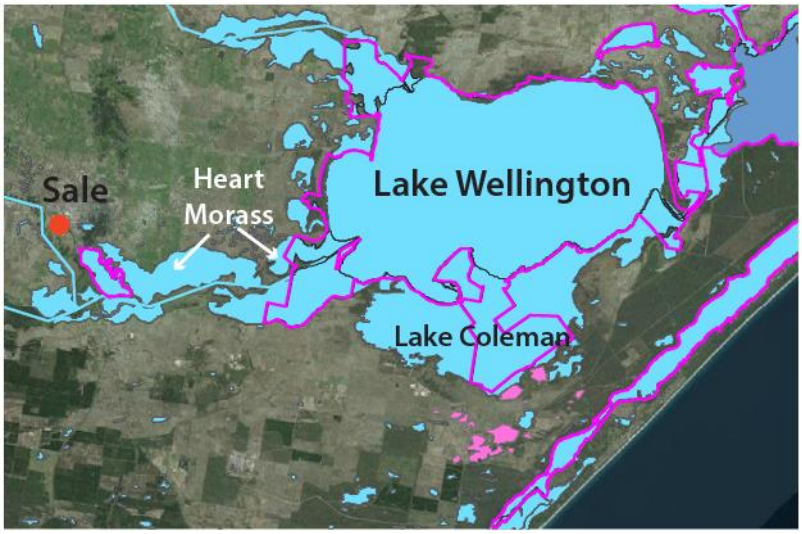


Figure 2: Ramsar site boundary around Lake Wellington, illustrating that a portion of Lake Coleman and Heart Morass lie outside the site boundary. Blue is mapped wetland areas, pink line is the Ramsar site boundary.

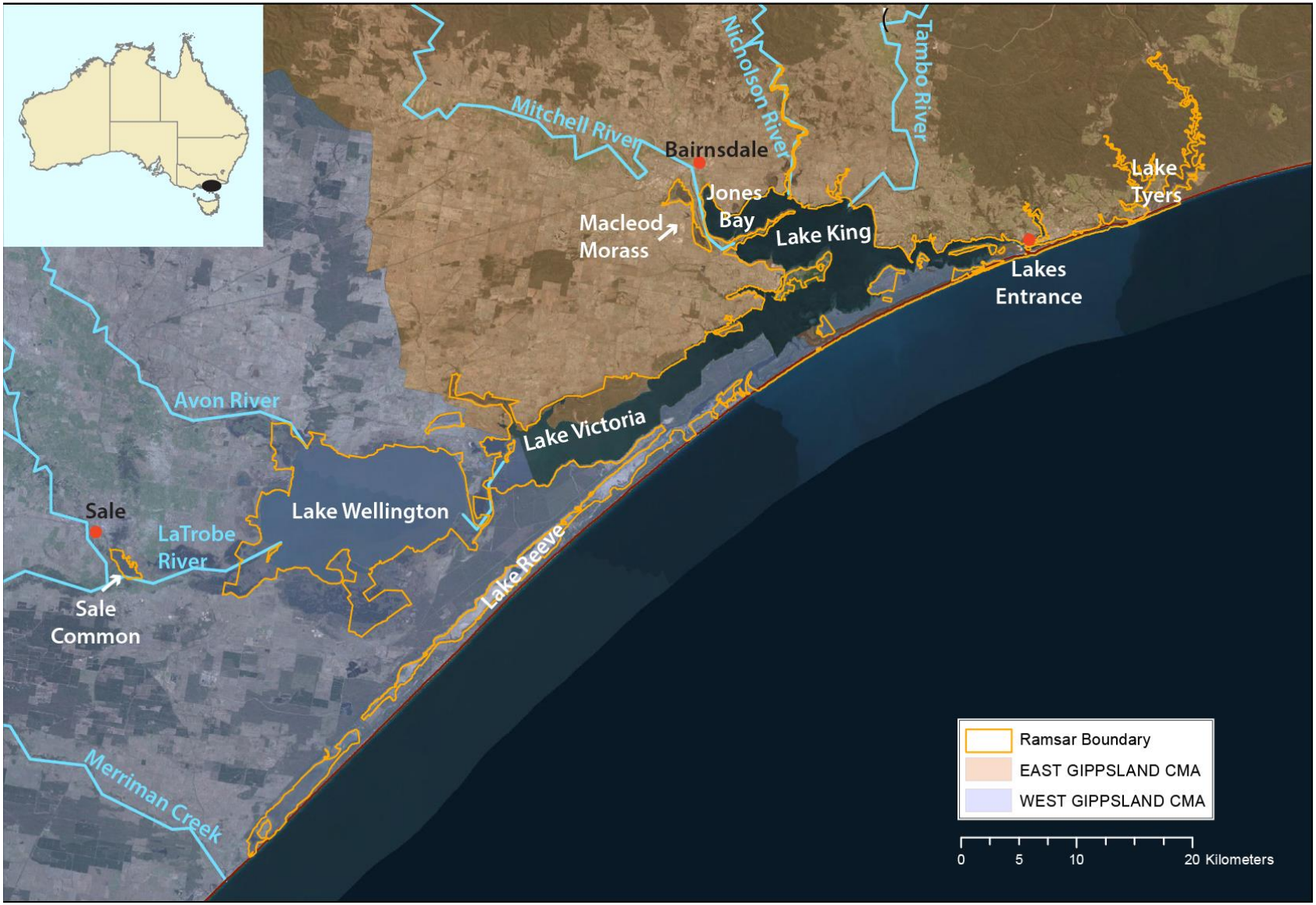


Figure 3: Location of the Gippsland Lakes Ramsar Site.

The Gippsland Lakes Ramsar Site is large, complex and made up of a variety of wetland types. In order to better guide the identification of values, threats and management strategies, the site was divided into smaller units, based on the mega habitats of Tilleard et al (2009). The mega-habitats are broadly aligned with Ramsar wetland types, and their use in the Gippsland Lakes Ramsar Site Management Plan aligns with other plans and strategies in place for the Gippsland Lakes.

The mega-habitats within the Gippsland Lakes Ramsar Site are (Figure 4):

Main Lakes

- **Deep Lakes** – permanent deep waterbodies, such as Lakes King, Victoria and Tyers;
- **Shallow Lakes** – shallow permanent waterbodies, such as Jones Bay and Lake Wellington;

Fringing wetlands

- **Freshwater wetlands** – two fringing wetlands that have freshwater, Sale Common and Macleod Morass;
- **Variably saline wetlands** – intermittent wetlands that fluctuate between fresh or brackish and saline, such as Heart Morass, Clydebank Morass and Dowd Morass;
- **Hypersaline wetlands** – wetlands with salinity generally greater than seawater, such as Lake Reeve and Victoria Lagoon; and

Estuarine reaches of the inflowing rivers.

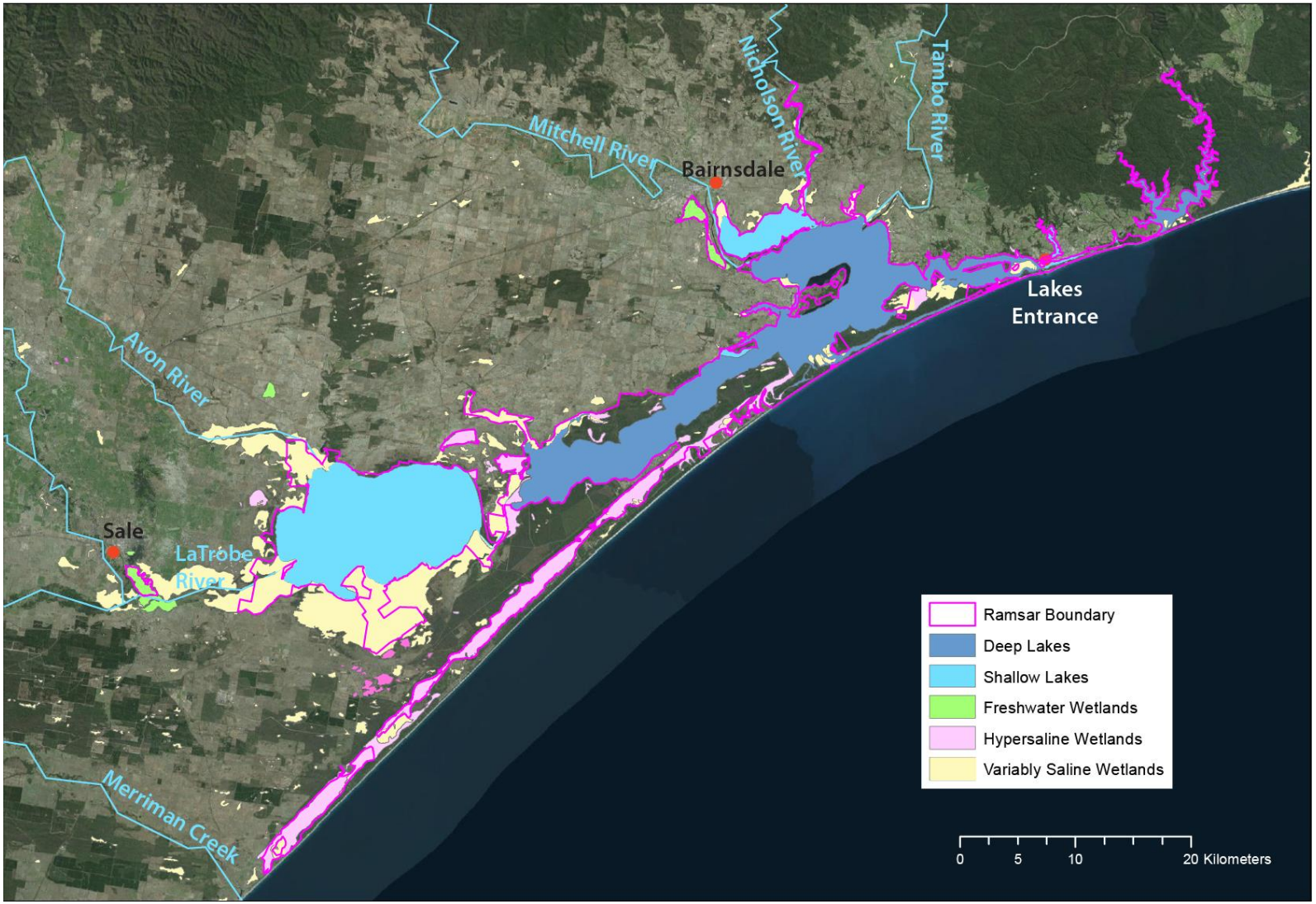


Figure 4: Mega habitats of the Gippsland Lakes Ramsar Site (modified from Tilleard et al. 2009).

2.2 Ramsar listing criteria

To be listed as a wetland of international importance under the Ramsar Convention, a site must meet at least one of the nine listing criteria. At the most recent assessment, in 2010, the Gippsland Lakes Ramsar Site met six of those criteria (Table 1).

Table 1: Criteria for Identifying Wetlands of International Importance that are met by the Gippsland Lakes Ramsar Site (BMT WBM 2010a).

Criteria	Gippsland Lakes
1. Contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region.	The Gippsland Lakes is within the south-east coast drainage division bioregion (Department of the Environment, Water, Heritage and the Arts 2008) and the site contains two waterbodies considered to be in near-natural state (Lake Tyers and Lake Reeve) as well as the Mitchell River Delta, which is considered one of the most outstanding examples of this wetland type (Rosengren 1984).
2. Supports vulnerable, endangered, or critically endangered species or threatened ecological communities.	The Gippsland Lakes supports the following species listed under the EPBC Act and or IUCN Red List: • Fairy tern (*Sternula nereis nereis*) • Green and golden bell frog (*Litoria aurea*) – Vulnerable; • Growling grass frog (*Litoria raniformis*) – Vulnerable; • Australian grayling (*Prototroctes maraena*) – Vulnerable • Australasian bittern (*Botaurus poiciloptilus*) – Endangered • Dwarf kerrawang (*Commersonia prostrate*) – Endangered • Swamp everlasting (*Xerochrysum palustre*) - Vulnerable • Metallic sun-orchid (*Thelymitra epipactoides*) – Endangered Since the drafting of the ECD, Coastal saltmarsh has been listed as vulnerable under the EPBC Act. The site supports substantial areas of this ecological community, which would now be considered to contribute to this criterion.
4. Supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.	The Gippsland Lakes supports breeding of waterbirds, is a recognised site for moulting waterfowl and the freshwater fringing wetlands are considered important drought refuges (BMT WBM 2010a). Also important for migratory waders supporting migration.
5. Regularly supports 20,000 or more waterbirds.	Although assessment of this criterion is hampered by a lack of comprehensive waterbird counts across the Gippsland Lakes Ramsar Site, there is strong evidence to suggest that the site "regularly" supports (i.e. in three out of five years) more than 20,000 waterbirds (BMT WBM 2010a, Wright and Wright 2012, Healey 2013).
6. Regularly supports one percent of the individuals in a population of one species or subspecies of waterbird.	Assessment of this criterion must be made using the most recent official population estimates (Wetlands International 2013). Two species meet this criterion: little tern (*Sternula albifrons*) and fairy tern (*Sternula nereis nereis*) both of which regularly breed within the Ramsar site
8. Is an important source of food for fishes, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere, depend.	The Gippsland Lakes is a recognised important commercial and recreational fishery and supports the largest commercial fishery of black bream in the State, accounting for 90 percent of the total catch (Department of Primary Industries 2011). The seagrass and other habitats within the lakes act as important nursery habitat for a range of fish and crustacean species (Warry and Hindell 2012).

Since the development of the ECD, there has been additional data collected that strongly suggests that the site may meet an additional criterion as follows. The formal process of reviewing and updating the criteria under which a site is listed occurs through the updating of the Ramsar Information Sheet (RIS). It is expected that consideration of Criterion 9 will be formally assessed at this time.

Criterion 9: Regularly supports one percent of the individuals in a population of one species or subspecies of wetland-dependent non-avian animal species.
In 2011 a new species of dolphin, the Burrunan dolphin (*Tursiops australis*), was described from south-eastern Australia (Charlton-Robb et al. 2011). The Gippsland Lakes is home to one of only two known resident populations of this species (Charlton-Robb et al. 2014), which suggests that this criterion may be met.

2.3 Critical components, processes and services

The Gippsland Lakes ECD identifies eight components, two processes and two services that are critical to the ecological character of the Ramsar site. These are described briefly below in terms of their benchmark condition, at the time of listing (Table 2). It should be noted these are not the only values of the Gippsland Lakes, but those identified in the ECD as critical to ecological character. A broader list of values was considered in the development of this plan (see section 3).

Establishing the benchmark: "At the time of listing"

The Ramsar Convention establishes the benchmark for the ecological character of listed wetlands as:

"*at the time of designation as a Ramsar Wetland of International Importance*" (Resolution VI.1 Annex Para 2.1).

This is an important concept in terms of obligations to maintain ecological character, especially in systems such as the Gippsland Lakes, which had undergone significant ecological change prior to designation. The opening of the permanent entrance to the Southern Ocean in 1889 had two significant effects (Boon et al. 2014):

- immediate changes to decrease the variability in water level; and
- progressive increases in salinity.

The ecological effects of these physical changes were probably evident within the first few decades, and by the time of designation as a Ramsar site in 1982, Lakes King and Victoria were estuarine / marine in character. Similarly, although there have been significant historical changes in fringing vegetation at Lake Wellington and its fringing wetlands, with a loss of the submerged freshwater plant species *Vallisneria australis* and a decline in the extent of emergent common reed (*Phragmites australis*) fringing the waterbody (see images below), the vast majority of these changes occurred prior to 1982 (Boon et al. 2014).

Extent of common reed at Lake Wellington in the 1950s (left) and 2010 (right). The arrow indicates two comparable areas (Boon et al. 2014).

Aquatic ecosystems are rarely static and stable, and the Gippsland Lakes are no exception. There are ongoing changes occurring, many of which commenced prior to designation, with a continuing trajectory of change. Establishing a benchmark, against which change in ecological character can be assessed, is a task for the Ecological Character Description, using Limits of Acceptable Change (see section 2.4 below). Maintaining the site to maintain ecological character in a changing environment is a challenge for Ramsar site management.

Table 2: Critical components, processes and services (CPS) of the Gippsland Lakes Ramsar Site and their baseline description (BMT WBM 2010).

Critical CPS	Baseline description
Marine subtidal aquatic beds (seagrass)	Seagrass covers an area of approximately 4000-5000 hectares within the Gippsland Lakes Ramsar Site, although there is a high degree of variability over time (Roob and Ball 1997). Seagrass predominantly occurs in depths from 0.5 to 2 m, with very little seagrass in intertidal zones. Condition and density of seagrass varies significantly between years most likely in response to changes in salinity and water clarity related to climate variables and freshwater inflows.
Coastal brackish or saline lagoons	Algal food webs are an important part of the Gippsland Lakes and the large lagoons that are dominated by phytoplankton drive the energy dynamics of the system. The system experiences periodic algal blooms.
Freshwater wetlands	Freshwater wetlands within the site at the time of listing were limited to Sale Common and Macleod Morass covering an area of approximately 400 hectares (BMT WBM 2010a).
Brackish wetlands	The brackish fringing wetlands within the Ramsar site fringe the open water areas of Lake Wellington and comprise and number of wetlands such as Dowd, Heart and Clydebank Morasses, Lake Coleman and Tucker Swamp. They are dominated by swamp paperbark woodland and common reed emergent macrophyte beds (Boon et al. 2007).
Saltmarsh	Saltmarsh communities are the dominant vegetation community in the long shallow coastal lagoon of Lake Reeve and some of the fringing wetlands. Coastal saltmarsh is listed under the EPBC Act as vulnerable and provides important habitat for fish and shorebirds.
Abundance and diversity of waterbirds:	The Gippsland Lakes Ramsar Site is known to support over 86 species of waterbird with periodic counts exceeding 20,000 individuals. The majority of the significant waterbird habitat is in the margins and fringing wetlands. Satlmarsh and saltflats such as those found at Lake Reeve are important feeding grounds for waders, including migratory species, with significant numbers of red-necked stint recorded on a number of occasions (Barter 1995, Clemens et al. 2009). Lake Tyers and islands of the Gippsland Lakes supports breeding of significant numbers of little tern and fairy tern, which then move to other areas in the site such as Jones Bay and Victoria lagoon to feed (Faye Bedford, biodiversity officer, DELWP, personal communication). The freshwater and brackish habitats support significant numbers of waterfowl including black swan (*Cygnus atratus*), chestnut teal (*Anas castanea*) and musk duck (*Biziura lobata*) and larger resident wading bird species (Corrick and Norman 1980). The large expanses of open water in Lakes Wellington, King and Victoria are considered less important as bird habitat, although may be important foraging areas for fish eating birds such as pelicans and cormorants (Coutin et al. 2003).
Threatened species	The site supports a number of threated species including: • Green and golden bell frog and growling grass frog recorded in Sale Common, Dutson Downs, Dowd Morass, Heart Morass, Clydebank Morass, Macleod Morass. • Australian grayling – a migratory fish that lives n the rivers of the Gippsland Lakes catchment and migrates to the ocean for part of its lifecycle. • Fairy tern and little tern nest at a number of locations in the Ramsar site, including Lake Tyers. • Australasian bittern – inhabits dense reed beds of the fringing wetlands. • Three species of wetland plant: dwarf kerrawang, swamp everlasting and metallic sun-orchid located on the fringes of Lake Victoria in Blond Bay Wildlife Reserve.
Waterbird breeding	The Gippsland Lakes Ramsar Site supports breeding of a number of waterbird species across a variety of habitats. This includes: • Australian pelican at Lake Coleman, Tucker Swamp and Crescent Island; • Little tern and fairy tern at mud islands and Lake Tyers; and • Black swan, Australian white ibis, straw-necked ibis and little black cormorant at Macleod Morass, Sale Common and Dowd Morass. In addition, Royal Spoonbills have been recorded nesting at Dowd Morass.
Fisheries resource value	The Gippsland Lakes Ramsar Site is an important commercial and recreational fishery as well as providing nursery habitat for a range of fish that form part of the Bass Strait commercial fishery. Over 170 species of fish have been recorded within the site boundary, the vast majority estuarine or marine species, with a number of species that move between fresh, estuarine and marine environments.

2.4 Current condition and Limits of Acceptable Change (LAC)

The mechanism against which change in ecological character is assessed is via comparison with Limits of Acceptable Change (LAC). LAC are defined by Phillips (2006) as:

"…the variation that is considered acceptable in a particular measure or feature of the ecological character of the wetland. This may include population measures, hectares covered by a particular wetland type, the range of certain water quality parameter, etc. The inference is that if the particular measure or parameter moves outside the 'limits of acceptable change' this may indicate a change in ecological character that could lead to a reduction or loss of the values for which the site was Ramsar listed. In most cases, change is considered in a negative context, leading to a reduction in the values for which a site was listed".

The LAC for the Gippsland Lakes Ramsar Site were established in the ECD for critical components, processes and services (BMT WBM 2010a). An example of a LAC and a comparison with current condition is provided below. The full set of LAC and an assessment with the current state of the Gippsland Lakes is provided in the full Gippsland Lakes Ramsar Site Management Plan. Note that although a full assessment of the status of ecological character occurs through the Ramsar Rolling review, there is no evidence from the information below of an exceedence of a LAC in the Gippsland Lakes Ramsar site.

Critical CPS	Limit of Acceptable Change	Current condition
S2 Fisheries resource value	Total annual black bream commercial fishing catch per unit effort will not fall below 6.1 tonnes in a successive five-year period. Sub-optimal black bream spawning conditions should not occur in any successive five-year period within key spawning grounds (that is, mid-lower estuaries and adjacent waters of main lakes) during the peak spawning period (October to December). Optimal conditions are as follows: • Water column salinity is maintained in brackish condition (for example, between 17-21 ppt median value) in the middle of the water column in the mid-lower estuaries and adjacent waters of the main lakes • The salt wedge is located within the mid-lower section of the estuarine river reaches or just out into the main lakes as opposed to far upstream or well-out into the Gippsland Lakes.	The most recent commercial catch data (Department of Environment and Primary Industries 2014) indicates that the annual catch of black bream over the past decade years has ranged from 26 to 148 tonnes, well above the LAC of 6 tonnes. Although the salinity portion of the LAC is difficult to assess, water quality data from Lakes Wellington, Victoria and King (as provided by EPA Victoria) indicate that salinity largely remained within the 17 to 21 ppt threshold October to December for the past decade; with the exception of flood years (e.g. 2008, 2011) when salinity was lower.

3 Priority values and threats

3.1 Method

A risk assessment was completed for the Gippsland Lakes Ramsar Site with the input of scientific experts, and local knowledge. The purpose of the risk assessment was to identify priority values and threats to inform strategic actions in the Gippsland Lakes Ramsar Site Management Plan. The outputs of the prioritisation process were (Figure 5):

- High priority values for management in the next eight years (Table 3)
- High priority threats for management in the next eight years (Table 4)
- Critical knowledge gaps (Table 5)

A complete description of the risk assessment process, the identified risks, and the process for identifying high priority values and threats is provided in the full Gippsland Lakes Ramsar Site Management Plan.

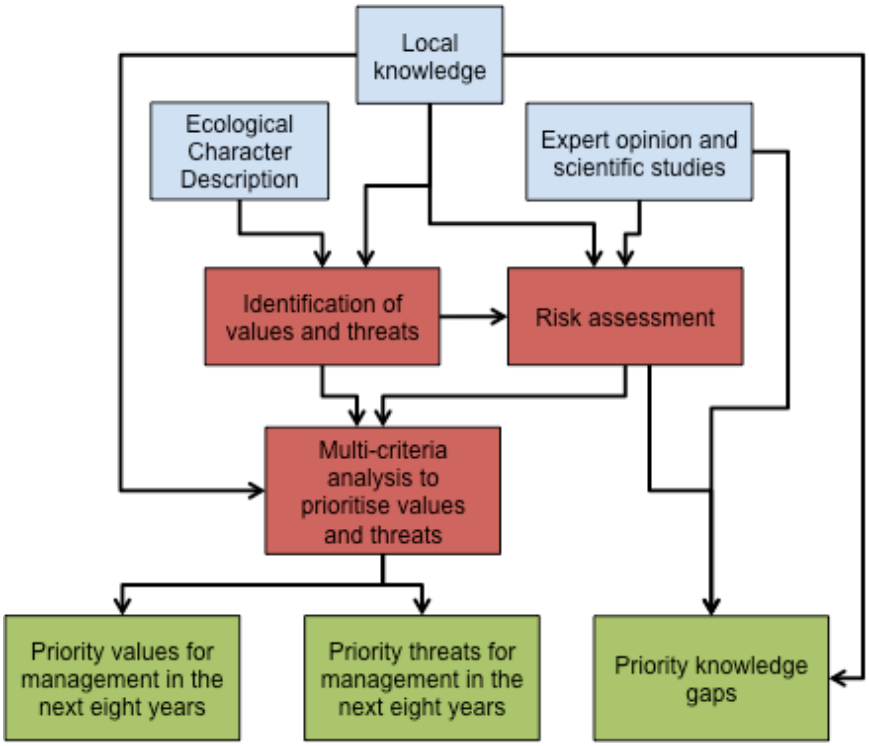


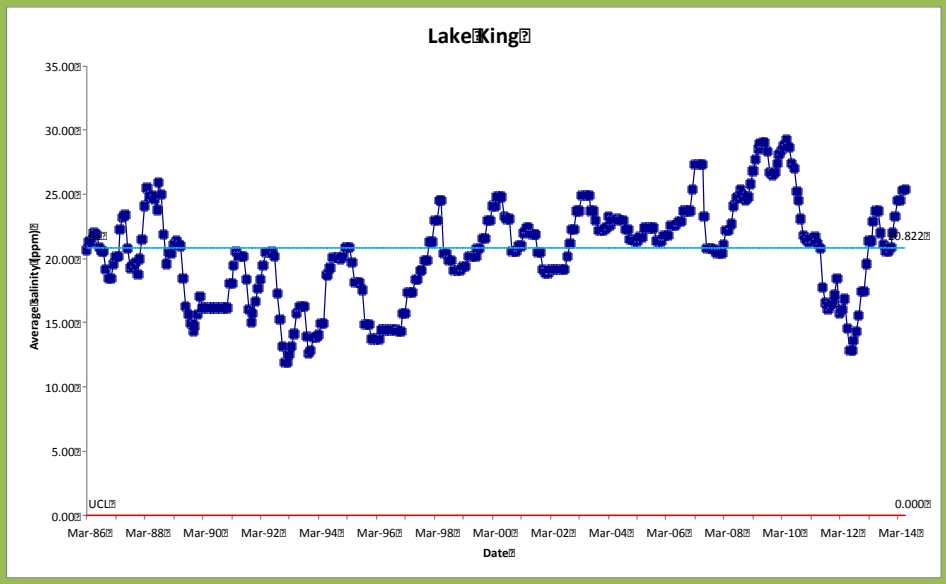
Figure 5: Process of prioritising values and threats and the role of the risk assessment.

Using an evidence-based approach to inform the risk assessment: Changed entrance conditions and salinity in the main lakes

The permanent connection to the ocean was in place for almost a century prior to the Gippsland Lakes being listed as a Ramsar site, so the benchmark for ecological character is as an estuary, with many of the values of the site and the majority of the critical components, processes and services reliant on estuarine conditions. The issue to be explored is that of changed conditions since 1982, specifically changes associated with dredging of the entrance following the switch to a Trailer Suction Hopper Dredge (TSHD) in 2008. A study by Water Technology (Reynolds et al. 2011) reviewed all the available information and is the most comprehensive review of this specific issue. Their conclusions were that the change in dredge method has not had an effect on salinity in the system. Specifically:

- Despite ongoing dredging, there has been a build-up of sediments in the navigation channel (Wheeler et al. 2010a, 2010b, 2010c). This was attributed to decreased freshwater inflows, particularly during the Millennium drought.
- Small changes in the volume of water that enters the Gippsland Lakes (called the tidal prism) have very little effect on salinity in the Gippsland Lakes. This is based on the CSIRO research (Webster et al. 2001) which modelled the effects of increasing the entrance channel such that tidal exchange was increased by 1.5 times, and decreasing the channel capacity to limit tidal exchange to 0.6 times current. The result was a negligible change in the salinity in the main basins, and a moderate change in salinity in Reeve Channel. This is due to the large attenuation of tide through the Entrance, which severely restricts tidal exchange between the Gippsland Lakes and Bass Strait. Any impacts to tidal exchange and salinity due to the adopted channel design will be considerably smaller than those modelled by Webster et al. (2001) with Reynolds et al. (2011) citing a potential increase of just 16 percent in tidal exchange at Lakes Entrance post 2008 (three times less than that modelled by CSIRO that indicated no change in salinity).
- "*Changes observed in the salinity concentration of the Gippsland Lakes over recent years can be predominantly attributed to the reduction in freshwater inflows through the inflowing river systems which is associated with lower rainfall conditions and water abstraction*"

There is no sustained increase in salinity in Lakes King and Victoria, using EPA water quality data. The graph below shows an Exponentially Weighted Moving Average (EWMA) of surface salinity in Lake King. It shows a rise in salinity in 2008 – 2009; followed by a fall during the wet years of 2010, 2011 and a minor rise again.



Entrance management is guided by the Gippsland Lakes Ocean Access Long Term Monitoring and Management Plan – Maintenance Dredging with Ocean Disposal 2013-2023"
http://www.gippslandports.vic.gov.au/pdfs/reports/gippslandport_30.pdf

Table 3: Priority values and mega-habitats of the Gippsland Lakes Ramsar Site (H = high priority for management; M = Moderate priority; L = Lower priority, as identified in the prioritisation process).

Value	Mega-habitats					
	Deep lakes	Shallow lakes	Freshwater wetlands	Variably saline wetlands	Hypersaline wetlands	Estuarine reaches
Marine sub-tidal beds (seagrass)	H	H				
Coastal lagoons (open water phytoplankton)	H	H				
Fringing freshwater wetlands			H			
Fringing brackish wetlands				H		
Saltmarsh				M	H	
Abundance & diversity of waterbirds: Ducks and allies	H	H	M	M	H	L
Abundance & diversity of waterbirds: Fish eating birds	M	M	M	M		M
Abundance & diversity of waterbirds: Large wading birds	M	M	M	M	M	L
Abundance & diversity of waterbirds: Migratory shorebirds	M	H	M	M	H	
Abundance & diversity of waterbirds: Australian shorebirds	M	M	M	M	H	
Abundance & diversity of waterbirds: Raptors	M	M	M	M	M	L
Threatened species: Little tern and fairy tern	H	M				
Threatened species: Green and golden bell frog			M	M		L
Threatened species: Growling grass frog			M	M		L
Abundance and diversity of native fish	M	M		L		H
Threatened species: Australian grayling	L	L				M
Threatened species: Dwarf galaxias			L	M		
Threatened species: Australasian bittern			L	M		
Threatened species: Dwarf kerrawang			M	M		
Threatened species: Swamp everlasting				M		
Threatened species: Metallic sun-orchid				M		
Threatened community: Gippsland Red Gum Woodland			L			H
Swamp scrub			L	L		L
Plains grassy woodland		L				L
Waterbird breeding	H		H	H		M
Burrunan dolphin	H	H				H
Geomorphic features (silt jetties)	M	M				H
Visual amenity / landscape	M	M	L	L	L	M
Recreational fishing	L	L				L
Commercial fishing (black bream; eels)	L	L	L	L		L
Water based recreation (swimming, boating)	M	M				M
Beside water recreation (bushwalking, nature observation)	M	M	L	L	L	M
Aboriginal cultural heritage	Assessed through a separate consultation process see section 4.8					
European cultural heritage	L				L	
Game hunting	L	L	L	L	L	L

Combined effects of multiple threats: Saltmarsh

Many of the values of the Gippsland Lakes Ramsar Site are impacted by different threats. These threats often do not operate independently, but interact to produce combined effects on biota and ecosystems. These may be greater than the sum of each individual threat.

Coastal saltmarsh is a recognised important vegetation community and is listed as vulnerable under the EPBC Act. Coastal saltmarsh is important in capturing and storing carbon (blue carbon) and is a vital habitat for many invertebrates, fish and waterbirds.

Saltmarsh is a complex community that grows in saline intertidal areas. It has specific requirements to maintain health that are related to water quality (salinity, nutrients, pH) and water depth (elevation). These factors interact to result in distinct zones of layers of vegetation from the sea inland from mangroves (where present), to succulent shrubs like beaded and shrubby glassworts to sea rush and swamp paperbark further inland (see image below).

Zonation of saltmarsh communities (Boon et al. 2014).

Threats that are currently impacting saltmarsh communities in the Gippsland Lakes include altered salinity from water resource use; increased nutrients, invasion by weeds such as *Spartina* spp. and physical damage from 4WD and other recreational vehicles. All of these factors are reducing the resilience of saltmarsh communities. This makes them more vulnerable to other threats and impacts reducing their ability to recover or “bounce back” from events such as storm surges. Added to this is the potential long term effect of sea level rise.

Recent climate modelling (Grose et al. 2015) indicates sea level has risen around Australia at an average rate of 1.6 mm per year between 1966 and 2009; by 2030 sea level is expected to be 70 to 190 mm higher than today. This could have serious effects on saltmarsh diversity and extent, particularly if those communities are already in poor condition from other impacts. Maintaining healthy saltmarsh may allow for migration of communities to higher elevations. In the example above, healthy vegetation that is actively flowering and reproducing may result in a slow movement of mangrove to where beaded glasswort currently is, and the glassworts further inland to the areas currently occupied by sea rush, and so on through the zones.

Table 4: Priority threats and mega-habitats of the Gippsland Lakes Ramsar Site.

Threat	Mega-habitats					
	Deep lakes	Shallow lakes	Freshwater wetlands	Variably saline wetlands	Hypersaline wetlands	Estuarine reaches
Nutrient inflows from agricultural activities in the catchment	X	X				X
Development on the shores affecting visual amenity	X	X				X
Foxes and cats predating on waterbirds	X	X	X	X	X	
Climate change (storms and sea level rise) affects silt jetties, exposed islands and sandy spits	X	X				X
Climate change (storms and sea level rise) impacts vegetation	X	X			X	
Artificial opening of the entrance at Lake Tyers affects biota (including nesting terns)	X					
Non-native invasive species (sea spurge) affects terns nesting	X					
Non-native invasive plant species affects native flora and habitat			X			X
Native invasive species (e.g. Typha) affects flora diversity and habitat			X	X		
Introduced marine pests (European shore crab) affects native species	X	X			X	
Introduced marine pests – potential introduction on new species	X	X			X	
Invasive species (carp and gambusia) affect native fish and habitat		X	X	X		X
Decreased freshwater inflows – impacts on breeding triggers for estuarine fish						X
Decreased freshwater inflows – altered water regimes impacts flora and fauna			X	X		X
Decreased freshwater inflows – increased salinity impacts flora and fauna		X	X	X		X
Exposure of acid sulphate soils (ASS)			X	X		X
Disturbance of migratory shorebirds and / or nesting birds by recreational activities (vehicles, people, dogs and noise)	X	X	X	X	X	
Vessels affecting the behaviour and condition of dolphins	X	X				
Recreational vehicles causing physical damage to vegetation and habitat			X	X	X	X
Grazing and trampling on riparian/coastal habitats from deer pigs, goats and rabbits			X	X		X

Table 5: Knowledge gaps and associated mega-habitats.

Knowledge gap	Mega-habitats					
	Deep lakes	Shallow lakes	Freshwater wetlands	Variable saline wetlands	Hypersaline wetlands	Estuarine reaches
Mercury (and other toxicants): bioavailability in sediments and bioaccumulation through the food chain.	X	X				X
Risks and mitigation strategies for endocrine disruptors in dairy, urban, and human waste from the wastewater treatment plant in Macleod Morass.			X	X		
Groundwater relationships with freshwater and variably saline wetlands, status, effects, potential causes of groundwater fluctuation.			X	X	X	
Wetland hydrology, current condition and potential impacts associated with altered water and salinity regimes.			X	X	X	
Environmental water requirements and setting realistic management goals for Macleod Morass and Jones Bay.		X	X	X		
Cues for migration and recruitment of native fish.	X	X	X	X		X
Impacts of blue-green algae on waterbirds and recruitment success.	X	X				
Impacts of reduced freshwater inflows on stratification and nutrient cycling in the deep lakes mega habitat.	X					
Effects of fire in the catchment on freshwater and variably saline wetlands.			X	X		
Productivity changes from altered water regimes and thresholds for change.			X	X	X	
Seagrass – reasons for fluctuations and possible management interventions, including thresholds.	X	X				
Water quality in the freshwater wetlands.			X			
Water quality and water regime in the freshwater and variably saline wetlands.				X	X	
Waterbird breeding: species and important breeding habitats / locations.	X	X	X	X	X	
Important habitats and populations of the threatened Australasian bittern in the Ramsar site.			X	X		
The populations and movement of native fish (including threatened species) in the freshwater wetlands and estuarine river reaches.			X			X
Habitat use by the Australian grayling within the site.	X	X	X			X
Vegetation extent and community composition in the fresh and variably saline wetlands and estuarine river reaches and drivers of change.			X	X		X
Importance of the estuarine river reaches to water dependent reptiles and mammals.						X
Feasibility of and options to improve the ecological condition of Lake Wellington.		X				
Implications of climate change for the ecological character of the Ramsar site.	X	X	X	X	X	X
Refuge for green and golden bell frog and growling grass frog during out of breeding season habitat requirements.			X	X		X
Migratory wader refuge: species and locations of important habitats; impact of recreational activities on migratory waders at these locations.	X	X	X	X	X	X

4 Site management strategies

4.1 Approach

Resource condition targets were developed for priority values to guide the development of appropriate management strategies. Resource condition targets are statements of aspirational condition for each of the identified priority values. High level management strategies were developed by experts and stakeholders to meet the targets and address critical knowledge gaps and assigned to one of six themes:

- Theme 1: Maintaining and restoring habitats
- Theme 2: Protecting fauna
- Theme 3: Managing nutrients and sediments
- Theme 4: Managing water regimes
- Theme 5: Integrating Aboriginal and European knowledge and management
- Theme 6: Improving our understanding.

4.2 Achievements from the 2003 plan

A large amount of on-ground work and research has been undertaken within the Gippsland Lakes Ramsar Site since the release of the 2003 Ramsar site management plan. A summary of this work, highlighting significant achievements related to maintaining ecological character is provided here for each management agency. Case studies of some key projects demonstrating the breadth of work being undertaken to maintain ecological character are illustrated in Figure 6.

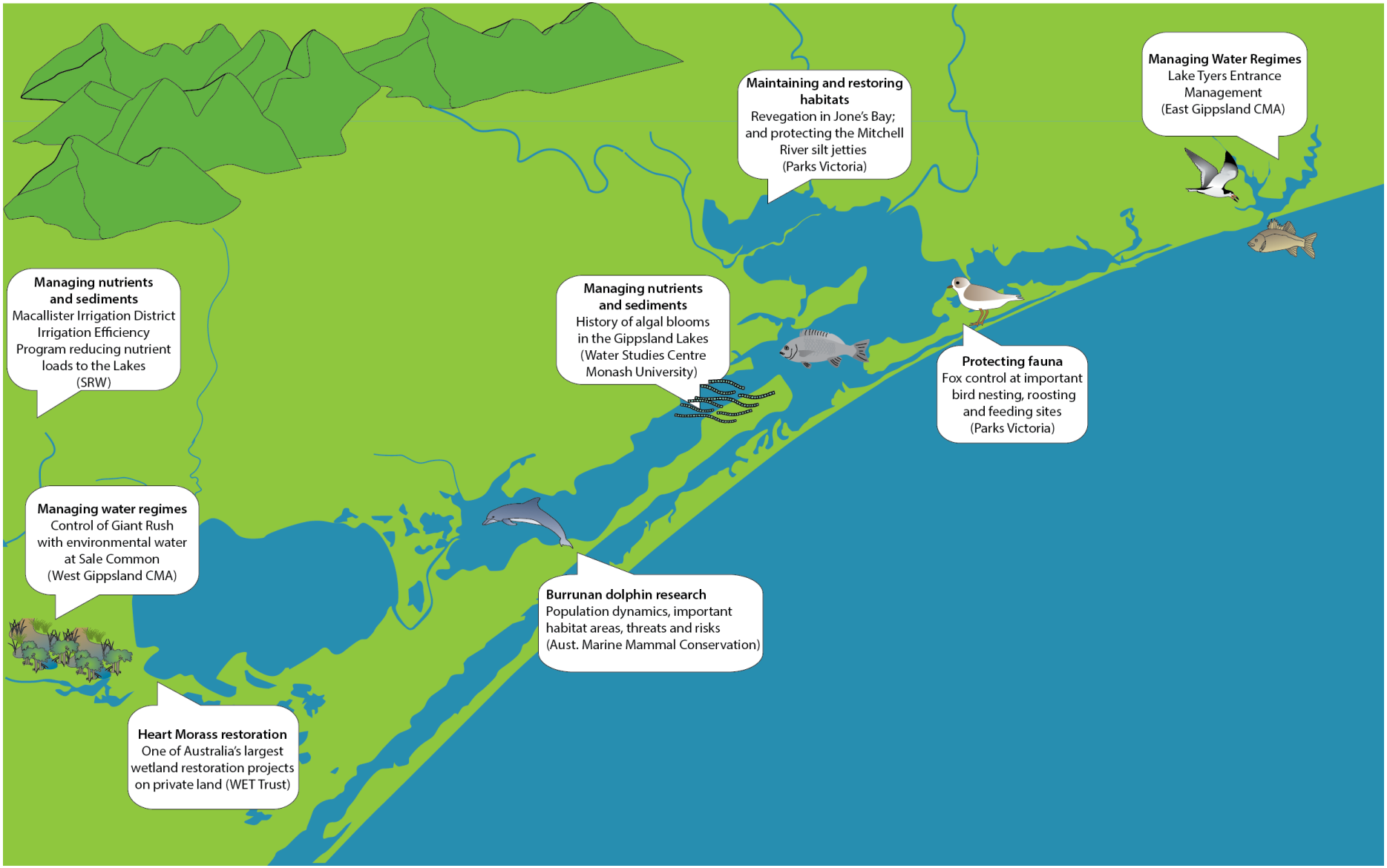


Figure 6: Case studies demonstrating some of the achievements in maintaining ecological character of the Gippsland Lakes Ramsar Site (further details in text boxes in subsequent sections).

4.3 Resource condition targets

A total of 26 Resource Condition Targets have been defined for the Gippsland Lakes Ramsar Site (Table 6). These have helped to guide the identification of management strategies and provide a goal for monitoring the ecological character of the site. Further information about RCTs can be found in the full management plan for the site.

Table 6: Resource Condition Targets for the Gippsland Lakes Ramsar Site.

Resource Condition Targets	Associated values
1. The current extent and condition of seagrass in the Gippsland Lakes Ramsar Site will be maintained as indicated by the following: • Maintain extent of seagrass – 4000 to 5000 hectares. • Maintain medium-dense seagrass cover in 25 % of beds (measured as a long term average over the 20 year timeframe).	Marine sub-tidal beds (seagrass)
2. Lakes Victoria and King remain clear with median secchi depths of > 1 m	Coastal lagoons (open water phytoplankton)
3. A reduction in the number of years in which blue-green algal blooms occur in the lakes to less than five over the 20 years.	
4. Maintain Macleod Morass and Sale Common as freshwater marshes.	Freshwater wetlands
5. Maintain the extent, diversity and condition of freshwater vegetation communities.	
6. Maintain extent of variably saline fringing wetlands.	Brackish wetlands
7. Maintain extent, diversity and condition of native vegetation communities: swamp paperbark (*Melaleuca ericifolia*) woodland and common reed (*Phragmites australis*) emergent macrophyte beds.	
8. Increase the extent and diversity, and improve the condition of native vegetation communities in and around the Heart Morass and other fringing wetlands on private land.	
9. Maintain the extent, diversity and condition of saltmarsh communities	Saltmarsh
10. Total diversity of waterbirds across the site remains above 86.	Abundance and diversity of waterbirds
11. The site supports greater than 20 000 waterbirds in three out of five years.	
12. Maintain successful breeding of little tern and fairy tern, with recruitment of 1.5 chicks per nest.	Threatened species
13. Green and golden bell frog and growling grass frog are recorded at Dutson Downs, Heart Morass, Clydebank Morass, Dowd Morass, Macleod Morass within a five-year period.	Threatened species
14. Successful breeding of green and golden bell frog and growling grass frog at a minimum of five sites in any five-year period, as evidenced by tadpoles and juveniles.	
15. Maintain native fish species richness, with a minimum of 70 species recorded in the Deep and Shallow lakes over any five-year period (based on Warry and Hindell 2012).	Abundance and diversity of native fish
16. Maintain fish diversity for species within each of the following life history strategy: estuarine dependent, estuarine opportunists, marine migrants, diadromous, and obligate freshwater species.	
17. Maintain sustainable native fish populations of important recreational and commercial fishes.	
18. Maintain hydrological and biotic connectivity between the catchment and the sea.	
19. Maintain populations of dwarf galaxias (*Galaxiella pusilla*).	Threatened species
20. Maintain populations of Australasian bittern (*Botaurus poiciloptilus*)	Threatened species
21. Maintain populations of threatened plant species: dwarf kerrawang (*Commersonia prostrate*); swamp everlasting (*Xerochrysum palustre*); metallic sun-orchid (*Thelymitra epipactoides*), river swamp wallaby grass (*Amphibromus fluitans*).	Threatened species
22. Maintain extent and community composition of Gippsland Red Gum (*Eucalyptus tereticornis* sub spp. *mediana*) Grassy Woodland.	Threatened communities
23. Maintain the existing population of Burrunan dolphins.	Burrunan dolphin
24. Maintain the current (2014) shoreline alignment in priority areas identified in Parks Victoria (2014).	Geomorphic features (silt jetties)
25. Protect regularly used colonial waterbird breeding sites (Pelicans, Darters, Ibis, Pied Cormorants, Little Black Cormorants, Royal Spoonbills)	Waterbird breeding
26. Increase instream habitat (woody debris and in channel vegetation) in the estuarine river reaches	In-stream habitat in riparian reaches

4.4 Theme 1: Maintaining and restoring habitats

4.4.1 Past and current activities

Parks Victoria, DELWP, East and West Gippsland CMAs and Gippsland Ports with partner organisations, community groups and volunteers have been actively involved in a wide range of projects aimed at maintaining and restoring habitats in the Gippsland Lakes. Activities include excluding stock from waterways, improving the condition/health of wetlands, improving riparian and shoreline frontages, active revegetation, weed and invasive native plant species control. Two case studies presented below highlight some of the successes.

Maintaining habitat: The Mitchell River silt jetties

The Mitchell River silt jetties are long, narrow tracts of land that extend almost eight kilometres into Lake King, forming the barrier between Lake King and Jones Bay. They are second in size only to those of Mississippi River that extend into the Gulf of Mexico and are considered significant both nationally and internationally as one of the finest examples of this type of landform in the world (Rosengren 1984).

The origin of the Mitchel River silt jetties has been the subject of scientific debate, with questions raised about how such an extensive formation of sediment could have accumulated from such a relatively small river (Bird 1978). However, the most common theory is that they were formed from the deposition of sediments from the Mitchell River as a type of river delta, with the low wave energy in the waterbodies prior to the permanent opening to the Southern Ocean, accounting for their unusual size (Rosengren 1984).

Since the 1900s, there has been considerable erosion of the silt jetties and surrounding shorelines, with much of the extensive reed beds that once protected these shorelines now gone. In addition, these important features, which provide habitat for a variety of plants and animals, are at risk from sea level rise and climate change (Arrowsmith et al. 2014).

Parks Victoria is leading a collaborative project to protect the silt jetties through a number of on ground management actions.

Shoreline erosion susceptibility (high shown in pink) of the areas around the silt jetties from predicted sea level rise (Arrowsmith et al. 2014).

Restoring habitat: Revegetation in Jones Bay

Parks Victoria is leading two key projects involving revegetation in the Jones Bay area of the Gippsland Lakes Ramsar Site. These projects complement each other and will provide Jones Bay with buffering protecting from the surrounding private property and industrial estate.

The Jones Bay Wildlife Reserve Revegetation Project

The Jones Wildlife Reserve Revegetation Project is a partnership between Greening Australia and Parks Victoria, funded through Caring For Our Country Grants. The project is based at the northern boundary of the Jones Bay Wildlife reserve area. The objective is to see the currently degraded fringing areas of the reserve enhanced with a diversity of species of native vegetation. This will not only increase the habitat values of the reserve but will also buffer the wetlands from the surrounding land use threats such as nutrient loads and weed seed dispersal. Specifically the project aims to:

- Prioritise the landscape over five years within each work area.
- Revegetate three main vegetation communities (floodplain riparian woodland, estuarine wetland and saltmarsh).

Jones Bay Gippsland Lakes Reserve Revegetation Project EGCMA

The Gippsland Lakes Environment Fund has funded a program of revegetation and habitat protection in the riparian areas of the streams flowing into Jones Bay. The project has provided appropriate financial incentives (in the form of landholder grants) in order to achieve ongoing stock exclusion and weed control on properties adjoining priority riparian areas. To date achievements include:

- 42 hectares protected from livestock
- 20 hectares revegetated
- 6.5 km of fence line constructed
- Revegetation program – 16 550 native seedlings planted throughout 9 protected sites. A further 7 000 seedlings will be planted (in-fill planting where required) within these sites during Autumn 2015.

The revegetation is proving to be very successful at this point –particularly given the challenging planting conditions at some sites. The consistent rainfall throughout spring and summer has been of tremendous benefit.

4.4.2 Management strategies

Many of the habitats of the Gippsland Lakes were identified as priority values for management during the life of this plan on the basis of both their ecological significance, community value and current threats. Direct impacts from physical damage (from erosion or human activities) as well as from introduced plants and animals were identified as critical threats. Twelve management strategies have been developed to meet resource condition targets by maintaining habitat values and addressing priority threats (Table 7). The relationship between management strategies, priority threats and priority values with their associated resource condition targets is provided in the full Gippsland Lakes Ramsar Site Management Plan.

Table 7: Management strategies and responsibilities for maintaining and restoring habitat.

Management Strategies	Responsibility	Linkages to existing programs / activities	Relevant mega-habitat(s)
1A. Manage boat and swing moorings to minimize physical damage to seagrass beds.	Gippsland Ports		Deep Lakes Shallow Lakes
1B. Implement island renourishment and re-vegetation.	Gippsland Ports, DELWP, Parks Victoria	On-going active management of sand islands for nesting bird habitat.	Deep Lakes Shallow Lakes
1C. Protect and restore habitat at little tern and fairy tern nesting and post-breeding sites. Manage sea spurge at little tern and fairy tern nesting sites.	DELWP, Parks Victoria	Gippsland Lakes Environment Fund program.	Deep Lakes Shallow Lakes
1D. Improve native vegetation corridors and connectivity within and between all habitat types represented in the Ramsar site.	East and West Gippsland CMAs	East and West Gippsland Regional Waterway Strategies	All
1E. Continue protection and rehabilitation of the Heart Morass.	WET Trust	Heart Morass restoration plan	Variably saline wetlands
1F. Continue strategic protection and rehabilitation of wetlands on private property that contribute to maintaining the ecological character of the Ramsar site.	East and West Gippsland CMAs	Greening Australia Western wetlands protection program	Variably saline wetlands
1G. Implement actions to control invasive native species such as Typha and Giant Rush in freshwater wetlands as required.	Parks Victoria, East and West Gippsland CMAs	DELWP, Parks Victoria Macleod Morass Vegetation Project	Freshwater wetlands
1H. Actively manage priority non-native pest plants.	Parks Victoria	Parks Victoria invasive species strategy	All
1I. Develop and implement instream and riparian habitat protection and/or rehabilitation programs for the estuarine river reaches	East and West Gippsland CMAs	East and West Gippsland Regional Waterway Strategies	Estuarine reaches
1J. Explicitly consider impacts to visual amenity of the landscape when assessing planning applications adjacent to the site	Shire Councils	Gippsland Lakes Sustainable Development Strategy Gippsland Lakes Coastal Action Plan	All
1K. Monitor and where possible control off-road vehicle use at priority locations within the Ramsar site	Parks Victoria		Deep Lakes, Shallow Lakes Hypersaline wetlands
1L. Develop management strategies to maintain and restore the Mitchell River silt jetties	Parks Victoria East Gippsland CMA	Shoreline protection and enhancement of key areas of the Mitchell River Silt Jetties	Deep Lakes

4.5 Theme 2: Protecting fauna

4.5.1 Past and current activities

Protecting fauna in the Gippsland Lakes has been a focus for a number of programs over the past decade. There has been work on controlling introduced animals such as foxes and carp; protection of important nesting sites and raising awareness of the potential harm to shorebirds, nesting birds and dolphins from disturbance and harassment. The case studies presented below illustrate the need for continued protection of the vulnerable fauna of the Gippsland Lakes Ramsar Site.

Protecting fauna: Sea spurge, foxes and nesting terns

Sea Spurge

Sea spurge (*Euphorbia paralias*) is a coastal plant that grows in sandy dunes and is native to southern Europe and northern Africa. It was introduced to Australia via shipping and first recorded in Albany, Western Australia in 1927. The plant is prolific seeder and produces buoyant seeds that were transported by ocean currents spreading east. It was first recorded in Wilsons Promontory in 1982 and in the Gippsland Lakes in 1993 (Heyligers 2002).

Sea spurge spreads quickly across dune areas, displacing the sandy habitat that shore nesting birds such as little tern, fairy tern and hooded plover require for nesting. These birds build a nest in a scrape in the sand and a lack of sandy habitat can reduce breeding success (Mead et al. 2012).

Parks Victoria, the Friends of the Parks and Reserves of the Gippsland Lakes and the Lakes Entrance Community Landcare Group have been working together to control the plant in nesting sites. The timing of the weed control is critical to ensure that nesting birds are not disturbed and the maximum amount of habitat is made available (http://parkweb.vic.gov.au/about-us/news/friends-unite-to-remove-sea-spurge-pest-from-gippsland-lakes).

Gippsland Lakes Coastal Park Fox Control Program

Parks Victoria leads a program of active fox control across 2300 hectares of the Gippsland Lakes Coastal Park taking in Boole Poole Peninsula, Bunga Arm, Rigby Island, Crescent Island, Barton Island and large sections of the 90 Mile Beach from Ocean Grange to Lakes Entrance. This Fox Control program provides protection to native wildlife including the threatened little tern and fairy tern, hooded plover and other significant wetland birds and their breeding habitat. In one form or another the program has been carried out by Parks Victoria and the Department of Environment, Land Water and Planning for more than 15 years.

Photo: Faye Bedford

Vulnerable fauna: The Burrunan dolphin

In 2011 a new species of dolphin, the Burrunan dolphin (*Tursiops australis*), was described from south-eastern Australia (Charlton-Robb et al. 2011). The Gippsland Lakes is home to one of only two known resident populations of this species, with an estimated resident population size of just 50 individuals (Charlton-Robb et al. 2014). During winter, however, the numbers increase, with over 150 individuals recorded. It is thought that this is due to migration of males between the Gippsland Lakes and Tasmania in a seasonal pattern, arriving in the Gippsland Lakes in winter to breed, then heading south to Tasmania in summer. By contrast, the female population appears to be more sedentary, remaining in the Lakes year round.

The very small population size makes these dolphins vulnerable to human impacts as the loss of only a few dolphins could affect the viability of a population. In February 2014, the species was listed as threatened under the *Flora and Fauna Guarantee Act 1988*.

Of concern are the impacts of tourism and boating on the Burrunan dolphins in the Gippsland Lakes, with the species affected by boat strike and altered behaviour from pursuit. In particular avoidance of boats and tour operators can detract from important activities for dolphins such as feeding and resting and can lead to a decline in their health (Howes et al. 2012, Filby et al. 2014). Managing boating and tourism in the Gippsland Lakes to maintain and improve the condition of the Burrunan dolphin is an important to both maintain dolphin populations and the long term sustainability of dolphin related tourism.

4.5.2 Management strategies

Waterbirds and the Burrunan dolphin were identified as high priority values for management in the next eight years due to their ecological importance and identified high risks (see Table 4). In addition, introduced marine pests were identified as a priority threat in the main lakes with the potential to impact on native fauna through competition and predation. Six management strategies have been identified to protect fauna (Table 8). The relationship between management strategies, priority threats and priority values with their associated resource condition targets is provided in the full Gippsland Lakes Ramsar Site Management Plan.

Table 8: Management strategies and responsibilities for protecting fauna.

Management Strategies	Responsibility	Linkages to existing programs / activities	Relevant mega-habitat(s)
2A. Control of introduced predators in priority bird areas	Parks Victoria, DELWP	Biodiversity programs by Parks Victoria and DELWP	All
2B. Increase signs in priority migratory wader and nesting bird habitats to reduce disturbance	Parks Victoria, DELWP	Biodiversity programs by Parks Victoria and DELWP	Deep Lakes Shallow Lakes
2C. Identify key nursery areas for the Burrunan dolphins	DELWP	AMMCF (Australian Marine and Mammal Conservation Foundation)	Deep Lakes, Shallow Lakes, Estuarine reaches
2D. Investigate the risk posed by human disturbance to migratory waders develop and implement feasible actions to address the risks	Parks Victoria, DELWP		Shallow Lakes, Variably saline and hypersaline wetlands
2E. Develop and implement a public awareness campaign to reduce harassment and boating injuries to Burrunan dolphins	DELWP / Gippsland Ports	AMMCF	Deep Lakes, Shallow Lakes, Estuarine reaches
2F. Implement an introduced marine pest strategy for the Gippsland Lakes	DELWP	GLMAC: Introduced marine pest investigation	Deep Lakes, Shallow Lakes

4.6 Theme 3: Managing nutrients and sediments

4.6.1 Past and current activities

Nutrient and sediment inputs to the Gippsland Lakes have been the subject of extensive investigation and committed on-ground management actions. In the past decade, our understanding of the triggers for algal blooms and nutrient and sediment sources has been greatly improved. In addition, agencies such as the West and East Gippsland CMAs have worked with landholders, industry and communities to try and reduce the loads of nutrients and sediments entering the Gippsland Lakes from the catchment. The two case studies reflect both the improvement in our knowledge and the achievements of on ground actions.

The impacts of increased nutrients: the history of algal blooms

A study of the long-term history of algal blooms in the Gippsland Lakes from sediment cores indicates that there are two distinct periods of blue-green algal blooms in the Lakes (Holland et al. 2013a). The first was prior to the permanent opening of the entrance to the Southern Ocean, and it is thought that the intermittently closed and open lagoon system was eutrophic. This is followed by a period immediately post construction of the channel at Lakes Entrance in 1889 of low algal growth, as the system filled and flushed with marine water. The second period of increased algal blooms occurred more recently with seven diatom / dinoflagellate blooms recorded between 1985 and 2012 (Day et al. 2011). Post 1986, a number of blooms of the blue-green algae *Nodularia spumigena* were recorded across Lake King and Lake Victoria (Webster et al. 2001, Beardall 2008, Day et al. 2011) and in 2007, for the first time a bloom of the cyanobacterium *Synechococcus* spp. extended across large areas of the main lakes for over five months (Beardall 2008, Day et al. 2011). In 2011 *N. spumigena* again bloomed across the Lakes from December 2011 to April 2012 causing the closure of fisheries, a second bloom occurred the following summer, but lasted a shorter period of time (Holland et al. 2013b).

Algal blooms are linked to periods of increased nutrients, which arrive in large loads following heavy rainfall and in extreme loads following widespread bushfires in the catchment. Erosion from cleared land and degraded river banks are a significant source of sediment and nutrients (Hancock et al. 2007). The West and East Gippsland CMAs and other agencies such as Southern Rural Water have a number of programs in place to address nutrient and sediment movement from the catchment to the Lakes to help manage algal blooms and protect the ecological character of the Gippsland Lakes Ramsar Site.

Reducing nutrient and sediment inflows to the Gippsland Lakes: Macalister Irrigation District Irrigation Efficiency Incentives Program

The Macalister Irrigation District Nutrient Reduction Plan (MID NRP) was developed in 1998 to reduce the amount of phosphorus leaving the district in drainage water and to lower the likelihood of algal blooms in the Gippsland Lakes. The plan identified more efficient use of irrigation water, fertilisers and dairy waste as the best way to achieve this outcome.

The MID NRP has now been replaced by the Macalister Land and Water Management Plan (MLWMP), which aims to improve not only the health of the Gippsland Lakes, but also the condition of a range of assets including productive farmland, wetlands and native vegetation. The plan recognises that more efficient use of irrigation water remains one of the best ways to minimise offsite impacts of irrigation.

Financial assistance has been available to MID farmers under the incentives program since July 2000 to help irrigators plan and implement improved irrigation practices on farms.

Projects completed to June 2014

Activity	No. of projects completed	Area serviced (hectares)	Estimated water savings (ML)	Estimated phosphorus savings (tonnes)
Irrigation farm planning	404	33,869	na	na
Irrigation re-use systems installed	221	11,127	22,000	84
Flood to spray irrigation conversions	126	4,039	8,000	32

4.6.2 Management strategies

Nutrient and sediment inflows from the catchment to the main lakes were identified as one of the highest priority threats for this Ramsar site management plan (see Table 4). Impact pathways from general agricultural run-off and elevated nutrient and sediment loads following bushfires, were identified as high risks for seagrass, waterbirds (including the threatened species little tern and fairy tern), visual amenity, recreation and tourism. A single integrated management strategy has been identified to address this important issue and maintain ecological character (Table 9). The relationship between management strategies, priority threats and priority values with their associated resource condition targets in the full Gippsland Lakes Ramsar Site Management Plan.

Table 9: Management strategies and responsibilities for managing nutrients and sediments.

Management Strategies	Responsibility	Linkages to existing programs / activities	Relevant mega-habitat(s)
3A. Reduce nutrient and sediment loads to the Gippsland Lakes through riparian, in-stream and catchment works to improve water quality of river flows to the Gippsland Lakes.	East and West Gippsland CMAs DEDJTR	Riparian, in-stream and catchment works in the East and West Gippsland Regional Catchments Strategies and Regional Waterway Strategies Existing Parks Victoria vegetation management programs CORE 4 program in dryland and irrigated areas of West Gippsland MID extension and incentives program SEPP Waters of Victoria (currently under revision)	Deep Lakes Shallow Lakes

4.7 Theme 4: Managing water regimes

4.7.1 Past and current activities

In the past decade there have been significant developments with respect to environmental water management in the Gippsland Lakes and catchment. Environmental water management arrangements have been established for rivers flowing into the Gippsland Lakes and used to "*preserve environmental values and health of water ecosystems including their biodiversity, ecological functioning and quality of water and other uses that depend on the environmental condition."* East and West Gippsland CMAs have worked with storage operators, water entitlement-holders and land-holders to maximise the environmental benefits from the environmental water and integrate it with other waterway management works and measures. In addition, there has been considerable effort into maintaining connectivity and managing the opening of estuaries, such as Lake Tyers. The two case studies below provide examples of both these functions.

Managing water regimes: Lake Tyers Entrance Management

Lake Tyers is naturally an intermittently open and closed coastal lagoon that remains closed for periods of time due to sand accumulation at the entrance. The system opens naturally following heavy rainfall, or can be opened artificially by excavator.

Extended periods of closure have been known to result in:

- A decline of seagrass health and cover;
- Water quality decline, including low dissolved oxygen leading to fish deaths;
- Loss of connectivity for fish species that migrate from the rivers and estuaries to the sea;
- Potential flooding of beach nesting sites for little tern and fairy tern; and
- If water levels exceed 1.9 m AHD, inundation of assets such as jetties, fish cleaning stations and boat ramps.

Artificially opening of Lake Tyers can have impacts to nesting birds (near the entrance location), and on the feeding opportunities for these birds near their nesting locations.

To maximise the benefits for environmental and social assets at Lake Tyers, East Gippsland CMA has developed and is implementing an Estuary Entrance Management Protocol. This provides a systematic and coordinated approach to entrance opening. The decision to artificially open the estuary entrance will be based on several factors. The main physical factors considered are staff and contractor safety, the level of the water in the estuary, the predicted tide levels at sea, the forecast weather conditions and the distance of the sand between the beach and the estuary. These factors determine whether there is a safe worksite and suitable gradient across the sand so that the entrance will scour sufficiently for the entrance to have the best chance to stay open.

The main environmental factors considered are the oxygen levels in the estuary at the time of the proposed opening. Low levels of oxygen have the potential to impact fish after opening if the oxygenated water drains from the top layers and forces fish into the deeper oxygen depleted water.

Managing water regimes: Sale Common

Dense stands of the native plant Giant Rush (*Juncus ingens*) colonised large areas of previously open water in Sale Common in early 2009. This dramatic vegetation change occurred during a prolonged dry period that extended from the summer of 2008 to spring 2010. The species grows best in shallowly flooded or waterlogged sediments over summer, and so was able to take advantage of the lower water levels over this period. Vandalism of the Sale Common water control structure that connects the wetland to the Latrobe River in spring 2009 is thought to have further encouraged the growth and spread of the rush. Initially water levels rose rapidly to almost fill the wetland. Water levels subsequently receded as water flowed back into the falling river, leaving shallow water across the wetland and creating optimal conditions for Giant Rush to thrive.

Giant Rush can provide excellent habitat for cryptic waterbird species such as bitterns, crakes and rails, and some colonial nesting species such as ibis. It can also become invasive however, creating tall dense stands that reduce overall habitat diversity. There was some concern that Giant Rush could permanently dominate much of the previously 'open' water areas of Sale Common without management intervention. Such a major shift in plant communities is undesirable because it has the potential to decrease the ecological value of the wetland.

The West Gippsland CMA, in collaboration with Parks Victoria, responded to the vegetation change by developing a management strategy aimed at reducing the extent and density of Giant Rush. The strategy was to 'drown' the rush as the seedlings and young plants are thought to be intolerant of long-term submergence. This was to be done by artificially filling the wetland using the Latrobe River regulator in spring 2010, and maintaining high water levels for approximately three years. Nature assisted the chosen watering strategy by completely filling Sale Common in September 2010 and maintaining high water levels through rainfall and natural over-bank flooding for the majority of the last four years. Natural inundation was supplemented with artificial watering in autumn 2013. West Gippsland CMA and Parks Victoria worked closely with VicRoads during the realignment of the South Gippsland Highway in 2010-2011 to ensure that water was retained in the wetland whilst de-watering of the footings for the new road bridges occurred adjacent to the Common.

The water management strategy has achieved the result it sought: a reduction in the extent and density of Giant Rush across Sale Common, in order to restore the mosaic of different vegetation types.

4.7.2 Management strategies

Altered water regimes in the fringing wetlands and the estuarine river reaches of the Gippsland Lakes Ramsar Site were identified as a priority threat for this Ramsar site management plan, with the potential to impact ecological character through changes in salinity, vegetation diversity and extent, disruption of bird breeding cycles and a loss of breeding triggers for estuarine fish (Table 4). Four management strategies have been identified in this plan to address this issue, supporting the existing work that is currently being undertaken in the Ramsar site (Table 10).

Table 10: Management strategies and responsibilities for managing water regimes.

Management Strategies	Responsibility	Linkages to existing programs / activities	Relevant mega-habitat(s)
4A. Undertake regular planning, delivery, monitoring and evaluation of the use of environmental water entitlements in the lower Latrobe wetlands (Sale Common, Heart Morass, Dowd Morass) and the Latrobe River estuary.	West Gippsland CMA Parks Victoria Victorian Environmental Water Holder	West Gippsland CMA environmental water program. Gippsland Region Sustainable Water Strategy	Fresh and variably saline wetlands Estuarine river reaches
4B. Investigate, and where feasible and cost effective, implement actions that enable and facilitate effective management of the water and salt regimes of priority fringing wetlands, including Sale Common, Heart Morass, Dowd Morass, Lake Reeve and Macleod Morass. For example: technical studies, management plans and/or agreements, water entitlements, on-ground works, operational management and monitoring.	East and West Gippsland CMA Parks Victoria Victorian Environmental Water Holder Wellington Shire Council East Gippsland Water, Department of Environment, Land, Water and Planning	West Gippsland CMA environmental water program Gippsland Region Sustainable Water Strategy	Fresh, variably saline and hypersaline wetlands
4C. Maintain and where necessary improve hydrological connectivity and freshwater inflows to the Gippsland Lakes for fish migration and breeding.	East and West Gippsland CMAs	East and West Gippsland Regional Waterway Strategies	Deep Lakes, Shallow Lakes, Estuarine river reaches
4D. Develop and implement a procedure for the management of estuary mouth closures for Lake Tyers and Merriman Creek	West and East Gippsland CMAs	East Gippsland CMA estuary opening strategy for Lake Tyers West Gippsland Regional Waterway Strategy	Deep Lakes Estuarine river reaches

4.8 Theme 5: Integrating Aboriginal and European knowledge and management

4.8.1 Aboriginal cultural values of the Gippsland Lakes

The Gunaikurnai people have been custodians of the waterways in the Gippsland region, including the wetlands and rivers of the Ramsar site, for thousands of years. Waterways were, and remain important to Aboriginal people, providing the following values (Leggett 2013):

- **Food** - fishing, collecting mussels, catching eels, hunting animals, collecting swan eggs, and gathering of various plants for food and medicine;
- **Implements** – materials for basket weaving, grinding stones in river beds, ochre for ceremony, bark for canoes;
- **Culture** - Water bodies are important places for our people to come together for cultural, social and recreational activities. In the past, these sites were important meeting places for different clans to conduct business such as trade; and
- **Travel and boundaries** – Rivers provided the tribal boundaries for our region, they were where our people waited to be welcomed on to neighbouring country, they were also an important means of travel both by foot and on water.

Aboriginal values of the Gippsland Lakes: The Dreaming

Creation story of the Gunaikurnai people

The father of the Gunaikurnai people was Borun the pelican, he came down from the mountains in the North West of Victoria carrying his canoe on his head, he crossed over what is now known as the Thompson River at Sale, and walked on to Tara Warackel (Port Albert) in the west. While walking he heard a constant tapping sound but did not know what it was. When he reached the deep water of the inlets, Boorun put down his canoe and, much to his surprise, there was a woman in it. She was Tuk the musk duck.

He was very happy to see her and she became his wife and the mother of the Gunaikurnai people – they are the parents of the five Gunaikurnai clans.

Tiddalik the frog

Tiddalik the frog was a giant frog, the largest frog that had ever been, one day he woke up very thirsty, he drank and drank until there was no fresh water left in the region. The creatures and plants were all dying and it seemed that soon Tiddalik would be the only one still alive.

The animals did not know what to do, until a wise old wombat suggested that if they could make Tiddalik laugh then all of the water would flow out of his mouth.

So all of the animals gathered at the frogs resting place, for a long time they tried to make him laugh, but he would not. The kookaburra told his funniest stories, he himself had a good laugh, the kangaroo jumped over the emu, the lizard waddled around on two legs, but the frog did not laugh. All the animals were reaching the point of despair when the eel, driven from his favourite creek by the drought, slithered up to the frog and began to dance. He started with slow, graceful movements, then moved faster and twisted and turned himself into weird and wonderful shapes, then suddenly Tiddalik the frog's eyes bulged, his body shook, and he began to laugh. As he laughed all of the water escaped from his mouth and caused a big flood which filled up all of the lakes and swamps and rivers.

4.8.2 Threats to Aboriginal cultural values of the Gippsland Lakes

To a large extent, the threats and risks to the ecological character of the Ramsar site are equally applicable to Aboriginal cultural values. Reduced water quality, pollution, pest plants and animals and inappropriate development have all been identified as impacting on the cultural values of the waterways (Leggett 2013).

In additional, there are several other issues of concern particular to the Aboriginal cultural values of the site. These include:

- Physical damage and erosion to burial sites and other physical artefacts / significant sites.
- Unmanaged public access to shell middens and other important sites
- Restricted Aboriginal access to important sites due to private land ownership.

Threats to Aboriginal cultural values: Legend Rock

The Legend Rock, an important part of Gunaikurnai mythology, lies in shallow water by the shore of Bancroft Bay, opposite the Metung Yacht Club in Tatungooloong Country.

One day, some fisherman who had hauled in many fish with their nets, ate their catch around their campfire. The women, guardians of the social law, saw that the men had eaten more than enough but had not fed their dogs. As a punishment for their greed the fishermen were turned to stone.

The Legend Rocks hold great spiritual value to the Gunaikurnai people and the story serves as a great legend for its people to remember the laws of the land.

There were originally three rocks in the formation at Metung, unfortunately two were destroyed during road construction along the shore of Bancroft Bay in the 1960s. The last rock was preserved when community members and Gippsland and East Gippsland Aboriginal Cooperative had an injunction issued. The Legend Rock continues to be protected under the Aboriginal Heritage Act (2006) of Victoria.

http://www.batalukculturaltrail.com.au/legend_rock.php

In October 2010, the Gunaikurnai were granted Native Title over nine national parks and one reserve in the Gippsland region, with joint management overseen by the Traditional Owner Land Management Board (TOLMB). This includes a number that are wholly or partly within the Gippsland Lakes Ramsar Site:

- Gippsland Lakes Coastal Park
- The Lakes National Park
- Lake Tyers State Park
- Raymond Island Gippsland Lakes Reserve

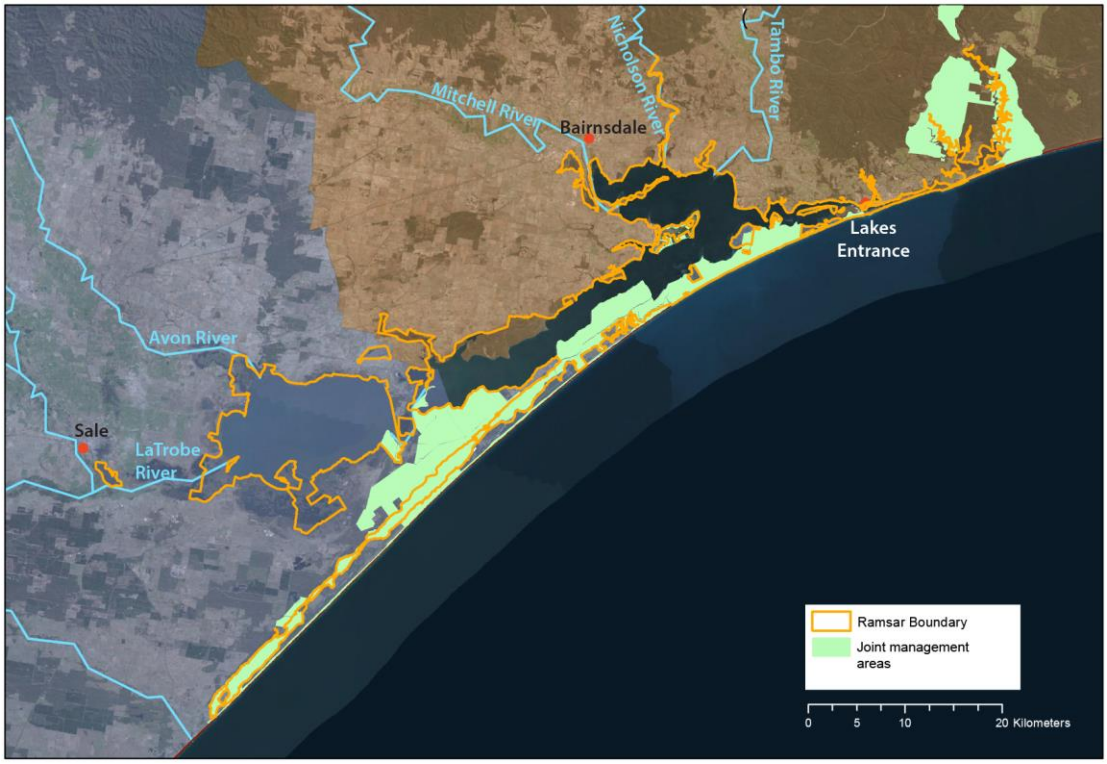


Figure 7: Joint management areas and the Ramsar site boundary.

Joint management benefits both Gunaikurnai and the wider community through recognising Aboriginal culture and knowledge, providing quality tourism experiences, improved public education and by conserving, protecting and enhancing natural and cultural values. Joint management has enabled increased funding to support joint management and employ Gunaikurnai people to work on country. This will result in healthier parks and better visitor experiences. Currently, Gunaikurnai Land and Waters Aboriginal Corporation (GLaWAC) has

a team of six on-ground rangers undertaking a range of management works in these parks. TOLMB is leading the development of joint management plans for each park to help guide works priorities and actions and is working closely with GLaWAC and Parks Victoria to do this.

4.8.3 Aboriginal priority management strategies

The Gunaikurnai Whole of Country Plan is being developed by GLaWAC with the assistance of Native Title Serves Victoria. The plan will guide the activities of GLaWAC and TOLMB across the region. The plan establishes some guiding principles, which are equally applicable to the management of the Aboriginal cultural values of the Gippsland Lakes Ramsar Site (see text box). Management strategies related to Aboriginal cultural values of the Ramsar site are provided in Table 11.

Table 11: Management strategies and responsibilities for integrating Aboriginal and European knowledge and management.

Management Strategies	Responsibility	Linkages to existing programs / activities	Relevant mega-habitat(s)
5A. Implement joint management of the Gippsland Lakes Coastal Park, The Lakes National Park, Lake Tyers State Park and Raymond Island Gippsland Lakes Reserve	GLaWAC Parks Victoria	Whole of Country Plan and Joint Management Plans currently under development	Deep lakes, Shallow Lakes, Hypersaline wetlands
5B. Deliver training and knowledge to increase the capacity of the Aboriginal community to be involved in the management of the Ramsar site	GLaWAC		All
5C. Conduct a comprehensive survey of all waterways in the Ramsar site with respect to cultural significance.	GLaWAC		All
5E. Recognise the cultural value of water bodies, collect data on cultural flows and to take steps to ensure that these values are included in decisions regarding Ramsar site management	GLaWAC		All
5F. Develop and implement traditional ecological knowledge projects within the Ramsar site	GLaWAC		All

Whole of Country Principles

We have cultural obligations
It is our inherent responsibility to look after Country – to heal the damage of the past and protect it for future generations.

Everything is connected
All of our Country is linked. There is no separation between our landscapes, waterways, coasts and oceans, natural and cultural resources. All are linked to our people, law and custom.

Every bit matters
We understand the need to prioritise limited resources to where important values are under threat, but every part of our Country remains important to us. Our values exist even when you can't see them – whether they are under water, deep inside caves, covered with vegetation, they are still important to us.

Don't wait until it is gone
When you lose a site it is gone forever. We need to act now to prevent any further loss of environmental or cultural values.

Look at what was there before
When we are healing and restoring degraded landscapes, we should try and put back the plants and animals that used to be there.

Sustainable use
Our approach to managing Country is to balance resource use with conservation – they are part of the same. Take only what you need – leave some for others.

Seek collective benefits
We use our resources for the benefits of the mob rather than seek individual gain.

We have a right to be on our Country
Traditional Owners should not be restricted in accessing our traditional Country. At the same time, we should have the right to restrict access to others who disrespect and damage our sensitive areas.

Our traditional knowledge is valuable
Our traditional practices and approaches sustained the land for thousands of years. Our Country should be managed in harmony with our traditional ways. We need to take the time to understand what natural and cultural heritage exists out on Country. It can't be managed properly if we don't know what is there.

4.9 Theme 6: Improving our understanding

Twenty-one priority knowledge gaps were identified during the development of the Gippsland Lakes Ramsar Site Management Plan (Table 5). Some of these are addressed through monitoring activities (see section 5) and 14 management strategies have been developed to address the remainder (Table 12).

Table 12: Management strategies to address critical knowledge gaps.

Management Strategies	Responsibility	Linkages to existing programs / activities	Relevant mega-habitat(s)
6A. Investigate priority species and locations for waterbird breeding and migratory wader refuges within the Ramsar site. Assess that habitat requirements are being met at priority locations.	DELWP	Oil Spill Response Atlas (OSRA) Gippsland Lakes Hotspots Project – BirdLife East Gippsland	All
6B. Assess the distribution of heavy metals and other contaminants (including mercury) in the Gippsland Lakes and the level of risk (i.e. bioavailability).	EPA Victoria, DHHS	Current EPA desktop review of sources.	Deep Lakes, Shallow Lakes, Estuarine reaches
6C. Investigate the risks of toxicants (steroid hormones) in Macleod Morass.	EPA Victoria, Parks Victoria East Gippsland CMA		Freshwater wetlands
6D. Investigate the cues for migration and recruitment of native fish	DELWP	Current research on black bream in the Latrobe River, including tracking (West Gippsland CMA)	Deep Lakes, Shallow Lakes, Estuarine reaches
6E. Assess the impacts of blue-green algal blooms on waterbird populations and recruitment success	DELWP		Deep Lakes, Shallow Lakes
6F. Assess variability in the extent and condition of seagrass, including environmental thresholds for change	DELWP		Deep Lakes, Shallow Lakes
6G. Investigate the habitat use and requirements for Australian grayling within the Ramsar site	DELWP		Deep Lakes, Shallow Lakes, Estuarine reaches
6H. Assess the importance of estuarine reaches to amphibians, aquatic reptiles and mammals	DELWP		Estuarine River Reaches
6I. Investigate the risk associated with and potential mitigation strategies for climate change impacts to ecological character of the Ramsar site	DELWP East and West Gippsland CMAs		All
6J. Investigate the impacts of altered freshwater inflows on nutrient cycling and productivity in the Deep Lakes, including thresholds for change	DELWP		Deep Lakes
6K. Investigate the impact of high nutrient and sediment loads to fresh and variably saline wetlands following bushfires	DELWP East and West Gippsland CMAs		
6L. Investigate feasible management options for the control of invasive freshwater fish (carp and gambusia)	DELWP		Fresh and variably saline wetlands
6M. Investigate options for improving the ecological condition of Lake Wellington.	DELWP		Shallow Lakes
6N. Investigate the non-breeding habitat requirements of threatened frog species	DELWP		Fresh and variably saline wetlands

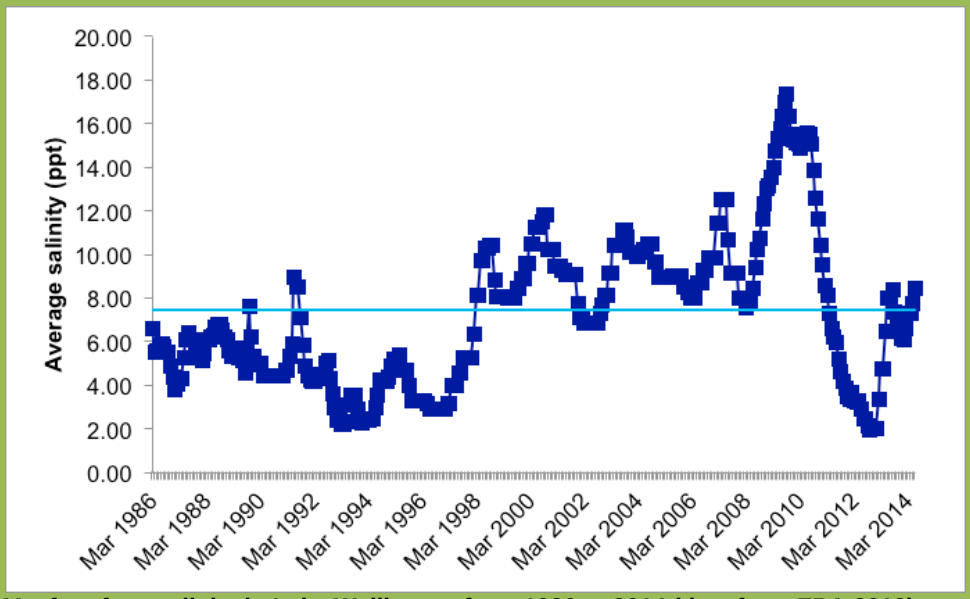
Management Strategies	Responsibility	Linkages to existing programs / activities	Relevant mega-habitat(s)
6O. Awareness raising/education about the Ramsar Convention, the condition of the Gippsland Lakes, environmental impact assessment, management options and implications.	DELWP East and West Gippsland CMAs		All

Improving our understanding: Setting realistic goals for Lake Wellington

Approximately 20 percent of the total average freshwater inflow to the Gippsland Lakes is extracted for consumptive use, particularly from the western rivers (Tilleard and Ladson 2010). Flows in the Latrobe River system are also highly modified by the Thomson, Glenmaggie and Blue Rock Dams. The combined effects of extraction and storage result in a reduction of freshwater inflow into Lake Wellington of more than one third (O'Connor et al. 2009).

This reduction in freshwater inflows has been identified as the critical factor affecting salinity (and the rise of salinity) in Lake Wellington (Tilleard et al. 2009, Ladson et al. 2011). The reduction in freshwater inflows results in increased saline water flowing from Lake Victoria through McLennan Strait into Lake Wellington (Tilleard et al. 2009, SKM 2010). This then has follow-on effects of the back flow of saline water from Lake Wellington into many of the fringing wetlands (Boon et al. 2007).

Salinity in Lake Wellington has risen since the time of listing as evidenced by the Exponentially Weighted Moving Average (EWMA) chart below. This chart highlights trends in salinity, indicating that there was a significant rise starting in the mid to late 1990s, with a reduction in salinity following heavy rains in 2010/2011. Without active management of water, Lake Wellington is likely to continue to increase in salinity, becoming more marine in nature; particularly under future climate scenarios (SKM 2010, Ladson et al. 2011).



EWMA of surface salinity in Lake Wellington from 1986 to 2014 (data from EPA 2013).

Management of salinity in Lake Wellington is complex and it is not likely that the system could be restored to a previous state. To successfully improve the ecological condition of Lake Wellington, careful consideration of the options and setting realistic management goals will be required. A strategic action of this Ramsar Site Management Plan is specifically directed at the issue:

"*Investigate options for improving the ecological condition of Lake Wellington*."

Improving our understanding: the issue of mercury

Information on toxicant concentrations in the waters and sediments of the Gippsland Lakes is limited. However, over the past 30 years, there have been several studies that have indicated that mercury may be of concern in the main lakes (Glover et al. 1980, Harris et al. 1998, Fabris et al. 1999).

There are a number of known sources of mercury in the Gippsland Lakes catchment. This includes:

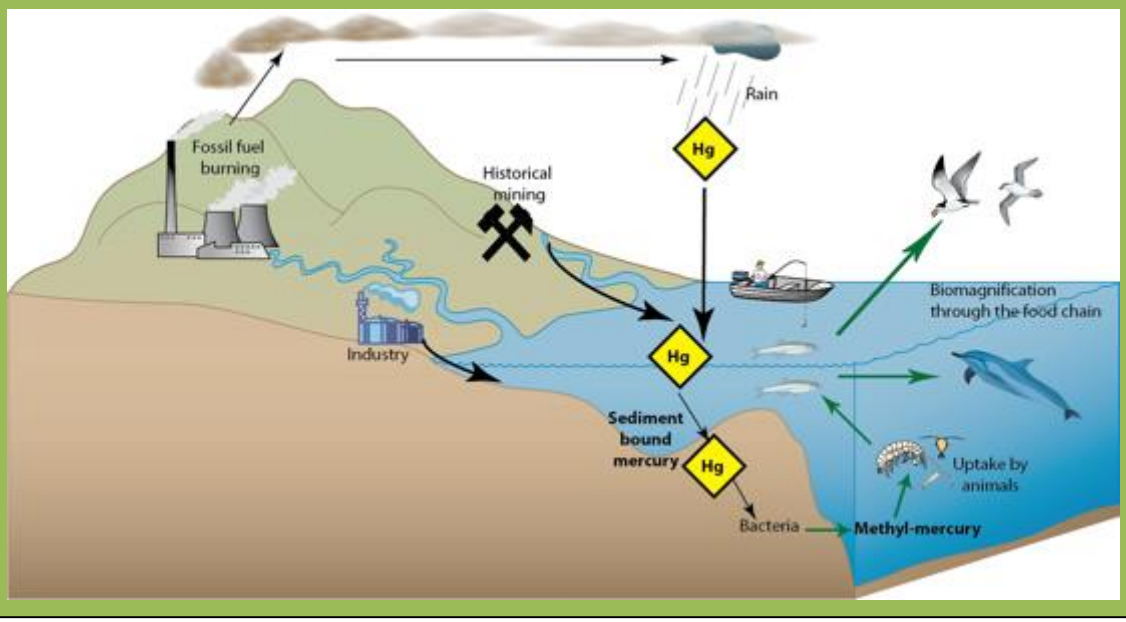
1. Gold mining in the 19th and 20th Centuries - Mercury was used to extract the gold from the crushed ore. The waste crushed rock, containing small amounts of mercury, was often discharged directly to waterways. This mercury could have remained in streams, but a portion at least has probably been washed into the sediments of the Lakes.
2. Coal-fired power stations - Reports from China (Wang et al. 2000) and the USA (USEPA 2008) indicate that coal-fired power stations are the single largest known source of mercury emissions. Although the amount of mercury in coal is very small, the large amount of coal burned each year (currently over 30 million tonnes annually in the Latrobe Valley) could mean a significant amount of mercury in the atmosphere. This can be washed into the Lakes with rain.
3. Mercury may naturally occur in bedrocks and sediments of the catchment.

Metal and organic toxicants are usually transported in aquatic system attached to sediment particles. Sediment particles transported down rivers and streams will ultimately settle out in lakes, estuaries and embayments. The Gippsland Lakes may therefore contain contaminants that have been transported down the rivers in its catchment.

Measures of mercury in the sediments of the Gippsland Lakes were made in 1979 and these indicated very high concentrations; with a mean of 43 mg/kg (dry weight) and a maximum of 100 mg/kg (Glover 1980). More recent studies indicated low, but possibly increasing concentrations of mercury in fish (Fabris et al. 1999). Elevated concentrations of mercury have also been recorded in the tissues of the Burrunan dolphin from Port Phillip Bay and the Gippsland Lakes (Monk et al. 2014).

The high concentration in the sediment does not necessarily mean that there is an impact on human health or the health of plants and animals that live in the Gippsland Lakes. Most of the mercury in the sediment will be in solid form, bound to sediment particles. In this form, mercury is not readily bio-available. Under certain conditions (like low oxygen levels) bacteria in the sediment can convert the mercury from the solid form to methyl mercury, which is very fat soluble and can be absorbed by animal cells. In addition, mercury is known to bioaccumulate, with concentrations increasing as animals up the food chain consume animals containing mercury.

There are currently information gaps regarding what form the mercury is in in the sediment and under what circumstances it could be released. An action has been proposed in Table 12 to address this information gap.



5 Monitoring, evaluation, reporting and improvement

5.1 Framework

Consistent with the *Victorian Waterway Management Strategy* (VWMS), the Ramsar Convention and the Australian Ramsar Management Principles, this Gippsland Lakes Ramsar Site Management Plan adopts an adaptive management approach. The Gippsland Lakes Ramsar Site Management Plan sits within the broader framework of the VWMS (Department of Environment and Primary Industries 2013) as a component of regional waterway management planning (Figure 8). The Gippsland Lakes Ramsar Site Management Plan will be renewed every eight years and is underpinned by a monitoring program that reports on the condition of the system with respect to change in ecological character and progress towards meeting resource condition targets.

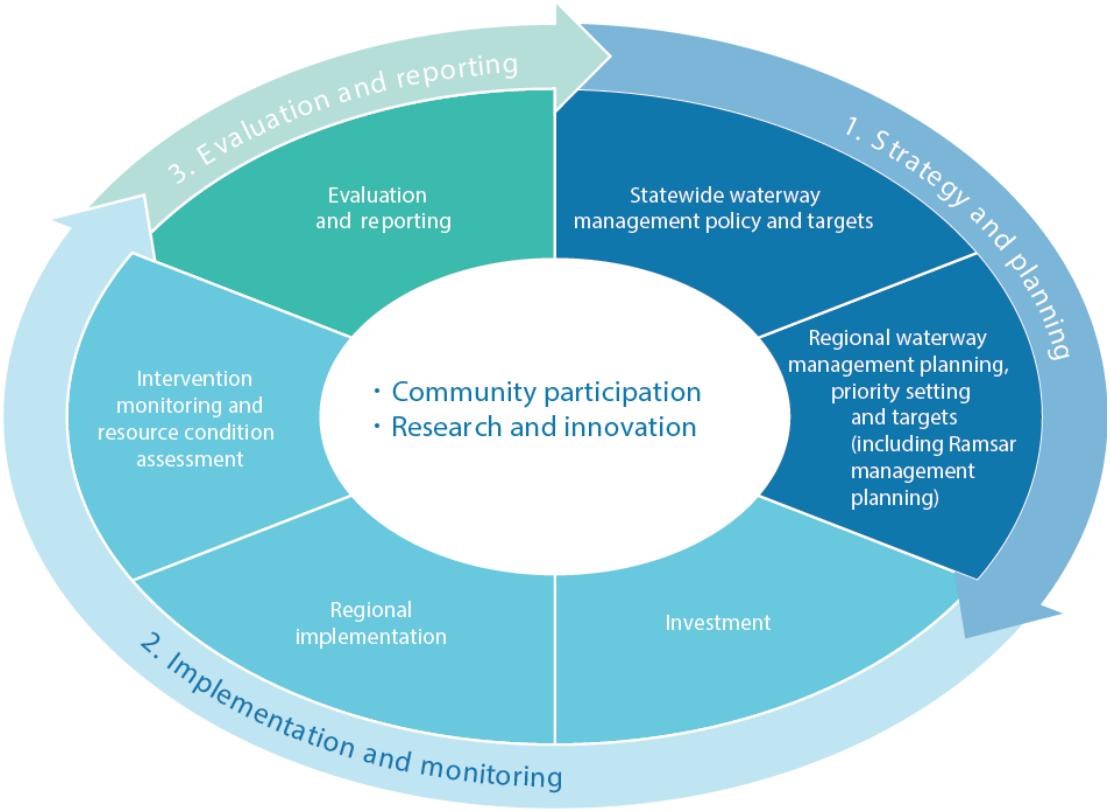


Figure 8: The eight-year adaptive management cycle of the Victorian Waterway Management Program, noting that this Ramsar management plan is a part of the regional waterway management planning process (adapted from Department of Environment and Primary Industries 2013).

5.2 Monitoring programs

Monitoring recommendations to assess progress towards resource condition targets and change in ecological character (i.e. evaluate critical components, processes and services against LAC) have been identified (Table 13) and are described in the full Gippsland Lakes Ramsar Site Management Plan. They build on existing monitoring programs and cover all the priority values of the site. Full monitoring programs, together with monitoring targeted at assessing the implementation of the plan will be required in the next phase of implementation planning (see section 6). It should be noted that many of the existing programs have limited funding and timelines and a full assessment of ongoing monitoring against monitoring needs will be required as part of implementation planning.

Table 13: Monitoring program for the Gippsland Lakes Ramsar Site.

Program	Responsibility	Linkages to existing programs
Seagrass	DELWP	Proposed mapping to be undertaken in 2015 by Monash University, DELWP (Arthur Rylah Institute)
Water quality monitoring in priority lakes and wetlands	EPA Victoria, DELWP, West Gippsland CMA	Current water quality monitoring by EPA Victoria covers Deep and Shallow Lakes. Suggest expand to include: Sale Common, Macleod Morass, Lake Reeve and priority estuarine reaches.
Sediment quality monitoring in lakes and wetlands	EPA Victoria, DELWP	Not currently included in any routine monitoring programs.
Mapping of wetland (including saltmarsh) vegetation communities in the Ramsar site	DELWP, Parks Victoria, East and West Gippsland CMAs	Boon et al (2011) mapped saltmarsh communities. Current mapping of wetland Ecological Vegetation Classes in West Gippsland CMA region (lower Latrobe wetlands only). Needs to be expanded to East Gippsland CMA Region
Condition assessments of priority vegetation communities: Freshwater marshes Swamp paperbark Common reed emergent beds Saltmarsh River Red Gum grassy woodland Riparian vegetation	DELWP, Parks Victoria, East and West Gippsland CMAs	No current programs in place.
Monitoring of threatened plant species	DELWP, Parks Victoria	Existing monitoring and protection programs for a selected group of threatened plants are in place by DELWP and Parks Victoria.
Waterbird counts and breeding records	DELWP, Parks Victoria	Current: Shorebirds 2020; Waterfowl annual counts (game species); nesting tern monitoring; and DELWP Hotspot program. Needs to be expanded to include an annual count at all priority locations in the site and targeted to specific species.
Frog monitoring: adults and tadpoles / juveniles	DELWP, Parks Victoria	DELWP Hotspot currently monitors adults through calls.
Native fish: abundance and species	DELWP	Current (historic) sampling in the Deep and Shallow Lakes only. Needs to be expanded to include sampling in the freshwater wetlands and estuarine reaches.
Abundance and population structure of Burrunan dolphins	DELWP	Current program funded by Gippsland Lakes Environment Fund, but is not on-going.

6 Governance and Implementation

6.1 Governance

Management of Ramsar sites in Victoria is the responsibility of the Victorian Government, through the Department of Environment, Land, Water and Planning (DELWP). This Gippsland Lakes Ramsar Site Management Plan is an integral component of a continuing program to develop a current management framework for Victoria's Ramsar sites.

6.2 Implementation

The East Gippsland CMA will co-ordinate implementation of this Gippsland Lakes Ramsar Site Management Plan, on behalf of regional agency partners.

A Ramsar Steering Committee comprising representatives of the partner agencies primarily responsible for the management of the Ramsar site (East and West Gippsland CMAs, DELWP, Parks Victoria, GLaWAC and DoE) will be convened and co-ordinated by East Gippsland CMA.

Each of the agency delivery partners will prepare agency implementation plans for the actions for which they are identified as responsible in the Gippsland Lakes Ramsar Site Management Plan, by 30 June 2016.

The East Gippsland CMA will integrate these agency plans into a single implementation plan for the Gippsland Lakes Ramsar Site Management Plan by December 2016 to ensure that the responsibilities for individual management actions are clearly established, priorities and sequencing is logical, implementation is focused and coordinated, and funding opportunities are identified.

Annual priorities and programs will be developed to best match the funding cycles of investors. Throughout the implementation of the Gippsland Lakes Ramsar Site Management Plan the East Gippsland CMA will work with the Ramsar Steering Committee to use the best available information tools to support the establishment of annual priorities. East Gippsland CMA will also work with the Ramsar Steering Committee to maintain the currency and accuracy of data and information to support implementation.

Partners will seek funding for implementation of this plan through the:

- Victorian Waterway Management Program
- Relevant initiatives of the State and Federal Governments
- Existing agency budgets
- Contributions of industries and communities

6.3 Ramsar Administration

The development of the plan identified a number of administrative matters to resolve. These are described, with a brief rationale in Table 14.

Table 14: Matters related to the administering of the Ramsar Convention and the Gippsland Lakes Ramsar Site.

Management Strategies	Responsibility	Rationale
7A. Review the Ramsar site boundary	DELWP DoE Ramsar Steering Committee	The Ramsar site boundary was delineated at the time of listing in 1982 and more recently described in detail (DEPI 2013). Since 1982, there have been some changes to land management and an increased understanding of the aquatic ecosystems in the region and their values. A review of the boundary to consider adjoining areas based on ecological function in a changing climate is proposed.
7B. Update the Ramsar Information Sheet	DELWP DoE Ramsar Steering Committee	Ramsar information sheets (RIS) are scheduled for review and updating every six years. The most recent RIS for the Gippsland Lakes Ramsar Site is 1999, making it past due for review. There is significant additional data, and updated criteria for which the site should be assessed.
7C. Review and where necessary update Limits of Acceptable Change, in particular for areas that are currently not covered by current LAC such as Lake Tyers.	DELWP DoE Ramsar Steering Committee	Since the development of the ECD, there has been further research and information available for the site. Some of this data may prove useful in informing LAC for the site. It is anticipated that this review could be considered in the next Ramsar Rolling Review for the Gippsland Lakes Ramsar Site.
7D. Apply the appropriate State and Commonwealth environmental impact assessment processes for activities that have the potential to impact on the Ramsar site and Matters of National Environmental Significance (MNES).	DELWP DoE Ramsar Steering Committee	Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), actions that have, or are likely to have, a significant impact on a matter of national environmental significance require approval from the Australian Government Minister for the Environment (the Minister). The responsibility for referral of an action lies with the proponent. The Minister decides whether assessment and approval is required under the EPBC Act. Ramsar sites are one of the nine MNES and so assessments would be required for any activity that is likely to impact on the ecological character of the site, whether inside the site or in the catchment.
7E. Undertake a regular review of the status of the ecological character of the Ramsar site. This review should include new and emerging issues as well as the current listed values and threats	DELWP	The Ramsar Rolling Review is undertaken every three years and reports on the status of ecological character of the Ramsar site. As new knowledge on the values and threats within the Ramsar site becomes available (e.g. new species supported in a changing climate), this should be incorporated into the sites ecological character and management planning.
7F. Develop implementation plans for this strategy	East Gippsland CMA with Ramsar Steering Committee DELWP	This plan has identified high level strategies for a number of agencies. Implementation plans, together with resourcing need to be developed within the first 12 months.

6.4 Communication

The East Gippsland CMA will co-ordinate communications and engagement for the Ramsar site as part of its role in co-ordinating implementation of the Gippsland Lakes Ramsar Site Management Plan.

Reviewing the boundary: Heart Morass

Need

Heart Morass is a variably saline fringing wetland along the shores of Lake Wellington. It has declined in condition due to altered water and salinity regimes and past grazing. In 2006, the wetland dried completely for the first time. Heavy grazing of the property up until this time meant that the ground layer of vegetation was absent. The dry, dusty conditions and salt-encrusted wetland bed created a symbolic "blank canvas" from which the restoration project began.

Planning

The project is built around a partnership between five key organisations, Bug Blitz Trust, Field and Game Australia, Hugh Williamson Foundation, Watermark Inc. and West Gippsland CMA. It aims to inspire and be inspired by the local community by restoring the values of the historic wetland. It is a unique partnership between hunters, conservationists and government which aspires to develop the Heart Morass Wetland as an icon. This is achieved by enhancing biodiversity, water quality and recreational and social values within the Heart Morass and through its contribution towards the health of the Gippsland Lakes.

A community project has developed to support the purchase of over 1,000 hectares of the wetland area and undertake one of the largest restoration projects in Australia on private land.

Works

The partnership has:

- planted more than 60 000 indigenous trees, shrubs and grasses
- direct seeded indigenous vegetation including grasses and rushes on five hectares of the wetlands
- controlled weeds including blackberry, boxthorn and invasive grasses
- developed a seed collection program from over 50 wetland and riparian plant species to support future revegetation efforts
- constructed a new gravel road surface and parking area
- managed existing drain entrances to maintain water levels in the wetland and rock beaching at the entrance of two main drains
- removed over 20 tonnes of carp.

Outcomes

The recent purchase of an additional 245 hectares brings the entire area of woodlands and wetlands under management as part of the Heart Morass Restoration Project to 1,370 hectares. Of this 1,125 hectares is now covered by a protective covenant with Trust for Nature, one of the largest in Victoria.

Much of the ecosystem, including all of the newly acquired land by the WET Trust is outside the current Gippsland Lakes Ramsar Site boundary. There is an opportunity to reassess the boundary and recognise the significant work of volunteers, show casing the principles of Wise Use at this wetland.

Map of Heart Morass with the Current Gippsland Lakes Ramsar Site Boundary in pink.

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