



PAINKALAC ESTUARY MANAGEMENT PLAN



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The Victorian Government's aspiration for healthy rivers, catchments and estuaries has been backed by a 10 year, \$320 million investment plan.



Investment from the Victorian Government into local projects is decided by priorities in Regional Catchment and River Health Strategies.

Why a Management Plan for the Painkalac Creek and Estuary?

In 2004, the Surf Coast Shire applied for and received funding from the Natural Heritage Trust and the Corangamite Catchment Management Authority for a Healthy Waterways/Healthy Estuaries Project. The project was initiated to help improve estuarine health and management through investigations, monitoring, and development of estuary and environmental management plans.

The main factors behind Surf Coast Shire instigating a Management Plan for the Painkalac Estuary include:

- A need for management authorities, groups and individuals to collectively discuss the current and future management of the area;
- Community interest and support in preparing a plan;
- A belief that the Plan would be an important tool for securing future funding for programs and works;
- Ability of the Surf Coast Shire to resource the preparation and implementation of the Plan; and
- An opportunity for funding arising from current Government Policy.

The Big Picture

"We never know the worth of water 'til the well is dry".

The Australian Government and most state and territory governments agreed to implement the National Water Initiative (NWI) in June 2004. The NWI was developed in recognition of the national imperative to increase the productivity and efficiency of Australia's water use, the need to service rural and urban communities and to ensure the health of river and groundwater systems. Under the NWI, the Australian Government Water Fund represents a \$2 billion program to invest in water solutions for current and future generations. The fund aims to support on-ground water projects to improve Australia's water efficiency and health.

The NWI builds on the Victorian Government's 10 year plan for investment in Victoria's water resources. The plan is backed by \$320 million Victorian Water Trust, of which \$160 million has already been committed.

In 2004, the Victorian Government released the "White Paper" on water reform. The White Paper shapes the Government's current water policy *Our Water Our Future*.

In *Our Water Our Future*, the Victorian Government has made a commitment to "direct substantial new resources to the Victorian River Health Strategy, the statewide framework for integrated management of rivers, floodplains and estuaries." The Victorian River Health Strategy (2002) requires the completion of regional river health strategies.

The Corangamite Catchment Management Authority is responsible for preparing the Corangamite Regional Catchment Strategy (RCS) and the Corangamite River Health Strategy. The RCS guides investment in regional natural resource management programs while the River Health Strategy includes an inventory of the environmental, social and economic assets and major threats for rivers in the Corangamite Region. High value rivers in Surf Coast Shire included in the strategy are: Cumberland River, Erskine River, Saint George River, Thompsons Creek, Anglesea River and Painkalac Creek.

The *Victorian Coastal Strategy* and *Central West Victorian Estuaries Coastal Action Plan* are prepared and overseen by the Western Coastal Board. These documents provide the direction for coastal management in Victoria.

introduction |

Who was involved?

This Estuary Management Plan was prepared by the Surf Coast Shire. This plan has been made possible by the collaborative effort of the following groups, organisations and people:

- Anglesea and Aireys Inlet Society for the Protection of Native Flora and Fauna (ANGAIR)
- Aireys Inlet and District Association (AIDA)
- Friends of Aireys Inlet Wetlands
- Aireys Inlet Tourism and Traders Association
- Barwon Water
- Coast Care/Coast Action
- Corangamite Waterwatch
- Corangamite Catchment Management Authority (CCMA)
- Deakin University (Adam Pope)
- Department of Sustainability and Environment (DSE)
- Ecologic Environmental Services
- Environment Protection Authority (EPA) Marine Sciences Division Melbourne
- Great Ocean Road Coast Committee (GORCC)
- Local landholders and residents
- Parks Victoria
- Wathaurong Aboriginal Co-operative
- Western Coastal Board



What is the Plan trying to achieve?

Workshops were held by Surf Coast Shire between December 2004 and June 2005 to identify objectives and actions for the Painkalac Estuary Management Plan. The workshops were attended by government agencies, community group representatives and local residents.

The objectives of this plan have been derived from the “Toolkit for Estuary Management” on page 23 of the Central West Victoria Coastal Action Plan.

The Objectives for Painkalac Estuary are to:

1. Restore and protect native flora and fauna and instream habitats.
2. Achieve a standard of water quality and quantity that protects the diversity and abundance of aquatic ecosystems and allows recreational and aesthetic enjoyment of the estuary.
3. Minimise estuary sedimentation and erosion caused by the effects of human activity in the catchment and along the riverbank.
4. Identify, acknowledge, respect and protect the Aboriginal and European heritage of the estuary.
5. Encourage and provide facilities for appropriate recreational use of the estuary and catchment while maintaining ecosystem viability.
6. Maintain the quality of the visual experience of the natural landscape from the waterway and from catchment vantage points.
7. Minimise the social and economic impact of flooding while maintaining ecosystem viability.
8. Encourage community participation in estuary management and activities and share information with the community on the values of the estuary.

Actions to meet these objectives are detailed in Chapter 4 of this Plan – Protecting What People Love: A List of Things To Do.

Who will make sure the Plan is implemented and how?

The Surf Coast Shire will establish, coordinate and convene a Painkalac Estuary Management Plan Implementation Committee. The Committee will consist of representatives from the following:

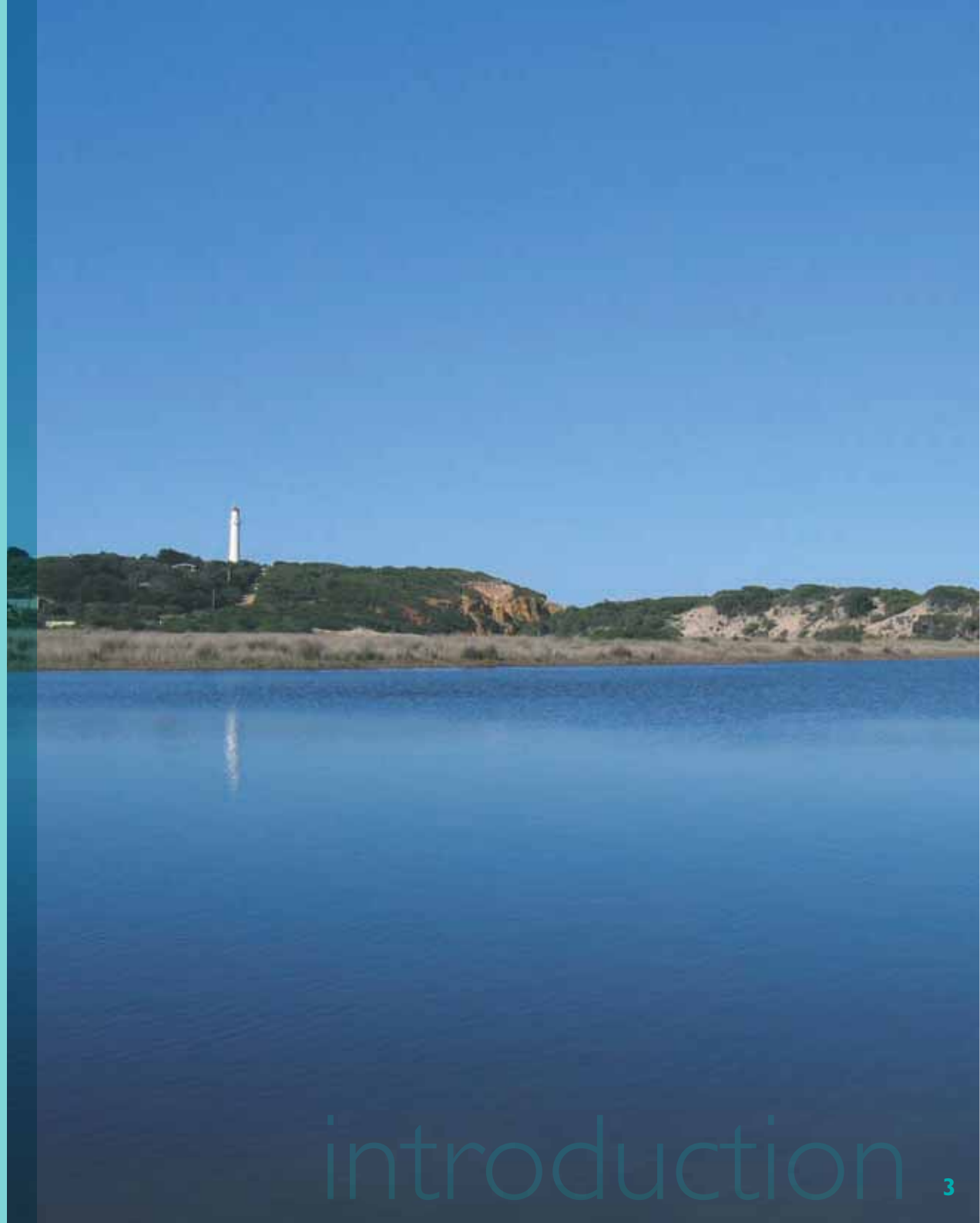
- Surf Coast Shire - this person will be responsible for convening the meetings and undertaking administrative tasks associated with the group;
- Corangamite Catchment Management Authority;
- Department of Sustainability and Environment;
- Parks Victoria;
- Great Ocean Road Coast Committee;
- Western Coastal Board;
- AIDA;
- ANGAIR;
- Barwon Water
- Regional water quality monitoring program;
- Wathaurong Aboriginal Co-operative;
- Aireys Inlet Tourism and Traders Association;
- A local education provider.

The role of the Committee is to:

- Set an annual work program consistent with identified actions in the Plan, as well as the budgets and work programs of each agency/group;
- Report on the implementation of the Plan to agencies and the community;
- Source and facilitate grants to support the implementation of the Plan and;
- Support the Painkalac Estuary-Watch Monitoring Group.

Funding

A significant role of the Implementation Committee will be to identify and pursue external funding opportunities available through current and future state and national programs (refer to “The Big Picture”, page 3). Additionally, actions in this plan may be included in the budgets and business plans of the relevant agencies.



ROLES AND RESPONSIBILITIES

What is the Painkalac Creek and Estuary area?

The Painkalac Estuary can be defined as the instream area between the mouth of the Painkalac River and the point upstream at which sea water and freshwater cease to mix. The Painkalac Estuary management plan area has been defined as the area encompassing the estuary and its adjoining flats (including Mellors Swamp and Painkalac Nature Reserve), the river and floodplain upstream to the Aireys Inlet reservoir and the residential areas that drain into the estuarine and river system.

This plan has also considered that the public land in the Painkalac Creek and Estuary catchment is currently managed according to the Angahook-Lorne State Park Management Plan and that a draft management plan for the Eagle Rock Marine Sanctuary was developed by Parks Victoria in 2004.

Map 1 shows the Painkalac Estuary Management Plan area.



11 different authorities have a direct or indirect responsibility associated with the management of the Painkalac Creek and Estuary.

ROLES AND RESPONSIBILITIES

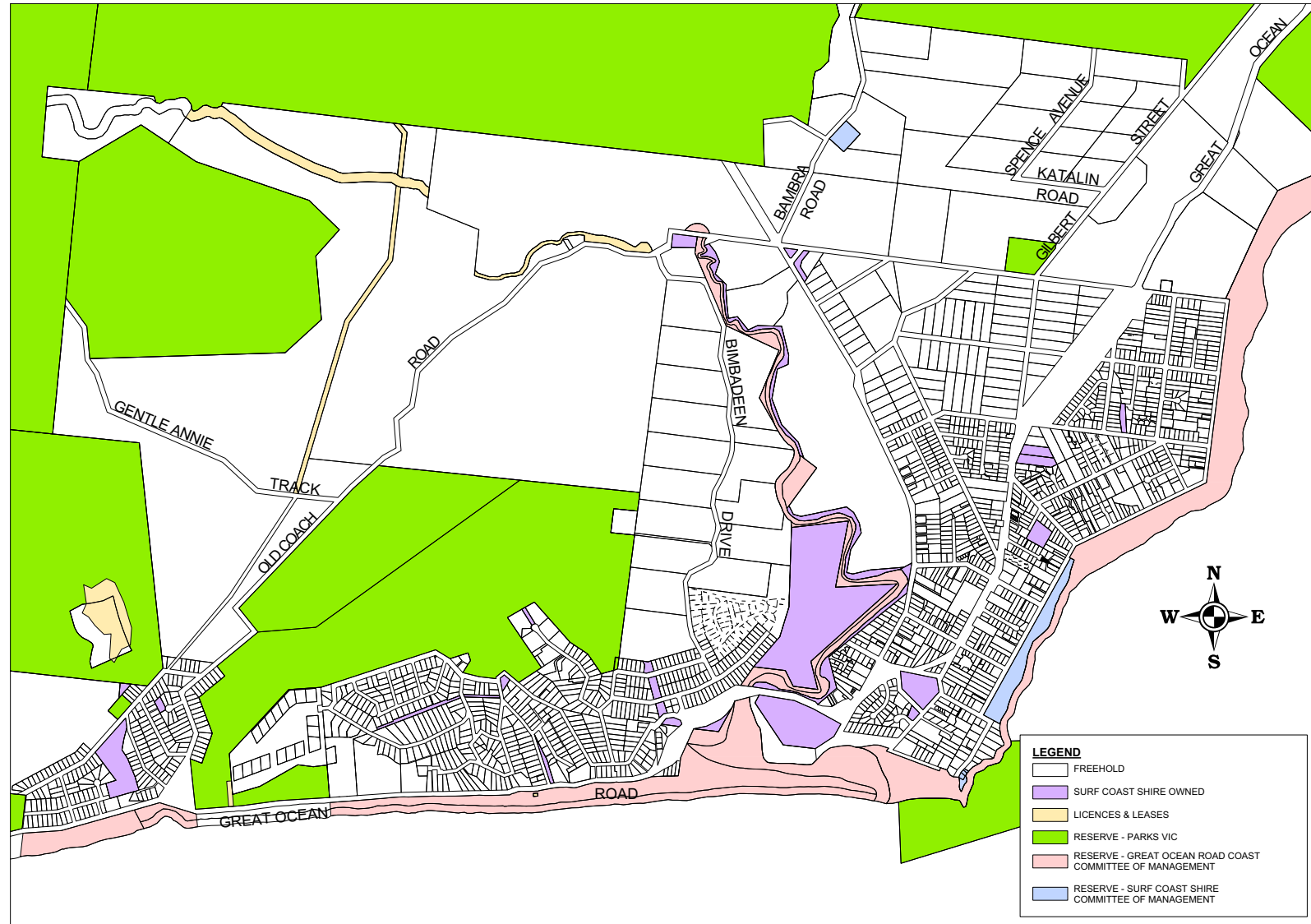
Who has a role or interest in the management of the Painkalac Creek and Estuary?

The following organisations, authorities and agencies have a direct or indirect responsibility associated with the management of the Painkalac Creek and Estuary:

- State Government (Department of Sustainability and Environment and Primary Industries);
- Local Government (Surf Coast Shire);
- Barwon Water;
- Corangamite Waterwatch;
- Southern Rural Water;
- Corangamite Catchment Management Authority;
- Western Coastal Board;
- Environment Protection Authority;
- Great Ocean Road Coast Committee;
- Parks Victoria;
- Victorian Coastal Council.

The following have an interest, or are currently participating in the management of the Painkalac Creek and Estuary:

- local landholders and business;
- Aireys Inlet Tourism and Traders Association;
- Deakin University;
- Wathaurong Aboriginal Co-operative;
- ANGAIR;
- Trust for Nature Victoria;
- Friends of Aireys Wetlands; and
- AIDA.



Map 2 shows ownership and management responsibility of land in the Painkalac Estuary catchment.

ROLES AND RESPONSIBILITIES

Table I: Summary of river and estuary management roles and responsibilities (taken from the Central West Victoria Estuaries Coastal Action Plan).

Department of Sustainability & Environment (DSE)

Responsibilities: Strategic direction for park and reserve management; management of all public land except parks and reserves managed by Parks Victoria; flora and fauna management; catchment and water management; forest management; coastal and port management; administration of the consent requirements of the Coastal Management Act; leasing; licensing and management of public land; strategic and statutory land use planning including the administration of the Victorian Planning Provisions. The Surf Coast region is currently supported by staff from DSE offices in Anglesea and Colac.

Department of Primary Industries (DPI)

Responsibilities: Provides strategic direction for fisheries management and research; agricultural services and sustainable development of Victoria's energy and mineral resources.

The Surf Coast region is currently supported by staff from DPI offices in Colac and Geelong.

Parks Victoria

Responsibilities: Manages National, State and Coastal Parks and conservation reserves. The Surf Coast region is supported by staff from the Parks Victoria offices in Lorne and at ALCOA Anglesea.

Southern Rural Water

Responsibilities: Service delivery – provides irrigation, drainage, salinity control, water supply, management of specific water supply catchments. Development of Streamflow Management Plans. License of stream diversions (stock and domestic). Southern Rural Water covers the southern half of Victoria.

Local Government (Surf Coast Shire)

Responsibilities: Service delivery – regulates local development through planning schemes, on ground works, manages urban and rural drainage. Administers planning schemes and regulates land use and development activities. Surf Coast Shire also owns and manages land in the Painkalac valley.

Committees of Management

(Great Ocean Road Coast Committee, GORCC)

Responsibilities: Skills based appointed members of the public who oversee planning and on ground management works. GORCC's responsibilities include coastal Crown land between Pt Impossible and Cumberland River (except for Bells Beach to Southside).

Regional Water Authority (Barwon Water)

Responsibilities: Service delivery – provides water and sewerage service to urban communities, management of special water supply catchments. Referral Authority under Planning Schemes.

Catchment Management Authorities

(Corangamite Catchment Management Authority)

Responsibilities: Development of Regional Catchment Strategies; advice in catchment management; funding for catchment management works; environmental improvement of the regions waterways including revegetation and rehabilitation; erosion control; implementation of nutrient management plan; floodplain management and issue of permits for works on waterways. CCMA is responsible for advice to the Minister about the composition of Streamflow Management Plan consultative committees. It coordinates and implements river health plans and manages river health including estuaries. The boundary of the Corangamite Catchment Management Authority stretches from Geelong to Ballarat and along the coast to Peterborough.

Environment Protection Authority (EPA)

Responsibilities: Statutory body, protection, restoration and enhancement of air, land and water quality and control of unwanted noise. Responds to pollution incidents, investigation of spills, licensing of sewage and other discharges and water quality monitoring.

Victorian Coastal Council

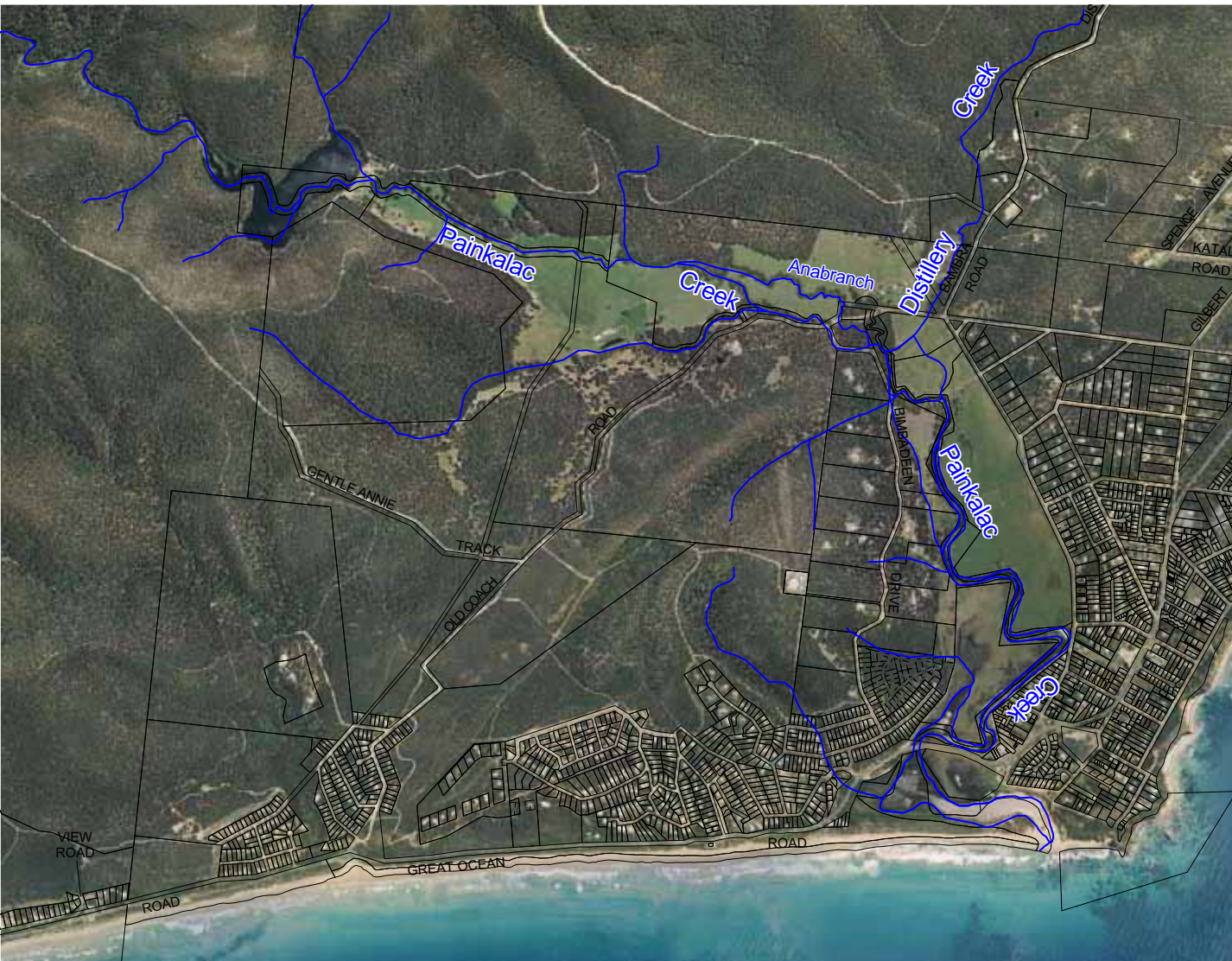
Responsibilities: Overall strategic planning advice for state coastal planning and management matters. Administers the Victorian Coastal Strategy.

Coastal Board (Western Coastal Board)

Responsibilities: Provides strategic regional coastal planning and management advice and co-ordinates the preparation of Coastal Action Plans. The Western Coastal Region encompasses the coastal and marine areas from Breamlea to the South Australian border.

Community groups and individuals also provide significant support and assistance to each organisation.

DESCRIBING THE PAINKALAC ESTUARY



Map 3 shows the tributaries of the Painkalac Creek and Estuary.

The Surrounding Environment

The Painkalac Estuary is located between the settlements of Aireys Inlet and Fairhaven on the Great Ocean Road.

To the south lies Eagle Rock Marine Sanctuary, covering 17 hectares and stretching east of the Painkalac Creek mouth to Castle Rock and extending about 300 metres offshore. The sanctuary consists of extensive intertidal platforms that support a high diversity of aquatic animal life, plus a range of other habitats such as rock pools. In 2005 Parks Victoria released the Eagle Rock Marine Sanctuary Management Plan.

Mellors Swamp is a 4.66ha Surf Coast Shire owned and managed Nature Reserve located on the south side of the Great Ocean Road. Mellors Swamp is under a Trust for Nature Conservation Covenant which protects and enhances its natural, cultural and/or scientific values in perpetuity. The covenant is binding on current and future owners of the land. The Painkalac Creek Nature Reserve (16.3ha), also owned and managed by the Shire, lies to the north of the Great Ocean Road. The Reserve is also under a Conservation Covenant. Prior to 1972, this area was used for agriculture and grazing.

The course of the Painkalac Creek has altered over time, resulting in the formation of an anabranche (a branch of a river that re-enters the main stream). The main tributary of the Painkalac Creek is Distillery Creek.

The flow of both creeks is seasonal, varying between dry and flooding following periods of high rainfall. A “backwater” of the creek is located at the south west corner of the Painkalac Creek Nature Reserve.

DESCRIBING THE PAINKALAC ESTUARY

Estuary type and function

The Painkalac Estuary is a barrier estuary that is characterised by low tidal influence, seasonal closure at the mouth and a layer of fresh water overlying a salt wedge.

The Painkalac estuary can experience a build up of 'brackish' water (part fresh part salt) with periods of high productivity by very small aquatic animals called microbes. The estuary may also experience periods of low oxygenation/stagnation, algal blooms and eutrophication. Typically, microbial production is a symptom, rather than cause of eutrophication.

The Painkalac Estuary

- Is less than 6,000 years old and is the result of wave based energy;
- Provides a diverse range of habitats such as shallow water habitats, salt marshes and intertidal flats;
- Receives the main source of water into the estuary from freshwater derived from the Painkalac Creek catchment;
- Water level in the lower estuary is also influenced by the degree of closure of the sand barrier at the mouth;
- The Height of the sand bar is determined by longshore drift patterns, tidal conditions, prevailing winds and streamflow;
- Generally the bar could be expected to be partially breached naturally at least 4-6 times per year, with total breaching occurring under extensive flooding generated by heavy rainfall every 10 years;
- Has had major flood events recorded in 1880, 1896, 1951 and 1954.



*Distillery Creek at Old Coach Road (looking downstream)
14 days after high rainfall event (111 mm) February 4 2005.*



*Distillery Creek at Old Coach
Road (looking upstream)
14 days after high rainfall event
(111 mm) February 4 2005.*

Water Quality

Water quality monitoring history

Although the water quality of the Painkalac Creek and estuary has been studied over the past 20 years, it is only recently that the data from these sampling programs has been collated and tabled.

The former Shire of Barrabool undertook two separate studies on E.coli between 1977 and 1981 and 1982 to 1989 and found that E.coli levels were higher near the Bambra Road-Beach Road sampling site but generally decreased towards the mouth (Ecological Horticulture et al, 1990). Studies by the Environment Protection Authority and the Aireys Inlet and District Association in 1987 identified that local drains are carrying reasonably low levels of treated effluent, indicated by low biological oxygen demands and generally low E.coli levels, with the source of these discharges being from both domestic and commercial premises, where either septic tank and soil absorption systems or septic and sand filter/treatment plants are used to treat the wastes off site (Ecological Horticulture et al, 1990).

The Environment Protection Authority has sampled E.coli and Enterococci at the estuary of Painkalac Creek on an irregular basis (Creek, G. 2004, pers.comm.).

The most regular water monitoring was undertaken at a freshwater site on Painkalac Creek at Painkalac Creek Dam between 1974 and 1987 (Government of Victoria, 2004). While important, given the significance of freshwater flows into the estuary, it does not give an indication of water quality within the estuary.

During the 1980's the Barrabool Shire, the EPA and the Fairhaven Foreshore Committee all commissioned sampling of Painkalac Creek at various sites between the mouth of the estuary and Bambra Road. However most of this monitoring was conducted on a short term basis and there is little correlation between monitoring sites in different monitoring programs.

Barwon Water, and its predecessor the Aireys Inlet & District Water Board, have monitored water quality within and downstream of the dam since 1981.

The Aireys Inlet Primary School monitored Painkalac Creek at River Road for physical, chemical, biological and habitat parameters on a monthly basis between 1995 and 1998 as part of the Corangamite Waterwatch Program.

Further monitoring was commissioned by the Surf Coast Shire at various points along the estuary as part of the pollution source investigation that supports this plan.

Table 2 summarises previous water quality monitoring.

The Victorian Environment Protection Agency, through Leonard & Steven (2001) has identified a number of indicators that can be used to monitor estuarine health. These include physical and chemical parameters, water clarity, nutrient status and E.coli and Enterococci. The point of difference between EPA monitoring and ANZECC guidelines is that the former is based on trigger levels whilst the latter is a system of pass or fail.



DESCRIBING THE PAINKALAC ESTUARY

Water Quality (cont)

Table 2 Summary of previous water quality testing in the lower Painkalac Creek and Estuary

ORGANISATION	SITES	DATA	DATES
Corangamite Waterwatch program	River Reserve Rd	PH, turbidity, DO, EC, soluble phosphorus, water temperature	1995-98
Barwon Water	Dam inlet and outlet	Monthly flow data	1999-present
Shire of Barrabool	River mouth, bridge and duck pond	E. coli counts	1977-81
Shire of Barrabool	River mouth, bridge and Bambra/Bridge Rd	E. coli, BOD, Ammonia N, Anionic surfactants	1982-89
Adam Pope, PhD Thesis, Deakin University	Five estuarine sites between the mouth and the head of the estuary and three freshwater sites: Painkalac and Distillery Creeks at Old Coach Rd plus one site above the reservoir	Physico-chemical parameters (salinity, temperature, dissolved oxygen, pH, redox potential, turbidity, Secchi depth, total suspended solids, total nitrogen, nitrate/nitrite, total phosphorous, soluble reactive phosphorous), flow.	1999-2002
Catherine Yule, Honours Thesis, Monash University	Bridge, Duck Pond, Above Dam and Below Dam (200 m and 1.2 km)	Major inorganic ions and total alkalinity	1978
EPA	Fairhaven Drain and Allen Noble Sanctuary	BOD, E. coli	1987
Barwon Water	Reservoir and Reservoir outlet	30 parameters	
Surf Coast Shire	Various sites from Old Coach Road to the Estuary opening	E.coli, nutrients and physiochemical parameters	2005

Water quality testing has been conducted in the area intermittently for many years; however, testing has been conducted by different organisations at varying sites and for varying purposes, therefore there is no consistent data over time.

Following is an overview of the historical data collected at various locations within the study area and a broad evaluation of the creek/estuary water quality based on reported results.

River Mouth/Estuary

Water quality in the estuary is usually of good quality, although significant pollution events can occur periodically, particularly after high rainfall events.

The current standards used to monitor estuarine health mostly use a percentile-based approach to assess exceedance of trigger levels, as opposed to the old method of individual measurements exceeding an absolute value.

The purpose of water quality monitoring can be from an ecological or human health perspective and the parameters tested for are different for each. For example, E Coli is monitored for human health while ecological monitoring includes pH, dissolved oxygen, phosphorous, turbidity and habitat condition.

Bridge

Water quality in the estuary is usually of good quality, although significant pollution events can occur periodically, particularly after high rainfall events. None of the parameters that have been measured in the past were consistently above Australian water quality standards.

Waterwatch site

Dissolved oxygen and turbidity have been variable at this site. The variance in turbidity may reflect the rapid increase in turbidity that can occur after high rainfall events.

Old Coach Road

None of the parameters measured at this site in the past were consistently outside of Australian water quality standards.

Further information on water quality can be obtained from Surf Coast Shire upon request.

Water Quality {Special Investigation}

Between early 1999 and 2002, depth profiles of water quality were measured at five sites along the estuary on an approximately monthly basis (Pope, in prep). In that time, salinity values of surface waters ranged between zero and 40 psu (practical salinity unit) with 2-3 psu typically recorded for freshwaters and 36-38 psu typically recorded for marine waters. The study found Phosphorus levels to be low in the Painkalac estuary, while Nitrogen levels were slightly in excess of State Environment Protection Policy (SEPP) water quality objectives, particularly during low flows. An algal bloom, generally symptomatic of high nutrient levels, was recorded in the upper estuary in 1999. Turbidity values in the Painkalac estuary were consistently higher post construction of the dam than in the eighteen months before construction (data from State of Victoria), and the only site of 11 estuary sites sampled in the Otway ranges to have a significant increase in turbidity. Dissolved oxygen levels in the estuary surface waters are typically between 80% to 110% saturation, which is within ANZECC and SEPP guidelines. Except for the furthest upstream site, prolonged or extreme deoxygenation of bottom waters was not observed.

Although acidic waters (pH<5) were measured 10 times in Distillery Creek, the mainstem of Painkalac Creek was more alkaline (mean pH 7.3). Acidification of the estuary was confined to surface waters in the upper half of the estuary on the three occasions that pH was recorded below 5 and related to high rainfall events. The acidification of surface waters in Distillery Creek is most likely attributed to acid sulphate soils in the Distillery Creek sub-catchment.

Aireys Inlet Reservoir

In 1978, a 514 megalitre capacity water supply reservoir for Aireys Inlet was constructed by the Aireys Inlet Water Board (pre amalgamation with Barwon Water) on the Painkalac Creek approximately three kilometres upstream of the estuary.

The dam is currently managed according to the rules stated in the Bulk Entitlement (Aireys Inlet) Conversion Order (1997) between Barwon Water and the Minister administering the Water Act (1989) for Victorian State Government.

A Bulk Entitlement is a document stating Barwon Water's entitlement to take water from Painkalac Creek for the Aireys Inlet Water Supply System. The entitlement works on the principle that water from the catchment flowing into the reservoir is stored and then released to the urban supply system and to the downstream waterway.

Releases from the reservoir:

There are two types of releases from Painkalac that occur concurrently, they are:

- For urban supply: the Authority may take up to 317ML in any year at a rate not exceeding 2.94 ML/day from the storage.
- For passing flows: The Authority (Barwon Water) must provide the following minimum passing flow calculated as follows:
- During the months December to February inclusive the minimum passing flow must equal inflow (flow is taken from the upstream gauging station on Painkalac Creek);
- During the months of March to November (inclusive):
 - a) when flow is less than 0.5ML/day the minimum passing flow must equal inflow and;
 - b) when flow is greater than 0.5ML/d, the minimum passing flow = 0.5ML/day.

Note: The Reservoir is operated for urban water supply purposes only (not for irrigation use or flood mitigation).

The third action under Objective 2 (page 27) refers to undertaking an environmental flow study for the Painkalac Creek.

DESCRIBING THE PAINKALAC ESTUARY

Flora

The vegetation of Painkalac Creek reserve is predominantly characterised by a Common Tussock-grass (*Poa labillardieri*), grassland with other minor communities that include a salt marsh complex, submerged saline herbfield, Common Reed (*Phragmites australis*), grassland and other herbfields variously dominated by Austral Bracken (*Pteridium esculentum*), Common Spike-rush (*Eleocharis acuta*), and Sea Rush (*Juncus kraussii*). In total, 15 different vegetation communities exist, consisting of 185 indigenous and 114 exotic species.

Poa grassland is considered to be of State significance while the other communities are of Local to High Regional significance. These communities are not only significant in their own right but also provide important habitat to a wide range of birds, mammals and amphibians, many of which have a restricted range or are rated as threatened throughout Victoria.

Noxious and environmental weeds in and around the estuary and river include Blackberry, Boneseed, Flax-leaf Broom, *Watsonia*, Sweet Pittosporum, Coast Wattle hybrid, Fiery Poker, Arum Lily, *Agapanthus*, Roses, Cape Wattle, Coast Tea-tree, Bulbil Sparaxis, New Zealand Mirror bush, Pampas Grass, Scotch Thistle and Kikuyu Grass.

A study by Adam Pope (Deakin University) on the seagrass of the Painkalac Estuary will be completed in late 2005.



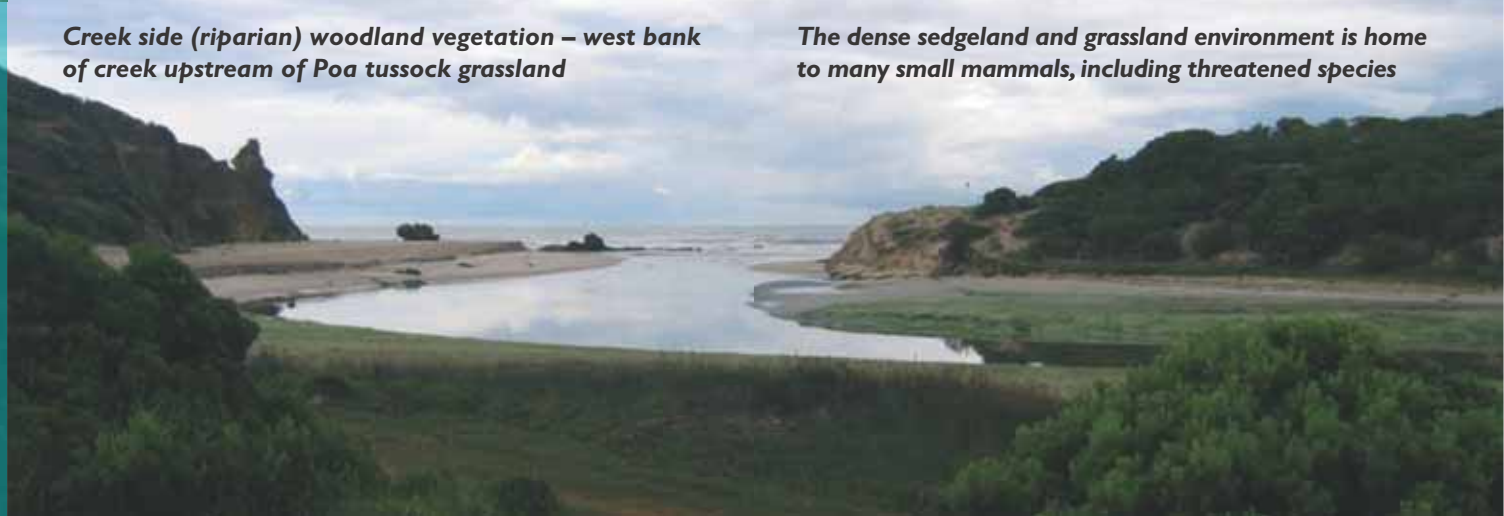
Poa tussock grassland in the Painkalac Valley



*Creek side (riparian) woodland vegetation – west bank of creek upstream of *Poa tussock grassland**



The dense sedgeland and grassland environment is home to many small mammals, including threatened species



Salt tolerant aquatic plants are found on the bank of the creek.



Coastal Poa Tussock grassland is a zone between shrubland and saltmarsh that is subject to inundation

DESCRIBING THE PAINKALAC ESTUARY

Fauna - General

Atlas of Victorian Wildlife (DSE, 2004) lists 185 fauna species in the Painkalac Creek and Estuary area, 12 of which are exotic (non-native). The suite of animals includes birds, mammals, reptiles, frogs and fish. Some species are known to be dependent on the estuary while others live in the area and utilise the estuary and creek environments in different ways.

Fish

Fish species in the Painkalac Creek and Estuary recorded in a 2001 survey included Short-finned Eel, Sea Mullet, Southern Anchovy, Yellow Eyed Mullet, Tupong, Tamar River Goby, Smooth Toadfish, Black Bream, Luderick, Small-mouthed Hardyhead, Flat-headed Gudgeon, Cobbler, Common Galaxias, Estuary Perch, Australian Smelt, Long-snouted Flounder and Australian Salmon.

In addition to the above, Mountain Galaxias, Brown Trout, Spotted Galaxias and Pouched Lamprey have been recorded.

*Short Finned Eel
Painkalac Creek
July 2005*





Mammals and Monotremes

Species recorded are: Feathertail Glider, Agile Antechinus, Swamp Antechinus (near threatened in Victoria), Eastern Grey Kangaroo, Bush Rat, Swamp Rat, Water Rat, Brown Rat, Broad-toothed Rat (near threatened in Victoria), Sugar Glider, Common Ringtail Possum, Koala, Chocolate Wattled Bat, Gould's Long-eared Bat, Little Forest Bat, White-striped Freetail Bat, Eastern False Pipistrelle and Wallaby.

Reptiles and Amphibians

The wetlands immediately surrounding Aireys Inlet attract Long-necked tortoises, Marbled Geckos, Mourning Skinks, Water Skinks, Common Blue-tongued Lizard, Lowland Copperhead, Red-bellied Black and Tiger snakes. They also support populations of Common Eastern Froglet, the Spotted Green Frog, Eastern Banjo Frog (Pobblebonk) and the Brown Tree Frog. These species are classified as common and widespread.

Birds

Reilly (1998) studied the species, numbers, seasonality and water level preference of waterbirds observed at the Painkalac Estuary from 1990-1995. Reilly lists 33 estuary reliant species of regular, occasional and irregular frequency. Of particular note are: Intermediate Egret, Blue-billed Duck, Australasian Bittern, Musk Duck, Hardhead, Great Egret, Caspian Tern, Whiskered Tern, Latham's Snipe.

Additional records collected by local residents indicate over 100 bird species used the Painkalac Estuary during 2000-2005.



The geological structure of Painkalac Creek formed between 50 and 150 million years ago and is the result of uplift of the Cretaceous rocks of the Otway Ranges creating cliffed coastal margins. Sandy beaches, dunes and barriers have been formed in the last 6,000 years. The evolution of the coast has been influenced by rises and falls in land and water levels over the past 120,000 years. The sea level reached a peak of about 7.5 metres above its present level 120,000 years ago and fell up to 120 to 140 metres below its current level (around 18,000 years ago) when glaciers and ice sheets reached their maximum extent during the last Ice Age.

Geomorphology

The floodplain, estuary and associated features of Painkalac Creek have state and high regional geomorphologic significance due to the well developed floodplains and estuaries that are rare in the eastern Otway Ranges.

Also, the floodplain is likely to contain a range of sediments that would yield valuable fossil-pollen evidence, enabling reconstruction of pre-historic vegetation patterns and climates.



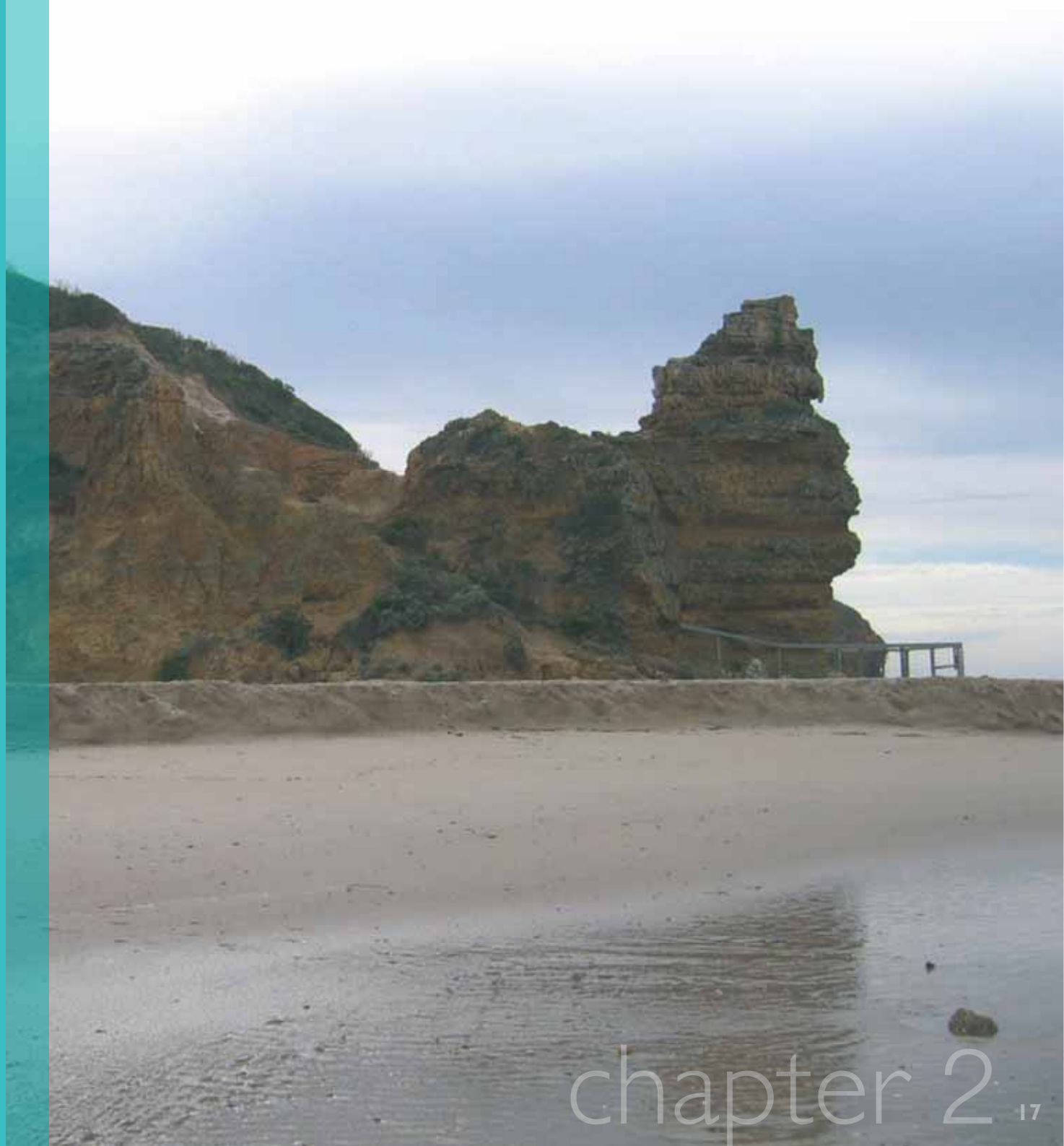
Climate

In estuaries, climatic factors such as temperature and rainfall/runoff regimes directly affect estuarine salinities, nutrient cycling and ecological conditions.

Aireys Inlet's climate is mild with an average summer temperature range (degrees Celsius) of 13-25; autumn of 11-21; winter of 6.5-14.5 and spring of 8.5-20. The annual rainfall average is approximately 650mm. Highest rainfall is in the months between April and November, with the wettest month being August and the driest being January. The Aireys Inlet area is in the rain shadow of the Otway Ranges.

Soil

The soils of the Painkalac estuary and valley tend to be saline or sodic, poorly drained, have slow permeability and are prone to soil compaction, erosion, structure decline and seasonal ponding. Loss of soil from the catchment and river banks into the river and estuary can have a negative effect on the clarity of the water, instream plants and animals and eventually, plants and animals living within the intertidal zone of the beach (area on the beach that is subject to daily changes in tide).





View west from lighthouse 1915



View west from lighthouse 2005



Aireys Inlet landscape early 1900's – taken from lighthouse and looking towards Fairhaven. Note Allen Noble Sanctuary at right of picture behind row of pines.



Aireys Inlet Landscape 2005- taken from lighthouse and looking toward Fairhaven.

DESCRIBING THE PAINKALAC ESTUARY

Fire History

The Fire Management Plan for Painkalac Nature Reserve states that as an approximation, minor fires would have occurred in the region on a frequency of every several years or so, while major fires over extended areas may have been events occurring in the order of a few decades. The intensity would have been dictated by weather and past rainfall.

Natural fire frequencies in wet gullies and wetlands would have been far less due to the greater moisture-retaining properties of the vegetation and soils, making them less prone to pre-curing and burning.

With the advent of settlement, types of ignition sources have increased and a more common cause of fires is from arson, accident or neglect. The latest major fire to affect the area was the 'Ash Wednesday' fire in 1983, which originated near the Deans Marsh sawmill. This fire burned across a large expanse of the Otway Ranges from Lorne to Bells Beach. Painkalac Creek reserve was burnt as the fire spotted ahead of the main front.

Between 1991 and 1999, Painkalac Creek Reserve was subject to annual rotational fuel reduction burning under a plan developed between the predecessor of the Department of Sustainability and Environment and the Aireys Inlet Country Fire Authority Brigade. Moulton (1999) indicates that this regime has higher levels of fire prevention works than in the past, and that a comparison between the present vegetation condition of the reserve and its condition based on the 1990 vegetation survey and historic air photographs indicate that changes have taken place. These changes include an increase in weed cover, particularly Boneseed, a change in ground cover species representation and a greater cover of shrubs and small trees such as Boobialla (*Myoporum insulare*) and *Acacia* spp. Moulton (1999) suggests that fire has been instrumental in stimulating a significant amount of Boneseed seed dormant in the soil.

Rotational burning ceased after 1999, following the preparation of the Painkalac Reserve Fire Management Plan (completed in 2003). The Plan recommends manual removal of weed species and that fuel reduction works through fire only occur where it can be demonstrated that the task benefits the ecological values of the Reserve.

The Painkalac Estuary, including the river flats and Painkalac Reserve, was burnt in the Ash Wednesday bushfires of 1983. There have been no major fire events since that time.

Prescribed burns (planned burns) were conducted in the reserve by the CFA until 1999.

Today, the Reserve Fire Management Plan recommends manual removal of weed species and that fuel reduction works through fire only take place where it can be demonstrated that the task benefits the ecological values of the Reserve.

DESCRIBING THE PAINKALAC ESTUARY



Historical/cultural background

>25,000 years ago to 1803 The Mon-mart clan of the Wathaurong lived in the region for more than 25,000 years prior to European arrival.

Painkalac Creek was significant in that it formed the boundary of Wathaurong and Gadubanud land. The name of Painkalac Creek is derived from the Wathaurong language and means 'Yaluk' for creek or river. The Wathaurong name for Aireys Inlet was 'Mangowak', which meant 'a good place for hunting swans'.

There is evidence of pre-contact Aboriginal occupation around estuary mouth and foreshores including shell middens, artefact scatters and burials. Five of the seven shell middens are in fair condition with the remainder being in poor and very poor condition.

1803 First known European contact at Aireys Inlet occurred in 1803 when escaped convict William Buckley, known as the 'Wild White Man', camped at "Mangowak" in 1803. He later visited the area with the Wathaurong people who adopted him and with whom he lived for about 32 years. In an account of his time with Aborigines, Buckley talks of using one of the filtered wells the Mon-mart dug near the salty river mouth.

1839-1842 European settlement of the area began in 1839 when Lieutenant John Airey took up a pastoral run between Pt Roadknight and the inlet, the 'Anglohawk run', in 1842. The Angahook-Lorne State Park that surrounds the town was named after the first cattle run.

1880-1894 The establishment of the Aireys Inlet township began in the 1880's with the sale of land in the district. The Split Point lighthouse began operating in 1891. Timber milling encouraged families to move into the area and a school was formed in 1893. The opening of the Grand Hotel in 1894 marked the beginning of tourism services. The use of timber by settlers for heating and cooking had a significant impact on tree density in the valley.

1907-1932 A report by J.A.Thomas from the Department of Agriculture in 1914 indicated that the floodplain was cleared of native vegetation in 1907 and was planted with rye grass, white paspalum and phalaris grasses. Grazing of domestic animals has occurred in the valley for more than 150 years.

The construction of the first section of the Great Ocean Road to Eastern View was carried out in 1922, enabling much more direct access to Geelong and Lorne, resulting in a gradual increase in population numbers. The bridge across Painkalac Creek was opened in 1932. Previous to the construction of the Great Ocean Road, it was a nine hour journey between Aireys Inlet and Geelong by horse.

1960-1983 From the 1960's, agriculture and timber gave way to occupations in tourism. The water supply reservoir for Aireys Inlet was constructed by the Aireys Inlet Waterboard in 1978.

1992 In 1992, a sewage treatment plant (water reclamation plant) was built in the catchment of Distillery Creek approximately 3kms from the point at which Distillery Creek meets Painkalac Creek.

VALUES:

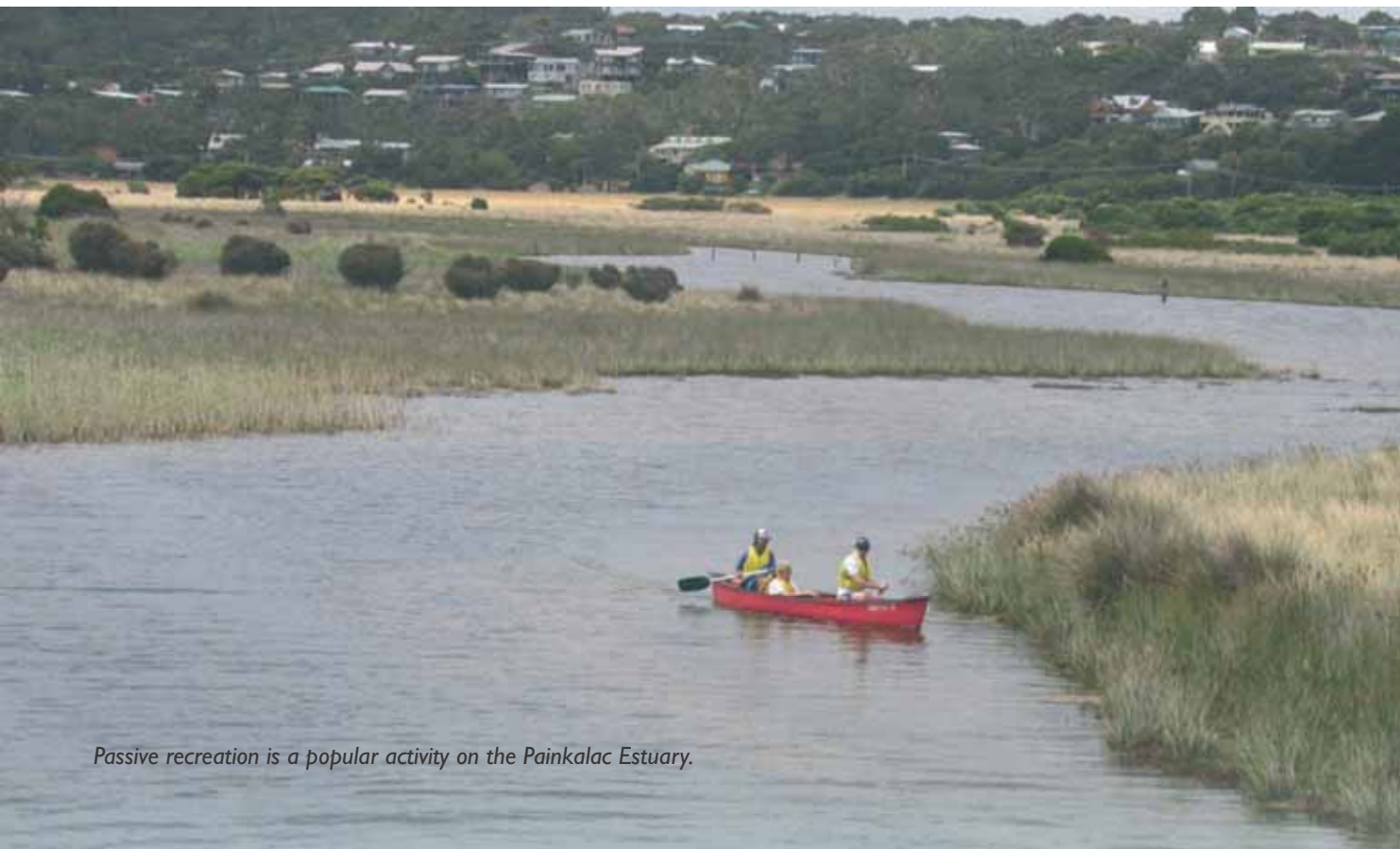
What do people love about the Painkalac Estuary?

During February 2005, Nexus Research was commissioned by the Corangamite Catchment Management Authority to conduct a research survey of residents living in the Corangamite region to establish their awareness and perceptions of local estuaries. A total of 650 residents took part in the research, with 100 selected from each of Aireys Inlet, Anglesea, Apollo Bay, Kennett & Wye Rivers, Lorne; Torquay/Jan Juc/Breamlea and 50 from Peterborough.

The information relevant to Painkalac Estuary gathered during the survey was combined with information already obtained by Surf Coast Shire during studies, surveys and workshops of recent years. This includes the Aireys Inlet Neighbourhood Character Study (2004), Community Planning workshops held during 2003, workshops conducted as part of the preparation of this Plan, and other information provided by community groups in the Aireys Inlet and Fairhaven area.

Estuaries are places where salt water from the ocean mixes with freshwater draining from the land.

Estuaries are productive and complex systems that have cultural, historic, economic, environmental and social value.



Passive recreation is a popular activity on the Painkalac Estuary.

What People Love

Indigenous Heritage *Beautiful Outlook*
Recreation *Wildlife*
Native Plants *The Peace & Quiet*
Swimming *Habitat* *Water Quality*
Tourism *European History*
Education *Birds* *Fishing*



What Are People Worried About?

Inappropriate Water Flow Regime

Unmanaged Tourism

Pollution

Overdevelopment

Rubbish

Septic Tanks

Uncontrolled Fire

Stock Access

Unmanaged Recreation

Loss of Streamside Vegetation

Storm Water of Poor Quality

Controlled Burning Too Often



PROTECTING WHAT PEOPLE LOVE: A LIST OF THINGS TO DO

“Doing nothing can be the answer or the downfall”.

The following tables list things to do (actions) aimed at meeting the objectives set for Painkalac Estuary (refer to “What Is This Plan Trying to Achieve?”, page 2.)

Page 2 also describes who will make sure these actions are implemented.

OBJECTIVE 1: BIODIVERSITY

Restore and protect native flora and fauna

WHAT IS HAPPENING NOW	NEW ACTIONS	Responsible Agency	Partner/s
<ul style="list-style-type: none"> Each year, ANGAIR has a weed day in Painkalac Valley as part of the Annual Weed Week in June/July. Each year in September or October, The Friends of Aireys Inlet Wetlands hold a Sunday morning community working bee, supported by SCS. The Aireys Inlet Neighbourhood Character Study was undertaken during 2004/5, and is the basis of an amendment to the Surf Coast Shire Planning Scheme. The amendment includes stronger native vegetation protection controls. A Trust for Nature Victoria Conservation Covenant applies to Painkalac Valley Nature Reserve and Mellors Swamp. Ecological Vegetation Class mapping of Painkalac Nature Reserve was completed in 2005. A Fire Management Plan has been prepared for the Painkalac Nature Reserve and Mellors Swamp to meet ecological and human safety objectives. Coast Action/Coastcare assist community groups with funding applications for Coast Action works on public land, including the areas around Painkalac Estuary. DSE's Biodiversity Action Plan (Landscape Plan for Zone 3 Gherang) includes recommendations relevant to the preservation of biodiversity values in the Painkalac Estuary. 	Implement the Fire Management Plan for Shire owned and managed land around the estuary.	Surf Coast Shire	Trust for Nature, DSE, CFA & GORCC
	Implement a targeted Boneseed removal program along Painkalac Estuary and on properties around the valley.	Surf Coast Shire	Relevant property owners, environment groups & GORCC.
	Collate existing flora and fauna data not on the DSE database and give to DSE for processing.	Surf Coast Shire & DSE	Environment groups
	Integrate ecological vegetation class mapping with topographical data as a basis for the Estuary Entrance Decision Framework for Painkalac Estuary.	Deakin University	Surf Coast Shire
	Fence and rehabilitate riparian areas on private land in the Painkalac catchment.	CCMA & land owners	GORCC and Surf Coast Shire
	Fence and rehabilitate riparian areas on Council owned and managed land in the Painkalac catchment.	Surf Coast Shire	GORCC, Trust for Nature and land owners
	Fence and rehabilitate riparian areas on land managed by GORCC in the Painkalac catchment.	GORCC	Surf Coast Shire and land owners
	Erect signage at recreational access points along the creek and estuary to explain permitted activities.	Surf Coast Shire, GORCC and DSE	Input from Implementation Committee

PROTECTING WHAT PEOPLE LOVE: A LIST OF THINGS TO DO

OBJECTIVE 2: AQUATIC ECOLOGY

Achieve a standard of water quality and quantity that protects the diversity and abundance of aquatic ecosystems and allows recreational and aesthetic enjoyment of the estuary

WHAT IS HAPPENING NOW	NEW ACTIONS	Responsible Agency	Partner/s
<ul style="list-style-type: none"> • A review of water quality data collected through the Water-watch program has been undertaken. • In-stream sampling of fauna and invertebrates was undertaken in 1991. • Historical flow data has been collected by Barwon Water. • An Estuary Entrance Decision Framework is being prepared by Deakin University to provide a guide for artificial opening of the estuary if required. • Surf Coast Shire has prepared a Stormwater Management Plan for the Shire. • SCS has a Flood Response Policy. • The CCMA has surveyed residents along the Central West coast, including around Painkalac Estuary, on their understanding and values of estuaries. • Western Coastal Board, in association with many project partners, has prepared the Central West Victoria Estuaries Coastal Action Plan. • Parks Victoria has prepared a Marine Parks Strategy. • EPA has prepared a Protocol for Fish Kills in Victoria. • Monthly upstream and downstream water quality monitoring by EPA (to be completed December 05). 	Develop a process to ensure all aquatic ecosystem data collected for the estuary is shared between stakeholders.	Implementation Committee	
	Establish an Estuary Watch Program for the Painkalac Estuary involving local community members.	CCMA	Western Coastal Board, Surf Coast Shire, GORCC, Coast Care Coast Action, Community Environment Groups, general community, local schools
	Undertake an investigation into environmental flow requirements for fresh water and estuarine systems to the Painkalac Creek from the Aireys Inlet Reservoir, with a view to reviewing the Bulk Entitlement held by Barwon Water. The investigation should also consider the potential role of the Aireys Inlet Reservoir in flood management downstream.	Barwon Water & CCMA	Implementation Committee
	Fence and revegetate creek banks where necessary (refer to Objective 1)	Refer to Objective 1	
	Map the drainage network showing side entry pits, piped drains, open drains and Gross Pollutant Traps in Aireys Inlet.	SCS	Implementation Committee
	Undertake an audit of the septic systems in Aireys Inlet and recommend management actions as part of the development of the Surf Coast Shire Waste Water Management Plan.	SCS	Implementation Committee
	Install drainage outlet release nets to catch large to moderate size gross pollutants from the Aireys Inlet commercial zone.	SCS	Implementation Committee

PROTECTING WHAT PEOPLE LOVE: A LIST OF THINGS TO DO

OBJECTIVE 3: EROSION & SEDIMENTATION

Minimise estuary sedimentation and erosion caused by the effects of human activity in the catchment and along the riverbank.

WHAT IS HAPPENING NOW	NEW ACTIONS	Responsible Agency	Partner/s
<ul style="list-style-type: none"> Surf Coast Shire is building a canoe launching ramp to minimise riverbank degradation. Surf Coast Shire has a Stormwater Management Plan, which includes actions within the Painkalac Creek Catchment. Fencing and revegetation of the creek (upper catchment CCMA and local landholders, east bank south of Old Coach Road by SCS/CCMA). Surf Coast Shire implements a training program on erosion and drainage management for all civil and parks staff. Surf Coast Shire has a Local Law for erosion and sediment control on building sites. Surf Coast Shire is undertaking a "Roads and Drainage Improvements Plan" during 2006. 	Install fishing platforms at popular fishing spots on the estuary.	SCS & GORRC	Trust for Nature
	Erect barriers such as bollards to prevent compaction of banks at vehicular access points.	SCS & GORRC	Implementation Committee
	Identify appropriate access points and pathways to the river and estuary and install appropriate infrastructure/signage to ensure access to the estuary is encouraged while not compromising its environmental values.	SCS & GORRC	Implementation Committee
	Fence and revegetate creek banks where necessary (refer to Objective 1)	Refer to Objective 1	
	Rock line open drains in the catchment where appropriate	SCS	Implementation Committee

OBJECTIVE 4: ABORIGINAL AND EUROPEAN HERITAGE

Identify, acknowledge, respect and protect the Aboriginal and European heritage of the estuary.

WHAT IS HAPPENING NOW	NEW ACTIONS	Responsible Agency	Partner/s
<ul style="list-style-type: none"> A Native Title on Crown Land Co-ordinator has been appointed for the Surf Coast region. Education programs incorporating Aboriginal and European heritage are implemented by a number of groups, including Coast Action, Parks Victoria, Schools, Surf Coast Shire and the CCMA. Historical Information is provided at points along the Painkalac Estuary. Surf Coast Shire Planning Scheme identifies areas of environmental significance and heritage areas that must be considered when making a planning application. Surf Coast Tourism has established a lighthouse precinct walk, which incorporates views of the estuary. 	Ensure a site inspection by a Wathaurong representative is undertaken as part of on-ground works causing soil disturbance along the waterway.	Implementation Committee	
	Undertake an annual inspection of sites of significance involving Wathaurong representatives and land managers. Actions to preserve the sites will be identified on an annual basis.	SCS & GORRC, Wathaurong	Implementation Committee
	Review current historical signage along the estuary and implement additions if required.	SCS & GORRC	Implementation Committee
	Continue to incorporate Aboriginal and European Heritage into education programs.	Implementation Committee	

PROTECTING WHAT PEOPLE LOVE: A LIST OF THINGS TO DO

OBJECTIVE 5: RECREATIONAL USE

Encourage and provide facilities for appropriate recreational use of the estuary and catchment while maintaining ecosystem viability.

WHAT IS HAPPENING NOW	NEW ACTIONS	Responsible Agency	Partner/s
<ul style="list-style-type: none"> Surf Coast Shire has prepared a Pathways Strategy, which has an initial implementation budget of \$1M for 2005/6. A permit system exists to regulate commercial recreation and tourism activities on the estuary. Surf Coast Shire is building a canoe launching ramp to minimise riverbank degradation. Surf Coast Tourism has established a light-house precinct walk, which incorporates views of the estuary. 	Undertake an audit (including mapping) of existing signage (words, condition, and consistency) and replace/erect new signs. This should include signage that prohibits motorised vessels as per the Marine Safety Act.	SCS, DSE and GORCC	Implementation Committee
	Develop a permitting system that achieves equity and consistency on the management approach of commercial operators operating on the estuary.	SCS, GORCC and DSE	Implementation Committee
	Install fishing platforms at popular fishing spots on the estuary (Refer to Objective 3).	Refer to Objective 3	
	Identify appropriate access points and pathways to the river and estuary and install appropriate infrastructure/signage to ensure access to the estuary is encouraged while not compromising environmental values (Refer to Objective 3).	Refer to Objective 3	

OBJECTIVE 6: LANDSCAPE VALUE

Maintain the quality of the visual experience of the natural landscape from the waterway and from catchment vantage points.

WHAT IS HAPPENING NOW	NEW ACTIONS	Responsible Agency	Partner/s
<p>The following documents all promote the preservation of landscape values along the Great Ocean Road, which are considered within the Statutory Planning process:</p> <ul style="list-style-type: none"> Coastal Development Policy in the SCS Municipal Strategic Statement. Significant Landscape Overlay/Environmental Significance Overlay in the SCS Planning Scheme. Great Ocean Road Region Strategy. Victorian Coastal Strategy. Siting and Design Guidelines (Victorian Coastal Council). Western Coastal Board Regional Coastal Action Plans. 	<p>Ensure that any structures, including signage, are low-key and do not impact on the landscape values of the site.</p> <p>Prepare a landscape plan or similar to appropriately locate and co-ordinate the siting and design of structures. Responsible agency Surf Coast Shire, partner Implementation Committee.</p>	<p>SCS, DSE and GORCC</p> <p>SCS</p>	Implementation Committee

PROTECTING WHAT PEOPLE LOVE: A LIST OF THINGS TO DO

OBJECTIVE 7: FLOODING

Minimise the social and economic impact of flooding while maintaining ecosystem viability.

WHAT IS HAPPENING NOW	NEW ACTIONS	Responsible Agency	Partner/s
<ul style="list-style-type: none"> • A Flood Overlay has been placed over some parts of the Valley to limit inappropriate development in flood prone areas. • An Estuary Entrance Decision Framework is being prepared by Deakin University to provide a guide for artificial opening of the estuary if required. • SCS have purchased 1m interval contour mapping to assist with understanding the distribution of flood waters during floods. • SCS is installing a flood level gauge to support the Estuary Entrance Decision Framework. 	Implement the Estuary Entrance Decision Framework being developed by Deakin University, including clearly documenting the physical process of opening the estuary.	SCS, DSE and GORCC & CCMA	Implementation Committee
	Monitor the opening of the estuary using a suitably qualified professional.	SCS, DSE and GORCC & CCMA	
	Undertake an investigation into environmental flow requirements for fresh water and estuarine systems to the Painkalac Creek from the Aireys Inlet Reservoir, with a view to reviewing the Bulk Entitlement held by Barwon Water. The investigation should also consider the potential role of the Aireys Inlet Reservoir in flood management downstream. (Refer to Objective 2)	Refer to Objective 2	
	Collate existing flora and fauna data that is not on the DSE database and give to DSE for processing (Refer to Objective 1).	Refer to Objective 1	
	Integrate ecological vegetation class mapping with topographical data as a basis for the Estuary Entrance Management Decision Framework for Painkalac Estuary (Refer to Objective 1).	Refer to Objective 1	

PROTECTING WHAT PEOPLE LOVE: A LIST OF THINGS TO DO

OBJECTIVE 8: COMMUNITY AWARENESS

Encourage community participation in estuary management and activities and share information with the community on the values of the estuary.

WHAT IS HAPPENING NOW	NEW ACTIONS	Responsible Agency	Partner/s
<ul style="list-style-type: none"> • Information on Painkalac Estuary is placed in the noticeboard at the 'Top Shops' in Aireys Inlet. • Stories are placed in the AIDA Newsletter. • Community water monitoring programs have been undertaken within the Waterwatch Program and a strong community interest has been expressed for the Estuary Watch Program proposed by the CCMA. • The ANGAIR Wildflower show (Sept) and Aireys Fair provide opportunities to display information on Painkalac Creek and Estuary. • Events are held at the Estuary, such as CCMA Freshwater Circus. • Presentations by SCS to community groups (at meetings) on what is happening at the estuary. • Coast Action Summer Activities Program includes activities at Painakalac Estuary. • Media at selected times of the year to engage with tourists and residents (part of broader media package) to visit and appreciate the Painkalac Estuary. • Encouraging participation in the preparation of this Estuary Management Plan. 	<p>Prepare an annual community education and events program for the Painkalac Estuary that provides opportunities for participation by both permanent and non-permanent residents and tourists.</p>	<p>Implementation Committee</p>	
	<p>Community education should encourage participation rather than providing information.</p>	<p>Implementation Committee</p>	
	<p>Evaluate the success of community education programs on annual basis. This should include the setting of annual performance measures.</p>	<p>Implementation Committee</p>	
	<p>Install signs that mark Painkalac Nature Reserve and Mellors Swamp Nature Reserve.</p>	<p>SCS</p>	<p>Trust for Nature</p>
	<p>Hold a Short Story competition about Painkalac Creek as a means of identifying and sharing community values of the Painkalac Creek and Estuary.</p>	<p>SCS</p>	<p>Implementation Committee</p>

FINDING OUT MORE about the Painkalac

This Estuary Management Plan pulls together the existing information on the Painkalac Creek and Estuary in a format that is user friendly, uses simple language, is not too technical, uses lots of pictures, has not too much text, has good maps, a glossary and historical information. A much more detailed and technical document (Draft Painkalac Estuary Management Plan Reference Document, 2005) has been prepared and is available from the Surf Coast Shire Environment Unit.

The following references have been utilised during the preparation of this plan or are good references for finding out more about Painkalac Creek and Estuary or estuaries in general.

References

Literature

- Aireys Inlet and District Association (1989) *Lialetta Road Housing Cluster Development submission on behalf of the Aireys Inlet District Association*. AIDA.
- Aireys Inlet Foreshore Reserve Committee of Management (1998) *Management Plan 1999-2001 for the Aireys Inlet Foreshore Reserve and Associated Public Land*. Aireys Inlet Foreshore Reserve Committee of Management.
- Barton, J. (2003) *Estuarine Health Monitoring & Assessment Review*. State Water Quality Monitoring and Assessment Committee (Victoria).
- Barton, J. & Sherwood, J. (2004) *Parks Victoria Technical Series Number 15 Estuary Opening Management in Western Victoria: An Information Analysis*. Parks Victoria.
- Bird, E. (1993) *The Coast of Victoria – the shaping of scenery*. Melbourne University Press.
- Brett Lane & Associates Pty. Ltd. (2001) *Central West Victoria – Coastal Waterway Guide*. Western Coastal Board, Geelong.
- Cecil, K.L. & Carr, R.V. (1987) *Aireys Inlet – A History*. Anglesea and District Historical Society.
- Creighton, C (2000) *Managing Australia's Estuaries*. Australian Land and Water Resources Audit. In Coast to Coast 2000. Au
- Coastal Management and Coordination Committee (1979) *Eastern View Coastal Reserve Management Plan*. Prepared with Assistance from the Soil Conservation Authority, the Town and Country Planning Board and the Ports and Harbours Division of the Public Works Department.
- Corangamite Catchment Management Authority (2005b) *Catchment Condition: Otway Coast*.
- Deeling, D.M. & Paling, E.I. (1999) *Assessing the Ecological Health of Estuaries in Australia*. Land and Water Resources Research and Development Corporation, Canberra.
- Department of Sustainability and Environment (DSE) (2004), *EVC/Bioregion Benchmark for Vegetation Quality Assessment. Otway Ranges Bioregion. EVC 163: Coastal Tussock Grassland*.
- Ecological Horticulture Pty Ltd, Biosis Research Pty Ltd, Context Pty Ltd, and Scat Environmental and Waste Treatment Consultants (1990) *Painkalac Creek Wetlands and Floodplain Environmental Study*. Painkalac Creek Valley Study Steering Committee.
- Floodplain Management Team (2001) Corangamite Catchment Management Authority (CCMA) *Floodplain Management Strategy (Draft)*. CCMA, Colac, Victoria.

FINDING OUT MORE about the Painkalac

- Gillanders, B.M.; Kingsford, M.J. (2002) *Impacts of changes in flow of freshwater on estuarine and open coastal habitats and associated organisms*. *Oceanography and Marine Biology: an Annual Review* 40 pp, 223-309.
- Green, R. (2003) *A study of the Resident Perceptions of Neighbourhood Character: Aireys Inlet to Eastern View*. University of Melbourne.
- Harty, C. (2005) *Central West Victoria Estuaries Coastal Action Plan*. Western Coastal Board, State of Victoria.
- Kellaway, C. (1998) *Surf Coast Shire Heritage Study - Farmland, Forest and Surf. Volume 3: Environmental History of the Surf Coast Shire*. Context Pty. Ltd.
- Leonard, A. & Steven, A. (2001) *Policy Background Paper: Water quality objectives for marine and estuarine waters – ecosystem protection; Draft State Environment Protection Policy (Waters of Victoria)*. Environment Protection Authority, Victoria.
- McClaren, I.F. (1988) *Aireys Inlet from Anglesea to Cinema Point. A History based on material prepared by Ian F McClaren*. Anglesea and District Historical Society and Aireys Inlet District Association.
- McLusky, D.S. & Elliot, M. (2004) *The Estuarine Environment: Ecology, threats and management*. Third Edition. Oxford University Press.
- McCoy, J. (1998) *Waterwatch Index of Stream Condition – Summary of 1997 Waterway Health*. Corangamite Waterwatch Program, Geelong.
- Morrice, M. (2000) *Planning and Integrated Future: the Central West Coast of Victoria - Discussion Paper: Issues and Options* “A coordinated and integrated planning framework and sustainable future for the regions coastal, intertidal and marine environments”. Surf Coast Shire, Torquay.
- Moulton, P. (1999) *Painkalac Creek – Fire Management Plan*. Surf Coast Shire
- Northcote, K.H. (1974) *A Factual Key for the Recognition of Australian Soils*. Rellim Technical Publications, Adelaide. In *Ecological Horticulture et al* (1990).
- NWLRA (2002) *Australian Catchment, River and Estuary Assessment 2002*. Land & Water Australia, Canberra.
- Parks Victoria (1999) *Angahook Lorne State Park Management Plan*. Parks Victoria, Melbourne.
- Parks Victoria (2004) *Point Addis Marine National park, Point Danger Marine Sanctuary and Eagle Rock Marine Sanctuary Draft Management Plan*. Parks Victoria.
- Pierson, W.L.; Bishop, K.; Van Senden, D.; Horton, P.R.; Adamantidis, C.A. (2002) *Environmental water requirements to maintain estuarine processes. Environmental Flows Initiative Technical Report Number 3*. Prepared by Commonwealth of Australia, Canberra.
- Pitt, A.J., Howe, D.F.R and Jakimoff, A.W. (1977) *A study of the land, its capabilities in Selected Coastal Areas*. Soil Conservation Authority, Victoria. In *Ecological Horticulture et al* (1990).
- Pope, A.J. (in preparation) *‘Physico-chemical Factors and Seagrass Dynamics in Intermittently Open Estuaries’*
- Roy, P. (1996) *A classification of southeast Australian estuaries*. In “Deeling, D.M. & Paling, E.I. (1999) *Assessing the Ecological Health of Estuaries in Australia*. Land and Water Resources Research and Development Corporation, Canberra.”
- Ryan, D.A.; Heap, A.D.; Radke, L. and Heggie, D.T. (2003) *Conceptual Models of Australia’s estuaries and coastal waterways. Application for Coastal Resource Management. Geoscience Australia Record 2003/04*. Department of Industry, Tourism and Resources.

FINDING OUT MORE about the Painkalac

- Rural Water Commission (1989 a) *Stream gauging records station No.235220 1967-1974*. In Ecological Horticulture et al, (1990)
- Shakelton, A.F. (1988) *Geelong Region Coastal Management Plan, Volume 1, Resource Document*. Department of Conservation, Forests and Lands, Geelong.
- Short, A.D. (1996) *Beaches of the Victorian Coast and Port Phillip Bay*. University Printing Services, University of Sydney.
- Strachan, D., Manning, J., and Snell, J. (1979) *Environmental Plan for Painkalac Creek Catchment*. Monash University.
- Surf Coast Shire Planning Scheme Part A: State Planning Policy Framework, Local Planning Policy Framework and Restrictive Covenants Guidelines. Revised 2003.
- Surf Coast Shire. Planning Scheme Part B: Zones, overlays, particular provisions, general provisions, definitions and incorporated documents. Revised 2003.
- Surf Coast Shire (20034) *Aireys Inlet to Eastern View Neighbourhood Character Study and Vegetation Assessment (Draft)*. Surf Coast Shire.
- Surf Coast Shire (2004) *Your Visions – Community Plan*. Surf Coast Shire, Torquay, Australia.
- Tract Consultants Pty Ltd and Chris Dance Land Design Pty. Ltd (1998) *Landscape setting types for the Victorian coast*. Victorian Coastal Council.
- Trengove, M (2003) *Aireys Inlet to Eastern View Neighbourhood Character Study –Vegetation Report*. Surf Coast Shire.
- Wade, S. (2002) *Ambient Water Quality Monitoring: Port River Estuary September 1995-August 2000*. Environment Protection Agency, Adelaide.
- Williams, B. (2000) *A brief history of AIDA: from birth to 2000*. Aireys Inlet and District Association.
- Wissing, R. & McCoy, J. (1997 a) *Water Quality Reports 1996 – Section 2: Painkalac Creek*. Corangamite Waterwatch Program, Geelong.
- Wissing, R. & McCoy, J. (1997 b) *Water Quality Reports 1996 – Section 1: Otway Coast Basin Report*. Corangamite Waterwatch Program, Geelong.
- Woodward-Clyde Pty Ltd (1995) *Coastal Management Audit- Surf Coast Shire*. Surf Coast Shire.
- Wooldridge, T. (1999) *Estuarine zooplankton community structure and dynamics*. In: Allanson
- Wynd, I. (1992) *Barrabool: Land of the Magpie*. Barrabool Shire, Torquay.
- Yule, C.M. (1978) *Fauna-substrate Relationships in a Victorian Coastal Stream with Consideration of the Impact of a Dam Construction*. Unpublished 1978 Honours Thesis, Zoology Department, Monash University.

Useful websites

- Government of Victoria (2004) Victorian Water Resources Data Warehouse www.vicwaterdata.net/vicwaterdata/home.aspx
- Australia's Great Ocean Road Aireys Inlet History. www.greatoceanrd.org.au/surfcoast/aireysinlet/history.asp
- Western Coastal Board www.westerncoastalboard.vic.gov.au
- Department of Sustainability and Environment and Primary Industries www.dpi.vic.gov.au and www.dse.vic.gov.au
- Great Ocean Road Coast Committee www.gorcc.com.au



