EUROBODALLA SHIRE COUNCIL

MORUYA / DEUA RIVER ESTUARY MANAGEMENT STUDY

Issue No. 4
FEBRUARY 2009

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resources & energy

Patterson Britton
& Partners Pty Ltd
consulting engineers

EUROBODALLA SHIRE COUNCIL

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FOREWORD

The Estuary Management Policy of the New South Wales Government has been developed in conjunction with other government policies that address resource planning and management on a catchment basis. The Estuary Management Policy focuses on tidal waterways and coastal lakes. These waterbodies are an essential component of coastal catchments and are characterised by the interplay of saline coastal waters and freshwater runoff from the land.

The Policy provides for the assessment of all estuarine uses, the resolution of conflicts and the production of a unified and sustainable management plan for each NSW estuary. The objectives of the Policy are:

- protection of estuarine habitats and ecosystems in the long term including maintenance in each estuary of the necessary hydraulic regime;
- preparation and implementation of a balanced long term management plan for the sustainable use of each estuary and its catchment, in which all values and uses are considered, and which defines management strategies for:
  - conservation of aquatic and other wildlife habitats;
  - conservation of the aesthetic values of estuaries and wetlands;
  - prevention of further estuary degradation;
  - repair of damage to the estuarine environment; and
  - sustainable use of estuarine resources, including commercial uses and recreational uses as appropriate.

The objectives of the Policy are to be implemented by the government's Estuary Management Program, which aims at the production and implementation of management plans. The Estuary Management Program is administered through the Department of Environment and Climate Change *(DECC)* and encourages the sustainable management of the State's estuaries in accordance with the government's draft Estuary Management Manual (*1992*).

The primary objective of this study has been to undertake appropriate consultation with the community and key stakeholders, and to combine the outcomes of this consultation with scientific data to develop this Management Study report for the Moruya / Deua River Estuary.

The Study is based on the outcomes of the *Moruya / Deua River Estuarine Processes Study* and the consultation process. It identifies and prioritises strategies for the future management of the Moruya / Deua River Estuary. The findings from this study will be used to formulate a Management Plan for the estuary.

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The Moruya / Deua River Estuary Management Study was prepared by Patterson Britton & Partners Pty Ltd on behalf of the Moruya / Deua River Estuary Management Committee. The Committee reports directly to Eurobodalla Shire Council.

The Study stems from Council's commitment to managing the estuarine reaches of the Moruya / Deua River and its major tributaries including Wamban, Malabar and Mogendoura Creeks. It has been funded jointly by Council and the Department of Environment and Climate Change on a 50:50 subsidy basis, under the New South Wales Government's *Estuary Management Program*.

The Study has been developed taking into account contributions from the broader community and key stakeholders. These key stakeholders include members of the Moruya / Deua River Estuary Management Committee, all of whom are listed in Appendix B. The contributions from Committee members and the key stakeholders have been essential to the preparation of the Study and are greatly appreciated.

1 INTRODUCTION

1.1 THE SETTING

The Moruya / Deua River is situated on the south coast of New South Wales, about 300 kilometres south of Sydney, and about 25 kilometres south of Batemans Bay (*refer* **Figure 1**).

The waterway is named the 'Moruya River' along its estuarine length between the ocean entrance at Moruya Heads and the tidal limit. Upstream from the tidal limit the river is named the 'Deua River'. The tidal limit is located approximately 20 km upstream from the entrance, near the confluence with Wamban Creek. The estuarine section has a waterway area of about 4.6 km^2.

The estuary entrance has been stabilised with twin training walls and therefore remains permanently open. The estuary has been classified as a mature 'Barrier Estuary' by Roy (*1984*) and has undergone significant in-filling with fluvial sediments from the upstream catchment.

There are four major tributaries that feed into Moruya / Deua River. These are Wamban Creek, Candoin Creek, Mogendoura Creek and Malabar Creek. Therefore, there are a total of five major sources of freshwater inflow to the estuary including the Deua River.

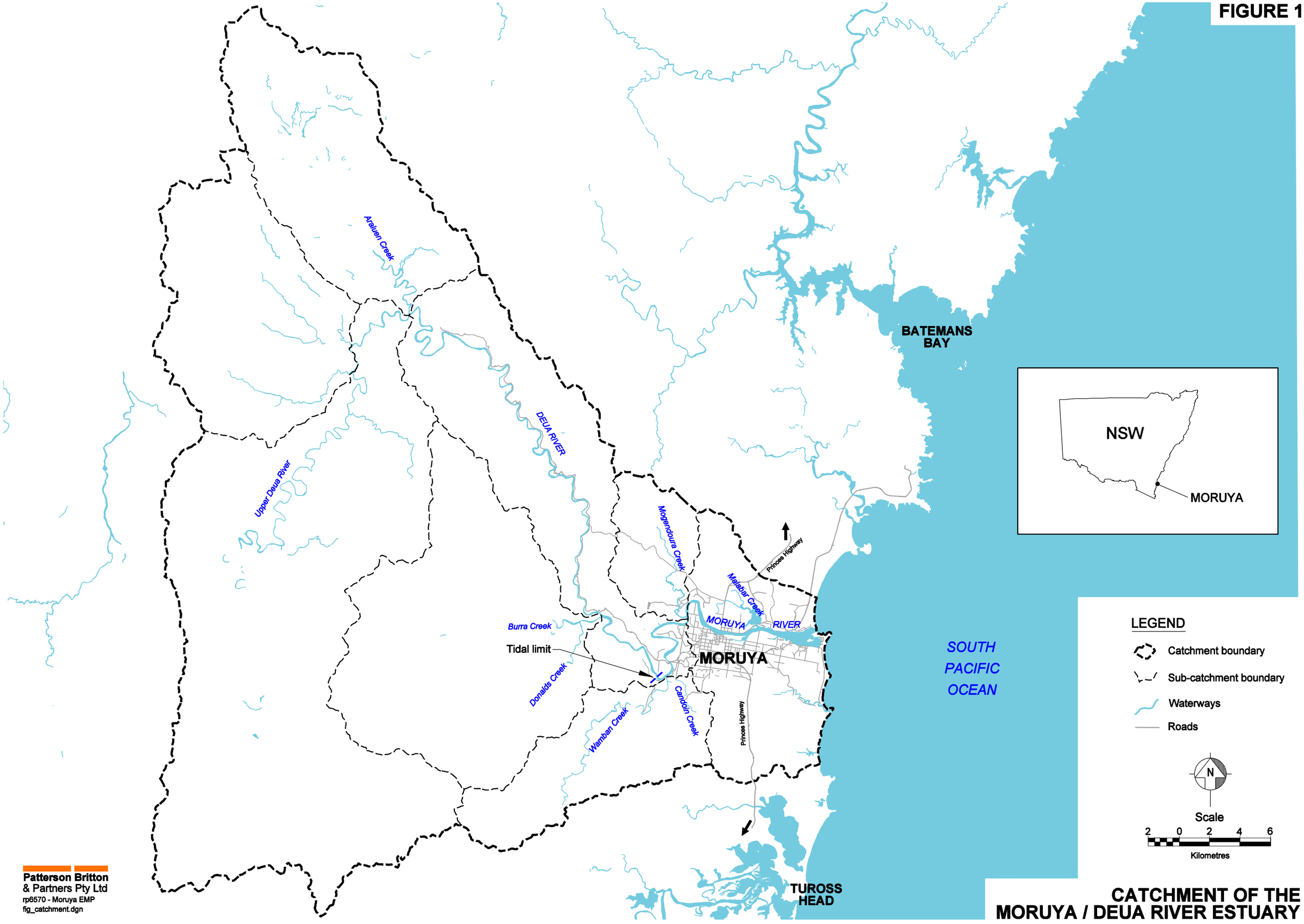
The estuary drains a total catchment area of about 1,550 km^2, which extends up to 50 km inland. The catchment comprises 60% rugged mountains, 30% undulating hills, and 10% flat coastal plains (*Eurobodalla Shire Council, 2000*). A majority of the catchment is forested. The land immediately surrounding the estuary has been cleared for agriculture, which includes dairy and beef production.

The catchment is also partly developed, including the township of Moruya, which is situated at the Princes Highway crossing of Moruya River, approximately 7 km upstream from the estuary entrance. The sewage treatment plant for the town discharges treated effluent to Ryans Creek, which feeds into Moruya River approximately 1.6 km downstream from the Princes Highway Bridge.

Industrial development within the catchment is limited to the North Moruya Industrial Estate located adjacent to the Princes Highway roughly 3 km north of Moruya and also the Yarragee Industrial Estate which is located to the south-west of Moruya. The North Moruya industrial area drains to Malabar Lagoon, which comprises significant areas of wetland and valuable saltmarsh community.

Several wetland areas exist adjacent to both banks of the estuary. The estuary also contains large areas of seagrass beds and supports a valuable fish nursery. A section of Eurobodalla National Park occupies the headland to the south of the estuary entrance. Quondolo Island, situated within the Pilot Station Backwater, is also included in the National Park. The National Park is considered to offer important habitat for waterbirds and threatened native animals.

FIGURE 1



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rp6570 - Moruya EMP
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CATCHMENT OF THE MORUYA / DEUA RIVER ESTUARY

The Eurobodalla area also has significant Aboriginal and European cultural sites, several of which are located along Moruya River, including the Glenduart Cemetery, Quarry Wharf and the Pilot Station at South Head.

Sedimentation within the estuary is an important management issue. Past land clearing and gold mining activities in the upstream catchment are considered to be significant sources of sediment that is found in the lower estuary.

During the past 100 years, significant rock protection works have been implemented downstream from the Princes Highway bridge for the purpose of stabilising the river banks and the river channel. These works are testament to the important role that shipping played in the original settlement of the region surrounding Moruya River

The estuary is also used for recreation. Recreational fishing and boating (*both motorised and non-motorised*) are the major pursuits undertaken within the estuary. Formal boat access to Moruya River is available from the public boat launching ramps at Moruya, Preddys Wharf and North Head. As Moruya is a popular tourist destination, boating and recreational fishing activities tend to be concentrated during school holiday periods. This concentration of boating activity can result in conflict between residents and visitors due to boat traffic and the impact of boat generated wake. At these times, there is also conflict between recreational fishers and commercial fishers.

In 1998, the National Land and Water Resources Audit updated the classification of the Moruya River estuary from '*near pristine*' to '*modified*' (*Eurobodalla Shire Council, 2003c*). The re-classification accounts for the potential impacts of rural and urban land use in the catchment, the extensive training walls throughout the lower estuary, and changes to flow regimes on the floodplain, including barrages. It is likely that the change in classification reflects an increased knowledge of the estuary in recent years, rather than the impact of any recent modifications to the catchment and waterway.

1.2 THE ESTUARY MANAGEMENT PROCESS

In 1992, the NSW State Government introduced an *Estuary Management Policy* which was aimed at managing the growing pressures on estuarine ecosystems. The policy forms part of a suite of catchment management policies, which have been combined under the *Catchment Management Act, 1989*.

The *Estuary Management Policy* is a component of the *NSW Rivers and Estuaries Policy,* which in turn comes under the umbrella of Total Catchment Management. The general goal of the *Estuary Management Policy* is to achieve an integrated, balanced, responsible and ecologically sustainable use of the State's estuaries, which form a key component of coastal catchments.

The *Estuary Management Policy* provides for the assessment of all estuarine uses, the resolution of conflicts, and the production of a unified and sustainable management plan for each estuary (*NSW Government, 1992*). The *Estuary Management Policy* is implemented on individual estuaries through a process which involves the establishment of an Estuary Management Committee. This Committee is responsible for carrying out the steps in this process. The process is shown in **Figure 2**.

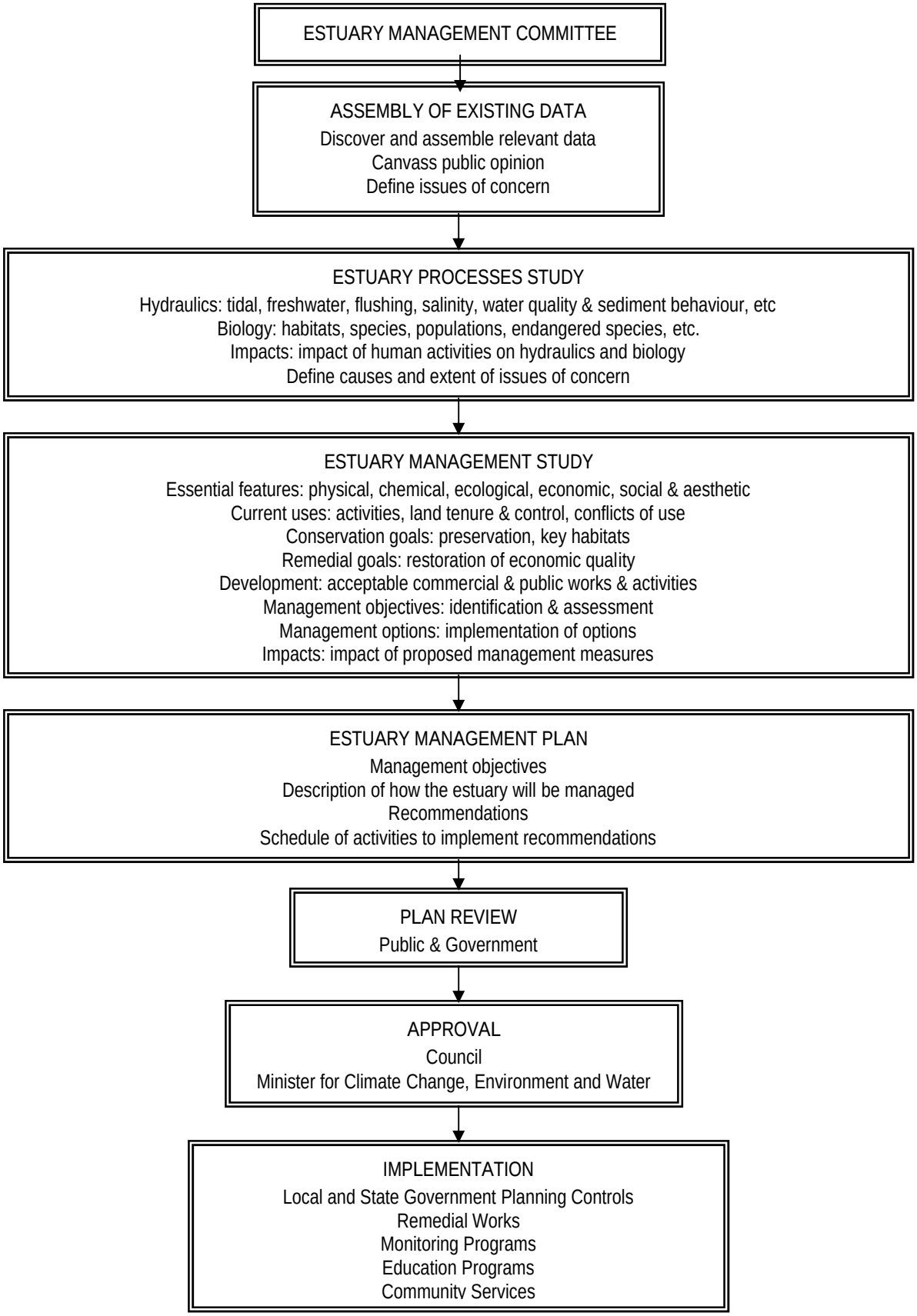

FIGURE 2 ESTUARY MANAGEMENT PROCESS

(Source: 'Estuary Management Manual', NSW Government (1992))

In February 2003, amendments to the *Coastal Protection Act 1979* came into affect. One of the significant amendments related to the preparation of Coastal Zone Management Plans, which include Estuary Management Plans. A new requirement is that plans now need to be referred to the Minister for Climate Change, Environment and Water for approval and once approved these plans must also be gazetted.

The Committee is responsible for the development of an Estuary Processes Study, which outlines all the hydraulic, sedimentation, water quality and ecological processes within the estuary, and the impacts of human activities on these processes. The Estuary Processes Study provides the necessary understanding of the physical and biological processes within an estuary, to enable informed decision-making in the resolution of conflicts and planning for the future development. These issues are usually addressed in detail in the next step in the process, which comprises the preparation of an Estuary Management Study.

The Estuary Management Study identifies the essential features and the current uses of the estuary, and determines the overall objectives required for management of the estuary. The Management Study also identifies options for meeting these objectives, and determines hydraulic and ecological impacts of the proposed options.

From the findings of the Management Study, an Estuary Management Plan is prepared. The Plan describes how the estuary will be managed, gives recommended solutions to management problems, and details a schedule of activities for the implementation of the recommendations. Once the Plan has been accepted by both the community and the relevant Government Departments, the Plan can be implemented through planning controls, works programs, monitoring programs, and education services.

This report documents the findings of an Estuary Management Study of the Moruya / Deua River estuary system. Through assessment of the current uses and features of the estuary, objectives for management of the estuary have been determined. From these findings, management options have been identified and then assessed in terms of meeting the objectives and their impact on natural processes within the estuary.

1.3 APPLICATION OF THE ESTUARY MANAGEMENT PROCESS

The *Estuary Management Policy* is implemented on individual estuaries through a process which involves the establishment of an Estuary Management Committee. The Moruya / Deua River Estuary Management Committee was formed in April 1999 to assist Eurobodalla Shire Council in achieving integrated, balanced, responsible and ecologically sustainable use of the Moruya / Deua River Estuary. The Committee's objectives are to:

- Conserve aquatic and other wildlife habitats, ecosystems and biotic communities in and fringing the river and wetlands;
- Conserve the aesthetic values of rivers and wetlands;
- Prevent further estuarine and foreshore degradation;
- Protect and restore estuarine and foreshore environments;
- Maintain and improve the water quality of the estuary and its tributaries; and,

- promote the sustainable use of estuarine resources, including commercial and recreational uses (*ESC, 2006d*).

The Committee consists of representatives from Council, state government authorities, and the local community. The charter of the Committee is to identify the main issues affecting the river and its tributaries and then to proceed with preparation of an Estuary Management Plan to address identified problems or issues.

1.3.1 Completed Stages of the Estuary Management Process

As the first step in the estuary management process, the *Moruya River Estuary Data Compilation* report was prepared for the Estuary Management Committee. This report was completed by the Applied Ecology Research Group at the University of Canberra in July 2000.

The report summarised the key estuary management issues and the available information, data and results of previous investigations that would aid in developing strategies to address these issues. The report also included recommendations regarding future investigations and additional data acquisition to 'fill-in' the gaps in the data that had been collected.

The findings of the Data Compilation Study (*2000*) were used as a base from which to develop the Moruya / Deua Estuary Processes Study. The Estuary Processes Study was prepared by AMOG Consulting in November 2003.

The study included:

- investigation into the estuary's physical and chemical processes, including sediment transport and water quality;
- detailed modelling of estuary hydrodynamics applied to water quality, estuary flushing and sediment transport modelling;
- identification and details of bank erosion sites within the estuary and suggested methods for bank remediation;
- reference to human usage and impacts; and,
- water quality parameters and their levels necessary to achieve acceptable water quality (*ESC, 2003c*).

This information can be used to support decisions on how to manage the estuary, and how to respond to issues that may confront the future sustainability of the estuary as a conservation area, tourist destination and place for rural and urban living.

It should be noted that the Estuary Processes Study did not contain significant information regarding the biological and ecological processes of the estuary, such as the condition of aquatic habitats and fish stocks. However, this is likely reflective of the lack of available data related to biological processes.

1.3.2 Estuary Management Study and Plan

In October 2006, Patterson Britton & Partners was engaged by Eurobodalla Shire Council to prepare an Estuary Management Study and Estuary Management Plan in accordance with the estuary management process.

As discussed, the aim of this phase of the estuary management process is to undertake appropriate consultation with the community and key stakeholders and to carry out investigations that will enable Council to adopt a Management Plan for the estuary. The Plan is to be based on the outcomes of the Estuary Management Study, which identifies and prioritises objectives and options for the future management of the estuary. The Plan is to provide a scheduled sequence of recommended activities that can be implemented over three, five and ten year timeframes.

This report documents the findings of investigations and consultation undertaken for the Estuary Management Study.

1.4 METHODOLOGY

The objective of the Management Study is to determine specific management measures that could be implemented as part of the Management Plan to address the range of human impacts that have been identified in the *'Moruya / Deua Estuarine Processes Study'* (*ESC, 2003c*) and the *'Moruya River Estuary Data Compilation'* (*ESC, 2000*).

In addition, the Management Study identifies measures to maintain or improve the value of the estuary where estuary conditions are considered to be good. The potential benefits of suggested management measures have been determined to assist in prioritisation during development of the Management Plan.

The general methodology adopted to complete the study involved the following tasks:

- identification of essential features of the estuary;
- identification of the significance of the estuary in terms of the broader urban planning issues;
- identification of issues or conflicts within the estuary;
- assessment of the potential impacts of these issues on estuary condition;
- identification of possible future land-uses in the estuary and assessment of these in the context of their potential future impact on estuarine processes and general estuary condition;
- an assessment of the need for nature conservation and remedial measures;
- identification and assessment of management objectives;
- identification of planning controls, works and other strategies to achieve these objectives;
- identification and justification of additional investigations or works that would need to be undertaken to resolve outstanding issues;
- identification of measures and strategies that could be implemented to resolve conflicts and reduce the impact of human activities;
- development of a set of actions required to undertake each of the recommended strategies; and,
- assessment of the effectiveness of management strategies.

2 COMMUNITY CONSULTATION

2.1 CONSULTATION PROGRAM

In order to develop a successful Management Plan for the estuary, it is essential that key stakeholders and the broader community have an opportunity to participate in the process leading to development of the Plan. Successful community consultation ensures that all management issues are identified and assessed, and that the full range of potential management options is considered.

In recognition of the importance of engaging the community, an extensive consultation program was developed. The primary aim of the consultation program was to ensure that all issues that could confront the future management of the estuary were identified.

The consultation process was extended to extract views and ideas on appropriate measures for estuary management. It also involved the identification of the major attributes of the estuary and an assessment of these to determine which attributes are essential to maintaining or improving estuary processes. The program of consultation involved the following:

- Consultation with key stakeholders and community groups including government organisations and individuals.
- Participation in site inspections with members of the Estuary Management Committee, aimed at identifying areas of the estuary in need of rehabilitation or further study.
- Workshops with the Estuary Management Committee which aimed:
  - to reaffirm the key issues identified in the *Moruya / Deua Estuary Processes Study*, and from site inspections;
  - to identify essential features and attributes of the estuary;
  - to rank the key issues confronting the estuary and to assign a value to the attributes and essential features of different sections of the estuary;
  - to identify, confirm and rank an acceptable series of management objectives;
  - to identify potential strategies and works that would enable better management of the estuary; and,
  - to resolve actions and timing for the implementation of agreed strategies (*to be incorporated in the Estuary Management Plan*).

2.1.1 Committee Workshop #1

An initial workshop was held with the Committee at the offices of Eurobodalla Shire Council on Thursday 9th November 2006. The primary purpose of the workshop was to ensure that the key issues established through completion of the *Moruya / Deua River Estuary Processes Study (ESC, 2003c)* reflected the current concerns of the community. The workshop was also used as a venue for determining the essential features of the estuary, or those features considered to be most significant and worthy of actions to ensure they are protected and where possible, enhanced.

Proformas requesting feedback on these aspects of the Estuary Management Study were distributed to attendees for their consideration and submission of responses on the relative ranking of key issues and the value of estuary attributes.

Committee Workshop #1 was followed by site inspections with the Committee the next day, during which the estuary was toured by boat between the river entrance and Yarragee.

2.1.2 Committee Workshop #2

A second workshop was held with members of the Moruya / Deua River Estuary Management Committee at the Eurobodalla Shire Council offices on 14th February 2007. The purpose of this workshop was to discuss the outcomes of Committee Workshop #1 (*including a review of the responses to subsequent submissions in the form of completed proformas*), and to establish an agreed list of management objectives and management strategies for the Moruya / Deua River Estuary.

The Committee Workshop was well attended and led to the adoption of set of management objectives for the estuary. These are presented in **Table 6** in **Section 6.1** of this report.

A list of provisional management strategies and works was provided to the Committee for comment. Their feedback was requested to enable the development of a refined list of management strategies for inclusion in the Estuary Management Study and Plan.

2.1.3 Community 'Drop-in Centre'

On the 26th April 2007 a community 'Drop-in Centre' was convened at the Moruya RSL Hall. The primary aim of the centre was to present a range of potential strategies for management of the Moruya River to the community and gather their feedback. The potential strategies were presented on a poster display and also provided within an information brochure and questionnaire that was distributed to attendees. The brochure was later 'uploaded' to Council's website to allow access by the wider community. Refer to **Appendix C** for a copy of the brochure provided on Council's website.

Roughly a dozen members of the local community attended the drop-in centre. Several attendees made comment on particular issues, in addition to providing their views on the potential management strategies. Notes were taken to record the issues raised during discussions.

A number of written submissions were also received from the community following the drop-in centre regarding various estuary management issues. The submissions included detailed letters, several photographs and also a petition that had previously been provided to Council. Phone calls and emails were also received from community members.

2.1.4 Committee Workshop #3

On 27th April 2007 a third workshop was held with members of the Moruya / Deua River Estuary Management Committee. The purpose of this workshop was to discuss the outcomes of community consultation at the drop-in centre and how they may affect the refined list of strategies for estuary management.

Assessment of a refined list of estuary management strategies was also discussed, prior to establishing a clear outline for the future direction of investigations to prepare the Estuary Management Study report and Estuary Management Plan.

2.1.5 Consultation with Key Stakeholders

The following consultation with key stakeholders was undertaken in the development of the Estuary Management Study report:

- Susan Dale Donaldson from Environmental & Cultural Services was engaged as the cultural heritage consultant for the project. Mrs Donaldson's work included extensive liaison with the Local Aboriginal Land Councils (*LALCs*) of Mogo and Cobowra which cover the areas to the north and to the south of Moruya River, respectively.
- Direct contact was made with the Environment Team at Eurobodalla Shire Council (*pers comm. Norm Lenehan*) to discuss existing initiatives that are in place to address estuary management issues such as riparian vegetation management and rehabilitation.
- Contact was made with Council officers, Royce Toohey and Harvey Lane in regard to various shire-wide development control policies and management plans and strategies.
- Discussions were held with Trevor Daly, the Committee representative from NSW Fisheries (*Department of Primary Industries*), in relation to existing and potential initiatives for management of aquatic fauna and flora.
- Discussions were held with NSW Maritime (*pers comm. Rob Moldovan*) to discuss potential waterway usage conflicts and the potential for development of a Boating Management Plan for Moruya River.
- Discussions were held with members of an informal Landcare group at Glenduart regarding the future management of riparian vegetation and bank erosion in the vicinity of Glenduart Riverside Reserve.
- Discussions were held with representatives from the Southern Rivers Catchment Management Authority (*SRCMA*) regarding the potential for establishment of an Ecosystem Health Monitoring Program for the Southern Rivers region.

3 SIGNIFICANCE OF THE ESTUARY

3.1 ESTUARY SIGNIFICANCE

The main landscape components of the Moruya / Deua River Estuary are common to other coastal locations of NSW. As with many estuaries in NSW, the Moruya River has an open entrance with training walls and twin breakwaters.

However, the landscapes of the Moruya / Deua River estuary are visually unique. Situated in the heart of the *Eurobodalla nature coast*, a variety of sceneries are offered by the Moruya / Deua River catchment, including steep mountain landforms, ridges and valleys and forested coastal plain.

Furthermore, the ecological value of the estuary is quite significant. The Moruya River falls within the Batemans Marine Park, which includes the Malabar Lagoon Sanctuary Zone. There are significant areas of wetlands protected under *State Environmental Planning Policy No.14 – Coastal Wetlands* (*SEPP14*) along Malabar Creek, Ryans Creek and Mogendoura Creek and along the lower Moruya River (*refer* **Figure 3** *and* **Figure 4**). The estuary is also lined by significant areas of saltmarsh communities and mangroves.

The report, *'Flora and Fauna of the Moruya Estuary'* (*ESC, 2005a*) identified that the Moruya River Estuary Saltmarshes are listed as of national importance. The listing includes areas within Malabar Lagoon, The Anchorage, Ryans Creek, Gilmores Creek and the Pilot Station Backwater (*refer* **Figure 3** *and* **Figure 4**). The study area contains examples of two separate types of Endangered Ecological Communities (*EECs*), as listed in the Threatened Species Conservation Act (*1995*). These are Forest Ecosystem 186 – Mudflats / Saltmarshes and Forest Ecosystem 25 – South Coast Swamp Forest Complex.

The Moruya / Deua River catchment also includes the Deua National Park in the upper catchment and Eurobodalla National Park that fringes the south side of the Moruya River entrance and Quondolo Island.

The historical township of Moruya is situated on the south shore of the Moruya River at the crossing of the Princes Highway. Tourists can explore the town's past on a guided bus tour. The historical significance of the town is compounded by its importance as the 'administrative centre' of the Eurobodalla Shire. Although being smaller than Batemans Bay and Narooma, Moruya is placed near the geographical centre of the shire, making it a suitable location for Council's offices and public institutions such as the Moruya College of TAFE (*Eurobodalla Tourist Information Centre, 2007*).

Moruya attracts tourists and locals to regular activities such as the weekend country markets and special events such as the Moruya Rodeo and the popular annual Jazz Festival. Boat charters and hire boats, based at the Moruya Boatshed, are also popular attractions for tourists. Moruya Heads (*or South Head*) is another population centre located on the foreshore of the Moruya River, approximately 7 kilometres east of Moruya near the estuary entrance.

FIGURE 3

To Batemans Bay

To Broulee

Malabar Creek

Dooga Creek

Princes Highway

North Beach

SOUTH PACIFIC OCEAN

Malabar Lagoon and Creek
- valuable salt marsh community
- habitat for wildlife
- fishery
- modified entrance

Malabar Lagoon

Trawling prohibited in estuary.
Currently 3 to 4 'Hauling' operators.
Significant seafood supply to local market and Sydney.

George Bass Drive

Water skiing activities based from shore

Quarry Wharf
- popular recreational fishing spot
- historic and culture value

Moruya Aerodrome

North Head camping ground

River Breeze Caravan Park

Existing foreshore management works to prevent vehicle access

Quarry Wharf

GARLANDTOWN

Brierley's Boat Ramp (overflow ramp)

Surfing

Moruya Boat Shed

North Head Drive

MORUYA RIVER

Surfing

Rock walls installed as a Floodplain Management measure

Clear, blue, pristine water throughout lower estuary

The Anchorage

Quondolo Island

Ryans Creek

STP

Moruya STP

Preddys Wharf

Pilot Station Backwater

MORUYA HEADS

Surfing

Racecourse Creek

Significant stands of seagrasses

Gilmores Creek

MORUYA

Primary boat ramp at Preddys Wharf
- access to offshore recreational fishing

Newstead Pond

South Head Road

LEGEND

- National Park
- SEPP 14 Wetlands
- Rock training wall
- Rock wall
- Submerged sandbar
- Mangroves
- Seagrasses
- Saltmarshes
- Boat ramp
- Picnic area
- Commercial fishing
- Recreational fishing
- Swimming
- Boat moorings
- Caravan park / camping
- Oyster farming
- Sewage treatment plant
- Recreational boating / water skiing

N

Scale

200 0 200 400 600

Metres

Princes Highway

To Narooma

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SIGNIFICANT ESTUARY FEATURES - LOWER ESTUARY

FIGURE 4

LEGEND

- SEPP 14 Wetlands
- Rock wall
- Submerged sandbar / beach
- Seagrasses
- Saltmarshes
- Boat ramp
- Picnic area
- Swimming
- Caravan park
- Recreational boating / water skiing

GLENDUART

Mogendoura Creek

Larrys Mountain Road

To Batemans Bay

Princes Highway

Powerboat berthing and water skiing launch areas

Glenduart Cemetery - cultural significance

Granite outcrops along base of bank

Reinstated riparian vegetation - limited coverage

Crown lease area

Major shoal - recently reduced

Minimal powerboat activity upstream from confluence with Mogendoura Creek

Natural beach - popular recreation spot for locals

Stable river bank - well vegetated and steep

MORUYA RIVER

Bank stabilisation using logs and revegetation

Concentrated area of seagrasses

Natural embankment of bedrock and vegetation

River Breeze Caravan Park

Moruya Boat Shed

Yarragee Reserve

YARRAGEE

River Street

Shore Street

Hawdon Street

Campbell Street

Murray Street

MORUYA

Luck Street

Kiora Bridge (1km)
Wamban Creek (2km)
Tidal limit (4km)

N

Scale

100 0 100 200 300 400 500

Metres

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rp6570 - Moruya EMP

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SIGNIFICANT ESTUARY FEATURES - UPPER ESTUARY

The *'Moruya / Deua Estuary Processes Study'* (*ESC, 2003c*) identified a range of significant aspects of the primary estuary processes of the estuary. It also identified numerous features of the estuary and adjoining lands that are important to the community and users.

3.2 ESSENTIAL FEATURES OF THE ESTUARY

Prior to considering management measures for an estuary, it is beneficial to assess those aspects that are significant or essential features. These comprise features which, until threatened, can be taken for granted. Therefore, it is appropriate to identify them so that measures can be implemented to prevent their degradation or the realisation of potential threats. In this way, management of the estuary can be preventative rather than purely reactive, and thereby minimise potential future expenditure to rectify problems that could adversely impact on the primary estuarine processes.

3.2.1 Assessment of Value of Estuary Attributes

The "essential features" of an estuary are those which make the estuary important in a local, regional or national sense. Based on work completed in preparing the *'Moruya / Deua Estuary Processes Study' (ESC, 2003c),* it was possible to develop a provisional list of estuary features that can be considered as being of value to the estuary. A list of features was developed for each of the following categories of estuary attributes:

- Aesthetic attributes;
- Ecological attributes;
- Social attributes; and,
- Economic attributes.

Proformas were prepared listing the special features for each of the above categories of estuary attributes. Prior to Committee Workshop #1, members of the Moruya / Deua River Estuary Management Committee were asked to complete these proformas by attaching a value of between 1 and 10 to each feature of significance in both a regional and local context. The following value scoring was applied:

- 8-10 An attribute of very high to extremely high value due to its rarity in the state and local area. Considered to be essential to the functioning of the estuary and important to continued estuary activities (***both in a productive sense and in terms of protection***)
- 7-8 An attribute of high value, but which is encountered elsewhere and which may be significant to the functioning of the estuary.
- 5-7 An attribute of moderate value that is commonly found within the estuary, and which although beneficial, is not essential to the functioning of the estuary.
- 1-5 An attribute of low value that may be construed as not necessarily being an essential feature to the estuary.

Significant features of the estuary were also discussed in detail during site inspections with the Estuary Management Committee following Committee Workshop #1.

Based on the discussions with the Committee and the scores provided in the completed proformas received from Committee members, a ranked list of the essential features and attributes of the estuary was developed. Respondents to the proformas also highlighted a range of additional attributes that were considered for inclusion in the final list of ranked attributes.

The attributes have been ranked in order of their local significance. This ranking was generally in accordance with the views voiced by the Committee at Workshop #1, and also with comments received by the general community during the Community 'Drop-in' Centre.

Based on this assessment, the most important essential features of the estuary were determined to be, in order of ranking:

Ecological Attributes

1. Saltmarsh / sedges / rushes
2. Breeding grounds for waterbirds / shorebirds
3. Large areas of SEPP 14 wetlands
4. Coastal swamps
5. Threatened shorebirds / waterbirds
6. National Parks and reserves
7. Terrestrial fauna
8. Riparian vegetation / corridors
9. Aquatic fauna
10. Seagrass beds
11. Mangroves
12. Clean, clear water

Aesthetic Attributes

1. Large areas of wetland
2. Coastal plains
3. Forests
4. Ridges and valleys
5. Mangrove stands
6. Steep mountain landforms
7. Saltmarshes
8. Dunes
9. Beaches
10. Clean, clear water
11. Intertidal shoals
12. Areas of wide open waterway
13. Permanent trained entrance
14. Oyster industry infrastructure

Social Attributes

1. Swimming / snorkelling
2. Picnicking and foreshore access
3. Rowing, kayaking and canoeing
4. Quiet, rural lifestyle
5. Cultural heritage sites
6. Recreational fishing
7. Recreational power-boating and water-skiing
8. Surfing
9. Boat cruises
10. Wharves and jetties
11. Boat launching ramps
12. Camping and caravan parks
13. Sailboarding

Economic Attributes

1. Fertile floodplains
2. Oyster / aquaculture industry
3. Dairy industry
4. Tourism
5. Industry
6. Beef production
7. Commercial boating – cruises and hire boats
8. Commercial fishing
9. Permanent trained entrance

Ecological, aesthetic and some social attributes are highly valued while economic attributes were generally assigned a lower value. This reflects the predominantly natural characteristics of the estuary catchment and the importance placed by the community on the estuary being considered to be valued from an ecological perspective on both a local and regional level.

The significant features of the Moruya / Deua River estuary are shown graphically (*where applicable*) in **Figures 3** and **4**.

3.2.2 Essential Features

The essential estuary features are those that are considered to be regionally or locally significant. Based on the value assessment undertaken as part of the consultation with the Committee and the wider community, the essential features of the estuary can be considered to include:

- Wetland areas and saltmarsh communities, particularly as habitat for endangered fauna;
- Opportunities for recreational kayaking, rowing and fishing;
- Rural vistas with a scenic mountain backdrop;
- Passive recreational activities such as foreshore picnicking and camping;
- Significant historical and cultural heritage sites;
- Clean, clear water; and,
- Tourist attractions, such as the Moruya Rodeo and the annual Jazz Festival.

4 KEY ISSUES, CONFLICTS AND CONCERNS

4.1 KEY ESTUARY MANAGEMENT ISSUES

The identification of the key issues confronting the future management of the estuary is an essential step in developing the Estuary Management Plan.

4.1.1 Previous Assessment of Key Issues

An initial list of key issues was identified in 2000 as part of work completed for the *'Moruya River Estuary Data Compilation Study'* (*Eurobodalla Shire Council, 2000*).

Additional key issues were identified based on information contained in relevant background documentation that was researched in the early stages of this project and in the minutes of previous meetings of the Estuary Management Committee. They are summarised in **Table 1**.

Table 1 PREVIOUSLY IDENTIFIED KEY ISSUES

WATER QUALITY	– Nutrients and the potential for algal blooms
	– Turbidity in the lower estuary
	– Organic matter with high oxygen demand
	– Potential for Acid Sulphate Soil disturbance and drainage of acid to the estuary
	– Tidal exchange
	– Rural / agricultural runoff
	– Boating
	– Urban runoff / stormwater pollution
	– Moruya Sewage Treatment Plant effluent
	– Potential for faecal contamination
	– Restricted mixing in the upper estuary
RIVER BANK EROSION	– Loss of riparian vegetation
	– Land clearing
	– Cattle grazing and livestock
	– Damage by powerboat wake
	– Bank undercutting
	– Wind waves
	– Estuary banks naturally susceptible to erosion
	– Slumping of rock walls in the lower estuary
	– Current scour
ENTRANCE CONDITIONS	– Entrance shoaling
	– Major floods scour the entrance and along rock wall at Pilot Station Backwater
	– Navigability

SEDIMENTATION	– Remobilisation & deposition of existing bed sediments
	– Constant sediment build-up since 1940 at Pilot Station Backwater
	– Natural build-up of marine sands in lower estuary entrance areas
	– Impact of alluvial gold mining in the past
	– Sand and gravel extraction
	– Urbanisation
	– Formation of islands and diversion channels in the upper estuary
	– Impact on navigation
THE FISHERY	– Recreational fishing Vs commercial fishing
	– Impact of commercial fishing on fish stocks
	– Health and productivity of oyster farming
	– Impact of sediment load and faecal coliforms on oysters in the lower estuary
	– Fish productivity
ACCESS TO WATERWAY	– Boat launching facilities with satisfactory parking areas
	– Foreshore access to amenities, beaches, picnic areas etc.
NATURE CONSERVATION	– Preservation of estuarine foreshore, indigenous and riparian habitats
	– Loss of seagrass due to sedimentation
	– Preservation of mangrove, reed and seagrass strips
CULTURAL VALUES	– Aboriginal heritage sites
	– European heritage sites
WATERWAY USAGE	– Conflicts between users, e.g. oyster farming Vs boating
	– Swimmers Vs boaters
	– Impact of boating activity in the upper estuary
DEVELOPMENT CONTROLS	– Estuary foreshores
	– Coastal urbanisation
	– Provision of public space

4.1.2 Committee Response to Potential Key Issues

The key issues identified and listed in **Table 1** were provided on the proformas that were distributed to members of the Estuary Management Committee prior to Committee Workshop #1. The issues were also presented to the Committee at the workshop. The relative importance of each key issue was workshopped to develop a ranking of the relative importance as viewed by those in attendance.

The outcomes for the committee workshop included a provisional list of ranked issues for future management of Moruya / Deua River estuary. The site inspections that followed Workshop #1 also provided opportunity for members of the Committee to identify existing concerns regarding the environmental or physical condition of the estuary and its attributes.

It should be noted that a limited number of responses were received to the proformas prepared for the workshop.

Notwithstanding, a comparison was made between the rankings derived from Committee Workshop #1 and those determined from processing the individual responses. The comparison showed the following:

- The issue of "Development Controls" was ranked higher in the workshop rankings than in the individual rankings. This is likely attributable to the fact that the importance of development controls was discussed in detail during Workshop #1 with reference to examples of estuary degradation that is potentially related to the disregard of development controls.
- The issue of "Water Quality" ranked highly within the individual responses, but during the workshop the general view was that the existing water quality of Moruya River and its tributaries is relatively good, especially in comparison with other estuaries. Therefore, the issue of water quality was considered to be less important by the Committee as a group.
- "Bank erosion" issues were ranked highly in both instances. However, damage to existing rock protection works and the cost of regular maintenance was the focus of discussions at the Committee workshop.
- The issue of "Sedimentation" was ranked low in discussion with the Committee at Workshop #1. However the issue was ranked high according to the individual responses received. It is understood that the Committee's view was based on the fact that bank erosion problems are seen to be a major source of sediment and therefore the issue of sedimentation can be addressed primarily through management of bank erosion.
- Cultural heritage issues ranked lower than most issues on both occasions, which can be considered contrary to the value placed on cultural heritage sites during discussion of the estuary attributes. This is likely attributable to a variety of factors, including the fact that knowledge of cultural sites is generally lacking within the community, and also because estuary processes are not typically considered to be linked with cultural sites.
- "Waterway usage" issues ranked low in both instances. The general view of Committee members was that recreational access to the foreshore is adequate and waterway usage conflicts are minimal.
- The loss of and protection / rehabilitation of "riparian vegetation" was ranked high in both the individual rankings and the Workshop rankings.
- Productivity of the fishery in Moruya River and understanding the link between fish stocks and aquatic habitats was ranked relatively high also.
- The Committee identified *emergency management* during severe bank erosion events as a key management issue. Emergencies of this nature are to be addressed through existing arrangements between Council and the State Emergency Service and any further procedures that are developed by the SES in the future.

During the second committee workshop held in February 2007, the Committee requested that the ranking of key issues be discussed further and then revised according to additional consideration that was had by members of the Committee since Workshop #1.

As a result, increased importance was placed on uncontrolled stock access to waterways in the upper reaches of the estuary. This decision was related more to preserving the quality

of the town's drinking water supply upstream from the water pumping station, rather than erosion or sedimentation issues associated with stock access to the foreshore.

Also based on discussions at Committee Workshop #2, less importance was placed on the impact of waterway usage on the wildlife habitat. This issue was raised during the initial committee workshop as a major issue, but the consensus of the Committee was that it should be ranked lower than originally determined.

The issue of climate change and the associated impacts for the Moruya River estuary were also identified during consultation with the Committee. Representatives from the recently formed Department of Environment and Climate Change (*DECC*) provided input on the potential mechanisms through which climate change can impact on the estuary, such as sea level rise, changes to catchment hydrology and storm intensity.

4.1.3 Community Concerns

As discussed above, a Community "Drop-in Centre" was convened at the Moruya RSL Hall on 26th April 2007. The event provided a forum for the local community to present their views on the potential management strategies for the estuary and also to voice any additional concerns that they believe confront the future management of the estuary.

Feedback from the drop-in centre identified certain key issues that the importance of which had been underestimated during previous discussions with the Estuary Management Committee. Issues that had not been previously been identified by the Committee were also discussed. Additional submissions were received following the drop-in centre.

The concerns of the general community include the following:

§ Bank Erosion	- Upstream from the Princes Highway bridge - In the vicinity of Glenduart Riverside Reserve - Natural banks (*not protected by rock works*)
§ Conflicts of Use	- Between water-skiers and residents (*particularly at Glenduart*) - Between water-skiers and recreational fishers and canoers / kayakers - Management of riparian vegetation (*particularly in the vicinity of Glenduart*)
§ Recreational Use	- Estuary not being used to full potential as a stop-over for recreational boaters travelling along the coast
§ Community Education and Involvement	- Lack of understanding of estuary processes and impact of catchment based activities on estuarine health - Lack of 'ownership' of the estuary by the community due to lack of education
§ Fish Stocks	- Impact of commercial fishing on fish stocks for recreational fishing

4.1.4 Adopted Key Issues

The adopted key issues are based on the consensus ranking of the key issues during discussions at Committee Workshop #1 and Committee Workshop #2, the individual responses to the proformas prepared for Workshop #1 and the public response to the Community Drop-in Centre.

The adopted key issues for management of the Moruya / Deua River Estuary, in order of rank, are listed in **Table 2**.

The issue of "water quality" is not ranked highly in **Table 2**. As discussed above, the water quality of Moruya River and its tributaries is considered to be relatively good. The sub-issues listed for water quality in **Table 2** are not major issues, but they do pose a potential risk to water quality.

Furthermore, it should be noted that several issues listed within **Table 2** are directly related to water quality. For example, if the issue of riverbank erosion is addressed, then this naturally results in benefit to the water quality of the estuary in terms of reduced sediment load that is discharged to the waterway.

A summary of the key management issues is shown graphically in **Figure 5** and **Figure 6**.

The issue of "climate change" has not been ranked in **Table 2**. Although the issue is important for future management of the estuary, the potential impacts on the Moruya River estuary and its natural processes have not previously been studied and therefore require further investigation.

Furthermore, the issue of climate change can be indirectly related to almost all of the issues identified in **Table 2** and therefore should be treated as an overriding management issue to be considered when determining actions to address the other issues. For example, the currently predicted rise in sea level as a result of climate change is likely to impact on the rate and location of bank erosion, the extent of riparian vegetation and foreshore ecosystems, primary productivity, water quality and future development controls.

FIGURE 5

To Batemans Bay

Malabar Creek

Dooga Creek

Uncontrolled stock access leads to damage of salt marsh and wetlands

Sedimentation of Malabar Lagoon
- reduced freshwater and tidal flows
- increased sediment supply

Princes Highway

MULLENDEREE FLAT
- potential Acid Sulfate Soils

Malabar Lagoon

Unused oyster processing shed and wreck of wharf - currently possessed by Department of Lands

Quarry Wharf in need of repair or removal - safety concern for recreational users

To Broulee

George Bass Drive

North Beach

SOUTH PACIFIC OCEAN

Undercutting of rockwall, bank slumping and migration of rock into channel

Bank erosion and damage to riparian vegetation resulting from unrestricted traffic of camping vehicles

Heavy shoaling leading to small breaking waves. Shoaling can block access to Brierley's Boat Ramp.

Damage to walkway on northern training wall - safety hazard

Toe failure, wall instability and rock migration into channel at northern rock wall

Unprotected bank erosion

Quarry Wharf

Increased nipper harvesting on sandbars may lead to reduced invertebrate numbers

Navigation can be hazardous along channel between foreshore and shoals

Moruya Aerodrome
- vegetation management

Moruya Boat Shed

MORUYA RIVER

Potential scouring along Pilots Station Backwater rock wall

Brierley's Boat Ramp

Illegal fish netting between training walls

North Head Drive

Unprotected bank erosion

Bank undercutting and erosion behind southern rock walls leading to collapse and maintenance works

Primary productivity of the estuary not previously studied - links from fish stocks to ecology of benthic communities

The Anchorage

Ryans Creek

Moruya STP

Racecourse Creek

Preddys Wharf

Pilot Station Backwater

Quondolo Island

MORUYA HEADS

Benthic communities potentially affected by sedimentation

MORUYA

Illegal clearing of mangroves to gain access to foreshore - enforcement of development controls and conflict with Rural Fire Service buffer clearing

Gilmores Creek

Newstead Pond

South Head Road

Traffic at Preddys Wharf boat ramp can be heavy during peak season

Constant sediment build-up in Pilot Station Backwater since 1940s

Sewage treatment plant discharges tertiary treated effluent to Ryans Creek - potential for increased nutrient levels and faecal contamination

Uncontrolled stock access leads to damage of saltmarsh and wetlands

Princes Highway

To Narooma

LEGEND

- National Park
- SEPP 14 Wetlands
- Rock training wall
- Rock wall
- Submerged sandbar / shoaling
- River bank erosion site
- Seagrass beds
- Saltmarshes

N

Scale

200 0 200 400 600

Metres

Patterson Britton & Partners Pty Ltd

rp6570 - Moruya EMP

fig-issues1.dgn

KEY ISSUES FOR ESTUARY MANAGEMENT - LOWER ESTUARY

FIGURE 6

LEGEND

- SEPP 14 Wetlands
- Rock wall
- Existing bank stabilisation works
- Submerged sandbar / beach
- River bank erosion site
- Seagrass beds
- Saltmarshes
- Boat launching

Conflict of waterway usage between landholders and recreational boat users at peak holiday times - access to foreshore and boat wake

GLENDUART

Larrys Mountain Road

To Batemans Bay

Stock access to Mogendoura Creek may impact on water quality and bank condition

Mogendoura

Potential for boat berthing and power boating to exacerbate bank erosion

Uncontrolled stock access may lead to damage of salt marsh and wetlands

Riparian vegetation requires enhancement and protection from stock access and estuary users to provide corridors for wildlife movement and preserve estuary health

Creek

Primary productivity of the estuary not previously studied - links from fish stocks to ecology of benthic communities

Access to shoreline by horses - potential bank erosion and soil disturbance

MORUYA

RIVER

Princes Highway

Benthic communities potentially affected by sedimentation

Illegal wharves and jetties constructed along foreshore by landholders

Illegal wharves and jetties constructed along foreshore by landholders

Undermining of existing rock bank stabilisation and erosion behind wall

River Breeze Caravan Park

River Street

Moruya Boat Shed

YARRAGEE

Yarragee Reserve

Shore Street

Hawdon Street

Uncontrolled stock access has the potential to cause bank erosion

Campbell Street

MORUYA

Murray Street

Kiora Bridge (1km)
Wamban Creek (2km)
Tidal limit (4km)

Upstream gravel extraction activities in the past may lead to increased sedimentation

Luck Street

N

Scale

100 0 100 200 300 400 500

Metres

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fig-issues2.dgn

KEY ISSUES FOR ESTUARY MANAGEMENT - UPPER ESTUARY

Table 2 ADOPTED RANKING FOR KEY ISSUES

KEY ISSUES	RANKING
RIVERBANK EROSION – natural bank erosion – damage to bank protection measures	1
DEVELOPMENT CONTROLS – implementation and enforcement of controls – illegal foreshore structures and vegetation clearing	2
LACK OF RIPARIAN VEGETATION – impact on wildlife corridors – unrestricted camping	3
UNCONTROLLED STOCK ACCESS – upper reaches of the catchment and lower estuary – impact on saltmarsh, riparian vegetation, mangroves, EECs and water quality	4
COMMUNITY EDUCATION AND INVOLVEMENT	5
PRIMARY PRODUCTIVITY OF THE ESTUARY – understanding the existing processes and relation to aquatic habitats – impact of commercial and recreational fishing – declining fish stocks – illegal netting – impact of bait collecting on invertebrate species and prey availability to fish, migratory birds and resident wader birds	6
ACCESS TO WATERWAY – foreshore access – unrestricted boat launching – shoaling at existing boat ramps	7
CONFLICTS OF WATERWAY USE – power boating vs passive recreation – riparian land management – impact on wildlife habitat	8
INCREASED SEDIMENTATION – impact on aquatic habitats such as saltmarsh and seagrasses	9
DAMAGE TO CULTURAL HERITAGE SITES	10
WATER QUALITY – potential impact of treated effluent from Moruya Sewage Treatment Plant – potential for Acid Sulphate Soils contamination	11
EMERGENCY MANAGEMENT – Response to major bank erosion events that threaten life or property	12
CLIMATE CHANGE – potential impacts of sea level rise and changes to catchment hydrology	

4.2 CONFLICTS OF ESTUARY USE

The estuary waterways and associated catchment areas are valued for their passive and active recreational uses as well as their ecological and economic value. Due to the variability in the range of these activities there are often conflicts of use on the waterway and within the immediate estuarine catchment.

4.2.1 Waterway Conflicts

Waterway conflicts can occur between parties involved with the following estuary uses:

- power boating vs bank stability (*impact of boat wake*);
- power boating vs passive recreation (*non-motorised craft, fishing, swimming*);
- power boating vs aquatic vegetation (*impacts of boat wake and anchoring*);
- foreshore access vs bank stability;
- foreshore access vs management of riparian vegetation and wildlife habitat;
- foreshore access vs preservation of cultural heritage sites;
- recreational fishing vs commercial fishing; and,
- oyster industry vs estuary aesthetics and estuary user safety (*storage of equipment*).

During holiday periods, the increased number of waterway users can result in overcrowding of the waterway and cause conflicts between users. For example, some tourists that operate power boats can affect other passive recreational users.

4.2.2 Power Boating

Formalised facilities for boat usage are limited to the boat ramps located adjacent Moruya town centre, at Preddys Wharf and near north head (*Brierleys boat ramp*). The demand for quick access to offshore recreational fishing and the impact of shoaling near the entrance to the estuary can lead to congestion at the Preddys Wharf ramp and Brierleys ramp during the peak holiday season.

Bank Erosion

Additional locations are commonly used throughout the lower estuary for launching recreational boats. Informal launching ramps exist at Yarragee Reserve, Glenduart Riverside Reserve, North Head Road at a location approximately 400 metres west of the Malabar Lagoon weir, and within Pilot Station Backwater from South Head Road. Additional access points may exist elsewhere. The identified ramps are either located at natural sections of the foreshore or have been constructed by hand using rocks or other debris. In both cases, the passage of vehicles across the foreshore can lead to increased riverbank erosion in the vicinity of the launching site.

The waves generated by power boat wake are also commonly considered to have an impact on the rate of erosion of natural river banks. In particular, wake-boarding activities have been shown to exacerbate bank erosion. The power boats used for wake-boarding are weighted so that the boat lies low in the water. This produces increased boat wake, which is used by wake-boarders to perform stunts. The resulting increased wave height and power of the boat wake is considered to be responsible for increased bank erosion.

Conflict exists between the residents of Glenduart and the water skiers who base activities from the foreshore at Glenduart. Consultation was undertaken with representatives from both parties involved and the Committee representative from NSW Maritime regarding this issue.

There is a group of about eight local families that regularly use particular stretches of the river for water skiing activities, particularly during school holidays and the warmer months of the year. These activities are predominantly based from Glenduart and from the section of foreshore opposite the Ryans Creek entrance on North Head Road (*refer* **Figure 3**). It is understood that the first preference is to launch boats at the Moruya town ramp and then base water skiing activity between the entrances of Ryans Creek and Malabar Lagoon. However, during times when a strong north-easterly wind blows, the chop created within the lower estuary is not suitable for water skiing. As a result, the water skiing activities are moved upstream and the Glenduart foreshore is used as a base (*refer* **Figure 4**). Although boat launching does not always occur at Glenduart, during peak holiday times several vehicles are driven onto the foreshore reserve (*refer* **Plate 1**).

Plate 1: Vehicles parked at the Glenduart foreshore, which is used as a base for water skiing

Safety of Other Recreational Waterway Users

Aside from the potential impact on bank erosion along the Glenduart foreshore, local residents believe that water skiing and power boating activities also present a safety hazard to other users of the river in this location. Other uses include non-motorised boating such as kayaking and rowing, as well as swimming. The noise associated with the power boating is also seen as a nuisance by Glenduart residents.

It should be noted that NSW Maritime report that the water skiing and power boating activities they have observed in the vicinity of Glenduart are conducted safely and within the requirements of boating laws.

Water Quality and Aquatic Vegetation

Fuel, lubricant and anti-fouling agents from power boats have the potential to pollute the estuary. In addition, turbidity caused by motors and anchor chains can smother and / or damage seagrass beds, which are significant in the Moruya River estuary (*refer* **Figure 3** *and* **Figure 4**)

4.2.3 Foreshore Access

Foreshore access is freely available along the banks of the Moruya River. In particular, informal vehicle tracks that branch to the foreshore from North Head Road and South Head Road are commonly used by recreational fishermen and campers.

The formalised North Head Camping Area is a popular spot for tourists to stay, particularly during school holidays and the warmer months. It is a camping area operated and maintained by Eurobodalla Shire Council. While most campers stay within the designated area, it is common to find several tents, caravans, or vehicles placed close to the estuary foreshore, outside the formal limit of the camping area.

Bank Erosion

Informal vehicle access to the foreshore by campers and fishermen has the potential to cause slumping and collapse of the river bank. Damage to riparian (*foreshore*) vegetation has obvious impacts on the habitat of local wildlife and can exacerbate erosion problems through removing the root systems of plants that help to hold the bank together.

Council has completed previous works to prevent informal access to the foreshore at particular locations along the lower estuary. These works typically involve the installation of bollards or boulders that physically block access by vehicles. However, the effectiveness of these measures is sometimes questionable, evidenced by paths trampled around the installed access controls.

Management of Riparian Vegetation

Maintenance of riparian vegetation along the estuary foreshore is important for the preservation valuable habitat for terrestrial and aquatic wildlife. Riparian vegetation also benefits the water quality of the estuary through natural mechanisms that treat stormwater runoff before it enters the waterway.

Accordingly, the management of foreshore vegetation is an estuary wide issue. Access to the foreshore by waterway users can often compromise the extent and health of the riparian zone, thereby reducing the habitat and natural resources available to foreshore ecosystems. Activities such as illegal grazing, slashing and clearing on public lands leads to degradation of the riparian zone and therefore impacts on estuary biodiversity and water quality.

Through the community consultation process, several residents of Glenduart have voiced their views regarding management of riparian vegetation in the vicinity of Glenduart Riverside Reserve.

The views are mixed. Several residents wish that the area be maintained as a grassed area, lined with vegetation at the foreshore and some native trees planted sparsely in the reserve. On the other hand, some residents believe that the area should be returned to its natural state, incorporating native trees and bushes.

It is understood that Council also wishes to restore the reserve to its natural state through rehabilitation of riparian vegetation and appropriate works to prevent vehicular access to the rehabilitated area. The potential to widen the riparian zone and therefore reduce the

size of grazing land downstream from Glenduart has also been considered as part of the rehabilitation works.

This has caused conflict between Council and farmers of riverside land, in addition to several residents at Glenduart.

Safety of Foreshore Users

It has recently come to the attention of Council and the Estuary Management Committee that the walkway along the crest of the northern training wall at the estuary entrance is in urgent need of repair.

Several sections of the concrete pathway have cracked or eroded away, exposing irregular shaped rock surfaces, thus creating a safety hazard for pedestrian traffic along the training wall. It is reported that some of the large boulders that line the walkway have been strewn across the path, making it difficult for pedestrians to pass safely.

4.2.4 Cultural Heritage Sites

Further to the issue of foreshore access and vegetation management at Glenduart, the Glenduart Cemetery is a cultural heritage site that requires protection so that it may be preserved for future generations.

Accordingly, Council has recently completed works to fence-off the Glenduart Cemetery from vehicle access.

In addition to its obvious value as a European heritage site, Glenduart also doubles as a site of Aboriginal significance. It is understood that investigations are underway in conjunction with consultation with the Local Aboriginal Land Councils to determine the number and extent of Aboriginal sites in the Glenduart area. The results of these investigations are likely to influence the future management of the Glenduart Riverside Reserve.

Several other sites along the Moruya River Estuary have significant Aboriginal heritage value. Theses sites include areas where indigenous tribes have previously gathered food, and prepared and eaten it.

A comprehensive assessment of Aboriginal cultural heritage for the Moruya area was undertaken as part of work to prepare this study. The results of this assessment are documented in the report titled, *'Moruya Deua River Estuary Management Study – Aboriginal Cultural Heritage Public Report'*, which was prepared by Susan Dale Donaldson from Environmental & Cultural Services. A copy of the report is provided in **Appendix D**.

The report includes an assessment of cultural heritage sites and the impact of estuary processes (*natural and anthropogenic*) on them. It also contains a series of recommendations for protection of Aboriginal sites and promotion of respect and awareness for Aboriginal culture. Where applicable, these recommendations have been incorporated into the management objectives and strategies for the Moruya / Deua River Estuary Management Study.

4.2.5 Fish Stocks

Fishing is a popular recreational activity in the Moruya River Estuary (*refer* **Plate 2**). Through the community consultation program, it has been determined that recreational fishers are concerned about the level of fish stocks in Moruya River. It is reported by recreational fishers that illegal netting activities are sometimes undertaken between the training walls near the estuary entrance.

It is understood that recreational fishers also disapprove of the commercial 'hauling' boats that operate on the lower estuary. There are (*unconfirmed*) reports of instances when the commercial operators have asked recreational fishers to move 'out of the way' of their netting activities.

Concern regarding fish stocks has increased recently, in light of the new Batemans Marine Park. Some recreational fishers are concerned that the number of commercial fishing operations on Moruya River will increase as a result of the closure of commercial fishing at other estuaries within the Marine Park and in turn, lead to reduced fish stocks at Moruya.

However, it is understood that similar concerns have existed since neighbouring estuaries were declared Recreational Fishing Havens (*banning commercial fishing*) some time ago, while Moruya River has remained open to commercial fishing. Creation of the Batemans Marine Park may not result in a significant change to the existing fishing pressure.

Plate 2: Recreational fisher positioned near Quarry Wharf

4.2.6 Oyster Industry

The oyster industry is relatively small in the Moruya River Estuary compared with other estuaries on the NSW coast. However, leases are located in the lower estuary; most commonly within the Pilot Station Backwater (*refer* **Figure 3**).

The leases at Pilot Station Backwater are primarily 'spat' leases. Spat is the term given to juvenile oysters. Moruya River effectively serves as a hatchery for juvenile oysters, which are then transported to other estuaries for maturing.

There are reports from the community at Moruya Heads that PVC pipes and other debris associated with the oyster industry are being left along the estuary foreshore (*refer* **Plate 3**). During very large high tides, the materials are sometimes transported by rising waters and left scattered over the shore and in the estuary. Derelict oyster leases and related debris along the foreshore can obviously reduce the aesthetic value of the estuary and can also present safety issues for other estuary users.

Plate 3: Example of materials left by oyster growers at Pilot Station Backwater

4.3 IMPACTS OF HUMAN ACTIVITIES ON KEY ESTUARY PROCESSES

In addition to the conflicts between estuary uses that are outlined above, there is also concern regarding the overall impact of human activities on the environmental health of the estuary.

Urban areas within the Moruya / Deua River catchment are primarily located adjacent to the estuary. As is the case with many estuaries on the coast of NSW, human activities are having a negative impact on key estuary processes. The critical activities that are having or have had adverse impacts on the estuary include:

- non-point source discharges from urban and rural areas;
- point source discharges, such as can occur from the Moruya Sewage Treatment Plan located at Ryans Creek;
- clearing of catchment and riparian vegetation;

- urban and rural development;
- gold mining in the upper reaches of the catchment;
- commercial and recreational fishing; and
- waterway structures such as weirs, rock protection works and training walls.

4.3.1 Urban Stormwater Management

Urbanisation in the Moruya township and at Moruya Heads, which are located adjacent to the estuary, has resulted in the creation of large areas of impervious surfaces (*e.g., roads and the rooves of buildings*) which decrease rainfall infiltration, increase runoff volumes and accelerate overland flow velocities.

Stormwater runoff from urban areas has the potential to cause a range of direct and indirect impacts on human health and safety and the aquatic environment. The potential impacts on aquatic ecosystems are currently not well known but may include:

- increased frequency of disturbance, which is likely to reduce the diversity of macroinvertebrates and favour more resilient species;
- hindering the drift of macroinvertebrates through the water column and substrate by reducing the inter-flood period, possibly hindering recolonisation; and,
- disrupting spawning cycles for some native fish species which are often triggered by seasonal floods (*EPA, 1996*).

Stormwater from the catchment may contain a range of pollutants which ultimately end up in the waterways. Pollutants may include garbage, nutrients, trace metals, oil and grease. Nutrients in stormwater may be derived from garden fertilisers, animal feedlots, construction activities, animal waste and washing powders.

A report was prepared for Eurobodalla Shire Council and Bega Valley Shire Council in September 2005, which contained a summary and interpretation of results of various water quality monitoring programs completed in the Moruya River catchment since 1991 (*Haines and Wilson, 2005*). The report is titled, *'Interpretation of Water Quality Monitoring Program Results – Final'*.

The project was a partnership between the two Councils and also involved the Department of Infrastructure, Planning and Natural Resources (*DIPNR*) and the Southern Rivers Catchment Management Authority (*SRCMA*). The project aimed to address existing shortfalls in water quality monitoring programs on the far South Coast.

Despite the fact that government, industry and community groups were investing time, effort and funds into a range of water quality monitoring programs, it was found that there was no comprehensive, coordinated view of water quality information available for the region. Nonetheless, the report also highlighted that water quality investigations that targeted rainfall events were valuable in identifying sources of nutrients, contaminants and sediment from catchments.

The investigations show that faecal coliform counts in the river adjacent to the Moruya township were consistently higher than elsewhere in the river. A high faecal coliform count indicates that stormwater runoff from Moruya may be contaminated with faecal material, most likely due to nearby agricultural activities, garden fertilisers or animal waste.

The report also showed that nutrient levels were elevated in Moruya River near the Moruya township. Stormwater discharge from the town is likely to contribute to these elevated levels. Increased nutrient inputs have the potential to stimulate algal growth, which may cause an imbalance in estuarine flora and fauna, and a negative impact on species such as seagrasses.

4.3.2 Mobilisation of Sediments

It is estimated that past gold mining activities are responsible for the dredging of up to 12 million cubic metres of soil in the lower reaches of Araluen Creek and the middle reaches of the Deua River (*ESC, 2003c*).

Mobilisation of sediment allows it to be transported into the river system during runoff events and ultimately to the lower estuary. The occurrence of such sediment transport is evident in the Moruya River catchment, based on the correlation of modern estuarine sediments with sediment found in the areas of past gold mining activities.

Unsealed roads and tracks within the Moruya / Deua River catchment are also potential sources of sediment load to the estuary. Erosion by stormwater runoff mobilises any loose sediment on the surface of the roads, which may then discharge to the nearest creek.

Concern regarding the increase in sedimentation in Moruya River prompted the formation of the Moruya River Estuary Management Committee in 1999 (*ESC, 2001b*).

Investigations undertaken by Fu, Field and Newham (*2006*) have suggested that the Donalds Creek sub-catchment (*refer* **Figure 1**) contributes a higher percentage of sediment per unit area to the Moruya River, compared with sub-catchments located further upstream. Therefore, it could be more effective to invest in sediment control measures within this sub-catchment, rather than in the upper catchment of the Deua River.

4.3.3 Agriculture and Forestry

Land clearing results in erosion and siltation, nutrient inputs, turbidity increases and in some cases acid runoff. The use of herbicides and pesticides contributes to the nutrient load and organic pollutants.

Agriculture and forestry also contribute to modified runoff rates, the loss of vegetation and habitats and the presence of invasive exotic weeds and pests. The loss of riparian (*foreshore*) vegetation, in particular mangroves and littoral rainforest, reduces important breeding and feeding habitats for fish and birds.

Sections of land along the Moruya River Estuary have been cleared for agricultural purposes. The clearing of riparian vegetation results in more pollutants and sediment

entering the estuary as the buffering capacity of the riparian zone is severely reduced. The loss of riparian vegetation has also caused riverbank instability and accelerated erosion as the plant roots, that previously bound the soil together, are no longer present.

Investigations undertaken for the *Moruya / Deua Estuary Processes Study* (*ESC, 2003c*) include a summary of results for water quality monitoring that has been undertaken in the Moruya River catchment since 1991. High faecal coliform counts in the vicinity of Kiora Bridge (*roughly 3 kilometres upstream from Yarragee*) indicate that faecal contamination is occurring in the upstream catchment.

Water quality monitoring results that are presented in the report, *Interpretation of Water Quality Monitoring Program Results* (*Haines and Wilson, 2005*), also show that faecal coliform levels in the upper reaches of the estuary have regularly been above ANZECC guidelines. However, more recent samples taken since 2001 show a decrease in the faecal coliform count.

It is likely that faecal matter is being discharged to upstream creeks from adjacent agricultural land that holds live stock. In addition to the environmental impacts on aquatic ecosystems, there is concern that faecal contaminants may be feeding into Moruya's water supply system.

Recently acquired water quality monitoring results for the upper catchment were discussed by Council's Environment Team at Committee Workshop #2 (*February 2007*). The data indicates a high faecal coliform count upstream from a water intake point for the town's water supply.

4.3.4 Commercial and Recreational Fishing

As discussed, fishing is a popular activity on the Moruya River. Both commercial operators and recreational fishers can impact on the level of fish stocks in the estuary, particularly if juvenile fish are inadvertently caught and taken during fishing activities. There is potential for the number of commercial operators on Moruya River to increase as a result of other estuarine areas being closed to commercial fishing as part of the Batemans Marine Park.

Fishing activities can also have other environmental impacts within the estuary. Ecologically valuable seagrass beds are susceptible to damage by the hauling nets used by commercial operators. Anecdotal reports indicate that hauling nets are repeatedly used across areas of seagrass beds located opposite the Anchorage in the lower estuary.

Bait collecting activities across the sandflats and foreshore of the lower estuary can impact on populations of invertebrate species, which are prey for fish, migratory birds and resident wader birds.

4.3.5 Wastewater Management

Investigations for the *Moruya / Deua Estuary Processes Study* (*ESC, 2003c*) determined that effluent discharges from the Moruya Sewage Treatment Plant (*STP*) located on Ryans Creek (*refer* **Figure 3**) may be contributing to an increased level of faecal coliforms

observed at locations immediately downstream from the entrance to Ryans Creek. Increased levels of nutrients in the river that were also observed are likely related to discharges from the plant.

The STP has been discharging tertiary treated effluent into Ryans Creek since 1973 at an average rate of 0.8 Ml/day (*ESC, 2000*). Recent upgrades to the STP are discussed in **Section 5.8.1**.

The pathogens associated with faecal contamination have the potential to kill aquatic organisms and therefore impact heavily on aquatic ecosystems. Oysters may be affected by faecal contamination which also presents a risk to human health. Blue-green algal blooms are attributable to nutrient loading and faecal contamination.

Results of the water quality monitoring programs documented in the report, *Interpretation of Water Quality Monitoring Program Results* (*Haines and Wilson, 2005*), confirm that faecal coliform counts in the vicinity of Ryans Creek are regularly high, particularly following rainfall events. Effluent from the STP is a likely contributor to the increased levels of faecal contaminants. In addition, diluted effluent from the STP is used to irrigate Moruya Golf Course, which drains to Racecourse Creek, which enters Moruya River at the same location as Ryans Creek (*ESC, 2003c*). Stormwater runoff from the golf course may contain a significant level of faecal coliforms, therefore contributing to the high counts recorded near the entrance of Ryans Creek.

The *Moruya / Deua Estuary Processes Study* (*ESC, 2003c*) determined that faecal coliform counts were above the ANZECC guidelines for aquatic food for monitoring sites in the lower estuary adjacent to oyster farming activities in Pilot Station Backwater (*refer* **Figure 3**). It should be noted that there are strict standards and methods in place to ensure that oysters are 'cleaned' before human consumption, as regulated by the NSW Food Authority's Shellfish Quality Assurance Program.

The high faecal counts in this section of the estuary may be attributable to the previous lack of sewerage system at Moruya Heads until the recent installation of services. Water quality monitoring undertaken in 2000 and 2001 showed that Newstead Pond, located south of Pilot Station Backwater (*refer* **Figure 3**), had a high count for faecal coliforms (*Haines and Wilson, 2005*). The same contamination, potentially from human sewage in the Moruya Heads area may be feeding into Pilot Station Backwater.

4.3.6 Waterway Structures

Man-made waterway structures can impact on estuary processes in a variety of ways, including modification to estuarine hydrodynamics, movement of sediment and impacts to water quality.

Construction of the entrance training walls at Moruya River and the rock protection walls downstream from the Princes Highway bridge (*refer* **Figure 3**) has lead to increased scour and sediment transport during floods and from regular tidal currents along the base of the man-made structures.

Illegal foreshore structures, such as jetties and retaining walls that have been placed without permission on public land, have the potential to exacerbate localised bank erosion. Several informal structures along the foreshore upstream from the Princes Highway bridge were noted during field inspections.

The construction of the road crossing over the entrance to Malabar Lagoon and the corresponding weir may be causing reduced tidal flushing and associated water quality problems in Malabar Lagoon (*refer* **Plate 4**). This can impact on the ecology of seagrass and saltmarsh communities in the lagoon, which could translate to loss of habitat for wader birds.

Plate 4: View looking north to Malabar Weir from Moruya River

Road crossings of creeks and waterways also have the potential to impact on the passage of fish, on which several species are dependent for breeding. NSW Department of Primary Industries (*Fisheries*) have prepared a report in 2006 titled, *'Reducing the Impact of Road Crossings on Aquatic Habitat in Coastal Waterways – Southern Rivers, NSW'*.

The investigations included the assessment of 1,673 waterway crossings across the Southern Rivers region. 578 of these crossings were identified as obstructions to fish passage. Based on mapping from the report, it is estimated that approximately 15 sites were assessed within the Moruya / Deua River catchment.

Three sites within the catchment were identified as *high priority* sites, based on their potential threat to fish habitat and passage. Appropriate recommendations have been made for these sites so that measures can be implemented to reduce the impact of the crossings on fish passage. Work has already been completed for a causeway across the Deua River on a private driveway off Araluen Road. The works involved improvement of culvert sizes and the removal of a levee.

The following recommendations have been made for the two remaining *high priority* sites:

- Causeway across Telowar Creek on Neringla Road – install additional culverts or convert to a bridge; and,

- Causeway across Candoin Creek on Dwyers Creek Road – increase culvert size in conjunction with retaining natural barriers to low flow.

4.3.7 Development Pressures

Eurobodalla Shire Council's *Moruya Structure Plan* (*2007*) contains predictions for population growth in the Central District of Eurobodalla Shire, which includes Moruya, Moruya Heads, Mossy Point, Broulee, Tuross Head and Bodalla. The population is expected to grow by about 40% over the next 25 years in the Central District to a total of more than 13,000 people.

The *Moruya Structure Plan* (*2007*) indicates that approximately 1,500 potential new dwellings will be made available in Moruya to accommodate the population growth, 85% of which will be low density houses. The remaining comprises dual occupancy and medium density housing.

Urban and rural development has the potential to cause an increase in nutrient loading and other pollutants to the estuary from sewage effluent, wet weather sewer overflows and stormwater runoff. Turbidity and litter can also become a problem.

4.3.8 Acid Sulphate Soils

Acid sulphate soils *(ASS)* and associated acid runoff that discharges to the estuary from areas of exposed acid sulphate soil, is a significant management issue for the Moruya / Deua River Estuary. Land clearing and drainage for agricultural and urban land-uses has led to the exposure and oxidation of these soils at a number of sites along the estuary shoreline.

Acidic stormwater runoff can impact on agricultural, fishing and aquaculture activities, particularly when discharges occur to natural waterbodies and wetlands adjacent to the estuary.

4.3.9 Climate Change

Background

Climate change refers to a statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (*typically decades or longer*). It may be due to natural internal processes or external influences, or to persistent anthropogenic changes in the composition of the atmosphere or in land use.

However, not all changes in climate are due to natural processes. Through a range of activities since the industrial era of the mid-19th century, such as accelerated use of fossil fuels and broadscale deforestation and land use changes, humans have also contributed to an enhancement of the natural greenhouse effect. This enhanced greenhouse effect results from an increase in the atmospheric concentrations of the so-called greenhouse gases, such as carbon dioxide and methane. The Greenhouse Effect is widely believed to be responsible for the observed increase in global mean temperatures during the course of the 20th Century.

Greenhouse gases effectively absorb infrared radiation emitted by the earth's surface, by the atmosphere itself due to the same gases, and by clouds. Atmospheric radiation is emitted to all sides, including downward to the earth's surface. Thus greenhouse gases 'trap' heat within the surface-atmosphere and thereby lead to global warming.

Global warming has the potential to cause sea level rise and to alter rainfall and storm intensity. The potential for global warming to increase average ocean levels is regularly assessed by the Intergovernmental Panel on Climate Change (*IPCC*). Predictions have been made since the late 1980s. Current projections of global average sea level rise from 1990 to 2100 lie in the range of 0.09 to 0.88 metres (*National Committee on Coastal and Ocean Engineering, 2004*).

The available literature indicates a predicted increase in the range of 0.03 to 0.25 metres by 2040 (*0.075 to 0.15 metres in the median band*), and 0.09 to 0.88 metres by 2100 (*0.3 to 0.5 metres in the median band*). This of course will vary depending on location along the coastline.

Accordingly, in considering coastal or estuarine development, it is appropriate to allow for a median value increase of 0.2 metres over a 50 year timeframe and 0.5 metres over a 100 year timeframe. The latter corresponds to the upper bound of the median band specified by the IPCC and is therefore considered to be a conservative estimate of the predicted sea level rise.

Potential Impacts on the Natural Environment

Natural systems are likely to have difficulty in adapting to climate change and its associated impacts. Sea level rise is considered to be a major consequence of climate change and is particularly relevant for coastal environments.

But there are additional concerns related to changes in weather and rainfall patterns, such as altered environmental flows, changes to the frequency and severity of flood events, increased storm intensity, periods of drought, changes in sedimentary processes and changes in estuarine biochemistry and the related impact on aquatic fauna and flora.

Sea level rise caused by climate change can have the following impacts on natural estuarine systems:

- forced landward migration of saltmarsh and mangrove communities, the pathway for which can be inhibited by physical impediments (*either natural or manmade*);
- reduction in width of the riparian zone and associated loss of wildlife habitat;
- increased salinity penetration to the upper estuary and associated impacts on estuarine biochemical processes, which can be exacerbated by extended periods of drought and altered catchment hydrology also caused by climate change; and,
- changes in the location and severity of bank erosion and shoal formation, which can also be influenced by changes in tidal current scour and flood scour resulting from climate change.

Wetlands that are already under threat from urban development, pollution and drainage may become more vulnerable with sea level rise and changes to salinity levels.

Potential Impacts on Human Settlements

The primary concern is that coastal foreshore and floodplain development would increasingly become threatened by inundation as a consequence of sea level rise due to global warming. In addition, altered weather patterns may intensify storms and increase the severity of storm surge and catchment flooding.

Sea level rise may also affect the operation of existing sewerage and stormwater infrastructure and the drainage efficiency of low lying agricultural lands.

Mechanisms for Managing the Risks Associated with Climate Change

The impact of floods and flood liability on coastal development, including projected climate change implications, are best addressed by Council through the implementation of recommendations made in Floodplain Risk Management Plans. These Plans are developed in accordance with the NSW Government's *Floodplain Development Manual* (*NSW Government, 2005*) and are typically based on flood modelling that takes account of sea level rise projections.

Eurobodalla Shire Council already has a Floodplain Management Plan for Moruya River. The plan includes recommendations regarding *freeboard* above design flood levels that incorporate the potential impact of climate change and sea level rise. However, this Plan was adopted by Council in 1999 and may not reflect contemporary approaches for addressing the potential for climate change to influence sustainable development on or adjacent to estuary floodplains. Hence, it may be appropriate for the Moruya River Floodplain Management Plan to be revisited.

In the meantime, proposals for the rezoning of potentially flood liable land for new development should be subject to the floodplain risk management assessment process. This process should consider the full flood risk up to the Probable Maximum Flood, and determination of the flood planning level (*FPL*) for the development based on consideration of the IPCC sea level rise projections for the 100 year planning timeframe.

Consideration should also be given to the future rezoning of urban land adjacent to the riparian zone to allow for the landward retreat of threatened vegetation.

Other measures to manage the impacts of climate change on natural systems may include investigations to determine possible locations for redispersal of flora threatened by sea level rise and to allow for migration of aquatic fauna. Education of the community regarding the impacts of climate change and encouragement of foreshore property owners to enter into voluntary conservation agreements would also be beneficial.

The location of developed and natural areas within Moruya / Deua River estuary that are likely to be affected by climate change have been identified as part of this study and are discussed in further detail in **Section 6.3**.

Eurobodalla Shire Council's Greenhouse Action Plan

In addition to combating the impacts of climate change, Eurobodalla Shire Council has been active in reducing the Shire's contribution to greenhouse gases and global warming. Council has developed a Greenhouse Action Plan as part of its participation in the Cities for Climate Protection (*CCP*) program, which it joined in 2005. As part of the CCP program, Council has endorsed the community's "50/50 by 2020" vision, which will involve targeting a 50% reduction in greenhouse gas emissions by the year 2020 and 50% of Council's energy requirements to be sourced from ecologically sustainable renewable sources by 2020 (*ESC, 2007a*). Council has also committed to encouraging industries and households within the Shire to also work towards the "50/50 by 2020" targets.

5 LAND USE & WATERWAY PLANNING

5.1 HISTORICAL LAND USE DEVELOPMENT

The Eurobodalla Shire was originally the home of the South Coast Aboriginals of the Bugelli-Manji and Yuin tribes. Small nomadic groups hunted and fished. Fish and vegetable foods were plentiful. These earliest inhabitants gave their attractive names to many of the Shire's beautiful and unique places (*ESC, 2006g*).

Land on the north bank of the Moruya River was first settled by Francis Flanagan in 1828. John Hawdon claimed land on the Moruya River in 1831, building the elegant Kiora House in 1832 and then acquiring parcels of land between Bodalla and Batemans Bay.

In 1851 the Moruya township on the southern side of the river became the centre of the Eurobodalla Shire's development. Passengers and goods crossed the river by punt. Gold was also discovered in the Moruya district in 1851. Araluen proved to be one of the three principal goldfields in Australia producing more than 26 tonnes of pure gold.

Entry to the Moruya River from the sea was difficult but the construction of breakwaters and dykes allowed the township to grow. The potential to construct breakwaters along the estuary shores was first investigated in the 1870s. By 1890 work had commenced on constructing a mile long dyke to maintain a straight navigable channel in the river. However, early attempts failed due to damage from flooding (*ESC, 2006g*).

In the 1880's many saw mills opened along the coast of Eurobodalla Shire from Batemans Bay to Wagonga Inlet. Small cheese factories dotted the whole area, including the Deua River catchment.

By the end of the 1890's the Eurobodalla gold was running out and thousands of hopeful miners dispersed to other gold mining sites or settled down to become local farmers and small businessmen.

By the turn of the 19th Century dairying and vegetable production flourished on the increasingly cleared land of the Eurobodalla. Commercial fishing had begun during the 19th Century and oyster farming was introduced early in the 20th Century.

The British Engineering firm, Dorman Long and Co won the contract to erect the Sydney Harbour Bridge early in 1924. The firm decided to take the granite required for the bridge pylons from a quarry site on the north bank of the Moruya River. The Ziegler family, monumental masons, had used the granite from this quarry prior to 1924 for cutting headstones (*ESC, 2006g*).

In 1925, ninety stonemasons and their families arrived in Moruya, primarily from Scotland. The regular movement of three steamers carrying the granite to Sydney increased shipping traffic on the Moruya River. In 1927, the construction of a spur wall was completed to improve the crossing conditions at the Moruya River entrance.

After completion of granite quarrying activity for the Harbour Bridge, the stonemasons left the area and the empty houses were bought by local people and shifted to house blocks around the district.

In 1954, the last major extension works for the northern and southern breakwaters at Moruya Heads were completed (*ESC, 2006g*).

5.2 CURRENT LAND USE

Aside from the large area of National Park and State Forest in the upper catchment of the Deua River, the primary land use within the catchment is agriculture. Many of the larger farms have now been subdivided into small land holdings or rural residential lots, particularly in the Glenduart and Yarragee areas and south of the Moruya Township.

Land uses across the lower catchment area comprise a mix of urban residential, rural areas and Nature Reserves. The urban residential areas are generally located at Moruya and Moruya Heads. Moruya Heads incorporates the urban areas at The Anchorage and properties along South Head Road.

The distribution of current land use within the immediate catchment of the estuary is shown in **Figure 7**. The mapping is based on interpretation of land use mapping that accompanies Council's *Urban Local Environmental Plan* (*LEP) 1999* and *Rural Local Environmental Plan 1987*. A detailed copy of the land use mapping is provided in **Appendix E**.

There are significant areas of land that are zoned for rural / agricultural purposes that still remain well vegetated. This is particularly evident in the areas north-west of Yarragee, south of Moruya Heads and north-east of Malabar Lagoon.

As shown in **Figure 7**, there are significant areas zoned for "Environmental Protection". These areas can be further broken down into environmental protection for:

- Wetlands (*Zone 7a*);
- Coastal Lands Protection (*Zone 7f1*); and,
- Coastal Lands Acquisition (*Zone 7f2*) (*refer* **Appendix E**).

The areas marked as Zone 7a (*Wetlands*) generally coincide with areas identified as wetlands under SEPP 14 (*refer* **Figure 7**). However, there are areas of SEPP 14 Wetlands that do not appear to be zoned as Environment Protection zones under the LEPs. Specifically, these areas have been identified at Ryans Creek, Racecourse Creek, Moruya Heads and within the Pilot Station Backwater (*refer* **Figure 7**).

Also shown in **Figure 7** is a significant area of land zoned as *Urban Expansion* in the Rural LEP 1987 (*refer pink shaded area*).

FIGURE 7

NORTH MORUYA INDUSTRIAL ESTATE
Mogendoura Creek
GLENDUART
Malabar Creek
Dooga Creek
Princes Highway
Malabar Lagoon
George Bass Drive
SOUTH PACIFIC OCEAN
MORUYA RIVER
YARRAGEE
North Head Drive
MORUYA RIVER
Ryans Creek
THE ANCHORAGE
Racecourse Creek
South Head Road
MORUYA
MORUYA HEADS
YARRAGEE INDUSTRIAL ESTATE
Pedro Point Road
Kiora Bridge
Princes Highway
Congo Creek
Wamban Creek
CONGO

LEGEND

- RURAL AGRICULTURE (1a)
- RURAL RESIDENTIAL (1c)
- STATE FOREST
- NATIONAL PARK
- RESIDENTIAL (2g, 2t and 2ec)
- URBAN EXPANSION (10)
- COMMERCIAL / INDUSTRIAL (3a & 4a)
- SPECIAL USES / COMMUNITY PURPOSES (5b, 5c and 5d)
- OPEN SPACE / RESERVES (6)
- ENVIRONMENTAL PROTECTION (7)
- SEPP 14 WETLANDS

N

Scale

200 0 200 400 600 800 1000

Metres

Source: Eurobodalla Rural LEP 1987
Eurobodalla Urban LEP 1999

Patterson Britton & Partners Pty Ltd
rp6570-Moruya EMP
fig-landuse.dgn

LAND USE ACROSS THE MORUYA RIVER ESTUARY

5.3 PROPOSED FUTURE LAND USE

In accordance with the *South Coast Regional Strategy* (*DoP, 2007*), Eurobodalla Shire Council is required to prepare a new Local Environment Plan by 2009 (*ESC, 2007a*).

Future land use mapping contained in the Moruya Structure Plan (*ESC, 2007a*) shows those areas where the current land use mapping described in **Section 5.2** is likely to change as a result of proposed zoning that will be included in Council's new LEP.

Future land use mapping in the vicinity of Moruya, Moruya Heads and the North Moruya Industrial Estate has been extracted from the *Moruya Structure Plan* (*ESC, 2007a*) and is included in **Appendix F**.

The future land use mapping has been used to identify those areas where future changes in land use could threaten a significant estuary process. For example, changes in land use from forest or wetland to agricultural or residential areas could degrade water quality, lead to increased sedimentation or cause the extinction of aquatic organisms in the immediate vicinity.

Most significantly, clearing of vegetated land for urban development, industrial development or rural pasture could increase sediment loads to the waterway, which could adversely impact on aquatic habitats such as seagrass beds. Increased deposition of sediment in the waterways may also compound navigation problems in the lower estuary near the river entrance.

Similarly, future land use changes to vegetated areas adjacent to the waterways may result in degradation of creek / river banks and threaten water quality and sedimentary processes. Without careful management, clearing of vegetation adjacent to waterways for rural pastures removes stabilising vegetation from the banks resulting in bank erosion and increasing sediment loads to the estuary. In addition, trampling of bank by livestock causes severe degradation of riverbanks accelerating erosion and increasing sediment loads to the waterways. Livestock access to the waterway may also impact on water quality processes due to the potential for increased discharge of nutrient to the creeks, resulting in a decline in water quality.

Runoff from urban areas often carried pollutants due to fertilisers from these sources applied to gardens, detergents used to wash cars, and oil and grit from roads. Water quality processes may also be threatened by increased urban development in the catchment due to increased urban runoff and stormwater reaching the waterways. In particular, increased nutrient loads from these sources can cause a decline in water quality resulting in algal blooms.

5.3.1 Future Land Use in the Vicinity of Moruya

The proposed future land use in the vicinity of Moruya is shown in **Appendix F** which has been extracted from the *Moruya Structure Plan* (*ESC, 2007a*).

As compared to the current land use mapping shown in **Figure 7**, a majority of the current Urban Expansion Zone is planned for conversion into 'Large Lots' and 'Low Density'. *Large Lots* zoning denotes the construction of single dwellings that are to be located on a large lot. This zoning type is proposed for the West Moruya Urban Expansion Area.

Using recent aerial photography, it was determined that the West Moruya Urban Expansion Area comprises a significant area of bushland, located north of the Yarragee Industrial Estate (*refer* **Figure 7**). Furthermore, the northern boundary of this urban expansion area borders Moruya River, on the outside bend upstream from the confluence with Mogendoura Creek.

If this land is cleared for *Large Lots* development, it is likely to result in the discharge of additional sediment to the waterway, and may increase the risk of bank erosion along this stretch of the bank. The removal of vegetation from this area of relatively steep topography is likely to result in increased rates of runoff through the catchment.

As shown in **Appendix F**, *Low Density* zoning denotes a zone of predominantly single dwellings in a low density environment (*ESC, 2007a*) and will apply to most of the Urban Expansion Zone to the south of Moruya.

As shown in **Appendix F**, a small portion (*5%*) of the current Urban Expansion Zone to the south of Moruya is to be zoned as medium density. It is also proposed that an additional small section of land currently zoned as Rural Residential land will be converted to *Low Density*.

The development of low and medium density housing in the Urban Expansion Zone south of Moruya will result in an increased proportion of impervious areas, and therefore an increased rate of stormwater runoff and stormwater volume.

The stormwater management system for the Urban Expansion Zones to the west and south of Moruya should incorporate appropriate methods to address the expected increase in stormwater runoff as a result of development. It should also cater for an increase in the load of sediment during any vegetation clearing activities and for increased loading of nutrients and gross pollutants that are associated with residential development.

Development should also consider any Endangered Ecological Communities (*EECs*) that existing with the current Urban Expansion Zone (*refer* **Appendix F**).

A report was recently completed for Eurobodalla Shire Council by Eco Logical Australia titled, *'Environmental Study – Eurobodalla Shire Biodiversity Survey (October 2007)'*. The study involved investigation of the impact of future development on EECs within the Urban Expansion Zones at West Moruya, South Moruya and Moruya Heads.

The report states that the Urban Expansion Zone west of Moruya is considered to be highly constrained by EECs and that development should be limited to areas of non-native vegetation or areas of EECs that have been assigned a 'low condition' rating. The remnant vegetation surrounding the existing waste disposal facility is considered to be a local 'biolink' that allows connectivity of EECs and therefore should also be avoided for development.

The report also indicates that the Urban Expansion Zone to the south of Moruya predominantly holds areas of EECs in low condition. There is potential to offset development within the areas of low condition zone by retaining EECs across the site that

are in better condition. It is recommended that local 'biolinks' are retained at reserves in the vicinity of Hawdon Street, Turnbulls Lane, Lagoon Street, Spencer Street and Francis Street.

5.3.2 Future Land Use at Moruya Heads

A map of the proposed future land use in the vicinity of Moruya Heads is provided in **Appendix F**, which has been extracted from the *Moruya Structure Plan* (*ESC, 2007a*).

Through comparison with the current land use mapping shown in **Figure 7**, it can be seen that Council proposes to convert the current Urban Expansion Zone at Moruya Heads into areas of 'Environmental Living'. *Environmental Living* is a proposed new zoning type that will be similar to the existing zone that is *Residential – Environmental Constraints* (*2ec*). It will allow for the development of single dwellings only that are suitable for areas with special ecological and aesthetic values (*ESC, 2007a*).

Significant areas of SEPP 14 Wetland and Endangered Ecological Communities (*EECs*) exist at The Anchorage. A considerable portion of these environmentally sensitive areas are incorporated into the current land use zoning as Environmental Protection (*refer* **Figure 7**). They present as well-vegetated areas in recent aerial photography.

However, as shown in the mapping of Potential EECs provided in **Appendix F**, a significant area of EECs exists within the proposed *Environmental Living* zone at Moruya Heads.

The report by Eco Logical Australia (*ESC, 2007c*) recommends that development south of South Head Road should incorporate vegetation linkages to any retained vegetation and EECs to the north of South Head Road.

In addition to the management of increased stormwater runoff and potential pollutants that is associated with vegetation clearing at Moruya Heads, particular care will be required when development occurs, so that the ecological communities are not disturbed.

Further environmental constraints, such as riparian corridors, soil wetness and bushfire hazard, will also need to be considered when determining the actual area that is suitable for development. Council have developed mapping to show the available area for development at Moruya Heads for inclusion in the Moruya Structure Plan (*refer* **Appendix F**).

5.3.3 Future Land Use at North Moruya Industrial Estate

The *Moruya Structure Plan* (*2007*) contains recommendations to extend the North Moruya Industrial Estate to incorporate a section of rural land that is located to the west of the existing estate. The layout of the extension to the estate (*refer* **Appendix F**) has been determined based on environmental constraints, including the extent of flood fringe areas for the Moruya River (*refer* **Appendix F**).

As with development in the Urban Expansion Zones at Moruya and Moruya Heads, expansion of the North Moruya Industrial Estate should consider the impacts of development on existing and potential Endangered Ecological Communities (*EECs*).

Industrial development should also incorporate effective stormwater management systems to limit the impact of increased stormwater volume and pollutant discharges into Malabar Creek, which feeds directly to Malabar Lagoon and the valuable saltmarsh communities and SEPP 14 Wetlands that it hosts.

It should be noted that the *Moruya Structure Plan* does not incorporate any expansion of the existing industrial estate at Yarragee (*refer* **Figure 7**).

5.4 PLANNING CONTROLS

Land-use in the catchment of the Moruya / Deua River Estuary is controlled by a range of legislation, planning instruments and regulations, which are administered by government agencies at both the local and state level. A summary of the environmental and land-use legislation applicable within NSW is provided in **Table 3**. In addition to these Acts and Regulations, there are also State Environmental Planning Policies (*SEPPS*), regional environmental plans (*REPs*), local environmental plans (*LEPs*) and development control plans (*DCPs).*

These pieces of legislation grant certain powers to local government. However, they also act to either, limit the powers which may be exercised by local government under the *Environmental Planning and Assessment Act 1979*, or to impose additional requirements such as the referral of certain applications to State agencies.

The large number of potentially relevant Acts clearly indicates that the amount of regulation is extensive. On this basis, attempts to enforce Total Catchment Management (*TCM*) principles and objectives by using the range of legislation can prove a difficult proposition. As a consequence, mechanisms for implementation of TCM based on community participation and partnerships between local government and landowners are likely be achieve more rapid results than the enforcement of current legislation.

Notwithstanding, the extent of legislation and how it applies to the Moruya / Deua River Estuary catchment needs to understood. Accordingly, the following sections provide a brief description of the relevant legislation and planning controls, and their relevance to the managing land-use issues within the catchment.

Table 3 ENVIRONMENTAL AND LAND USE LEGISLATION

LEGISLATION	JURISDICTION WITH PRIMARY RESPONSIBILITY FOR IMPLEMENTING LEGISLATION
Catchment Management Authorities Act 2003	State
Coastal Protection Act 1979	State
Conveyancing Act 1919	State
Crown Lands Act 1989	State
Environmental Planning and Assessment Act 1979	State
Protection of the Environment and Operations Act 1997	State
Fisheries Management Act 1994	State
Local Government Act 1993	Local government
Marine Parks Act 1997	State
National Parks and Wildlife Act 1974	State
Native Vegetation Act 2003	State
Rivers and Foreshores Improvement Act 1948	State
Roads Act 1993	State
Rural Fires Act 1997	State and Local Government
Soil Conservation Act 1938	State
Threatened Species Conservation Act 1995	State
Water Management Act 2000	State

5.5 RELEVANT LEGISLATION / PLANNING CONTROLS

5.5.1 Link between Estuary Management and Legislation

In recognition of the need for future sustainable use of these threatened resources, the Government has launched a number of key strategic initiatives. These include the establishment of water quality objectives for major estuaries under the water reform initiatives, and the expansion of the *NSW Coastal Policy* to include estuaries in the development of integrated sustainable management initiatives in coastal zone catchments. In addition, the management of estuarine and coastal waters has been included in the *Water Management Legislation* to protect estuary water flow, quality, and associated threatened ecosystems.

New initiatives to enable community industry and agency participation in developing solutions to local problems will be facilitated and integrated through newly formed *Catchment Management Authorities.*

Thirteen (*13*) Catchment Management Authorities (*CMAs*) have been established across the State by the NSW Government to ensure that regional communities have a significant

say in how natural resources are managed in their catchments. The CMAs are statutory authorities with a responsible and accountable board. CMA boards report directly to the Minister for the Environment and Climate Change. Each CMA also has a general manager and a team of professional staff.

The CMAs are locally driven organisations that are responsible for involving regional communities in management of the natural resource management issues facing their region, and are the primary means for the delivery of funding from the NSW and Commonwealth Governments to help land managers improve and restore the natural resources of the State.

The CMAs work in partnership with the community, local government, State Government agencies, industry and individuals.

Southern Rivers CMA (*SRCMA*) has recently completed a Catchment Action Plan for the Southern Rivers region. Further details are included below in **Section 5.8.1**. Over 60 staff work for the SRCMA.

The Coastal Protection Act 1979 provides for the preparation of Coastal Zone Management Plans, including Estuary Management Plans and Coastline Management Plans. The Department of Environment and Climate Change (*DECC*) now administers this act and the Estuary Management Program, which supports the development of estuary management plans.

5.5.2 Statutory Powers

Those organisations empowered to administer the various land-use controls applicable to the Moruya / Deua River Estuary are listed in **Table 4**, along with the legislation that they are responsible for administering.

Other organisations with activities and responsibilities that will impact upon land use include:

- Department of Commerce;
- Health Commission of NSW;
- Telstra; and,
- Roads and Traffic Authority.

Table 4 ORGANISATIONS REPSONSIBLE FOR PLANNING CONTROLS APPLICABLE TO THE MORUYA / DEUA RIVER ESTUARY

ORGANISATION	LEGISLATION
Eurobodalla Shire Council	§ Environmental Planning and Assessment Act 1979 § Eurobodalla Shire Rural and Urban LEPs § Development Control Plans
Department of Environment and Climate Change (*formerly DEC and now undertakes certain functions of former DNR*)	§ Coastal Protection Act 1979 § Protection of the Environment Operations Act 1997 § Native Vegetation Act 2003 § Catchment Management Authorities Act 2003 § Marine Parks Act 1997 § Protection of the Environment Administration Act 1991 § Environmentally Hazardous Chemicals Act, 1985 § National Parks and Wildlife Act 1974 § Wilderness Act 1987 § Threatened Species Conservation Act, 1995 § Responsibilities for a wide range of specific legislation § Soil Conservation Act 1938
Department of Water and Energy (*divisions of former DNR and DEUS*)	§ Rivers and Foreshores Improvement Act 1948 (Amended 1991) § Water Management Act 2000
Department of Primary Industries	§ Fisheries Management Act 1994
Department of Planning	§ Environmental Planning and Assessment Act 1979 § State Environmental Planning Policies – No. 14 – Coastal Wetlands; No. 26 – Littoral Rainforests; No. 62 – Sustainable Aquaculture; No. 71 – Coastal Protection § Regional Environmental Plans
Department of Lands	§ Crown Lands Act 1989

5.6 CONSOLIDATED ACTS AND NSW PLANNING CONTROLS

5.6.1 State Legislation

Details of the state legislation relevant to the management of Moruya / Deua River Estuary are provided in **Appendix G**.

5.6.2 State Environment Planning Policies (*SEPPs*)

SEPP 14 - Coastal Wetlands

State Environmental Planning Policy No. 14 – Coastal Wetlands (*SEPP 14*) was gazetted on 12 December, 1985, with the aim of ensuring that coastal wetlands are preserved and protected in the environmental and economic interests of the State.

The policy applies to the cities, municipalities and shires with direct frontage onto the Pacific Ocean (*excluding those in the Sydney metropolitan area*), and is accompanied by a series of maps which identify the lands to which the policy applies.

Except with the consent of Council and the concurrence of the Director General, land to which this policy applies can not be cleared, drained, filled or have levees constructed on it.

SEPP 26 - Littoral Rainforests

State Environmental Planning Policy No. 26 – Littoral Rainforests (*SEPP 26*) commenced operation on 5 February 1988. SEPP 26 provides a level of protection to the core area of littoral rainforest and also to 100 metre buffer zones surrounding the core area. A significant feature of SEPP 26 is that, unlike other planning policies, it recognises the importance of buffer zones surrounding important ecological areas.

SEPP 62 – Sustainable Aquaculture

State Environmental Planning Policy No.62 – Sustainable Aquaculture (SEPP 62) commenced operation on 25th August 2000. SEPP 62 encourages the sustainable expansion of the industry in NSW. The policy implements the regional strategies already developed by creating a simple approach to identity and categorise aquaculture development on the basis of its potential environmental impact. The SEPP also identifies aquaculture development as a designated development only where there are potential environmental risks.

SEPP 71 – Coastal Development

State Environmental Planning Policy No. 71 – Coastal Development (SEPP 71) commenced operation on 1 November 2002. It is a key element of the NSW Government's Coastal Protection Package to protect the State's beaches, headlands and other coastal features for future generations. The Policy has been made under the Environmental Planning and Assessment Act 1979 to:

- ensure that development in the NSW coastal zone is appropriate and suitably located;
- ensure that there is a consistent and strategic approach to coastal planning and management; and,
- ensure there is a clear development assessment framework for the coastal zone.

5.6.3 NSW State Rivers and Estuaries Policy 1992

The *NSW State Rivers and Estuaries Policy*, adopted in 1992, committed the NSW government to reporting on the condition of each of the State's major river and estuary systems and the actions underway to halt degradation of these systems. The *State of the Rivers and Estuaries* reports will provide information for River Management Plans and Groundwater Management Plans and report on performance monitoring during resource security periods.

The objectives of the SoRE Reporting Program are to:

- provide an overall picture of the condition of rivers and estuaries in NSW;
- identify trends in resource degradation and improvement;
- identify critical gaps in natural resource information;
- identify management response activities and indicate their effectiveness;

- provide a mechanism for the exchange, integration and presentation of information on rivers and estuaries from a wide range of sources;
- provide a tool for local and regional decision making;
- support involvement in Total Catchment Management; and,
- provide input to State, national and international forums, policy processes and State of the Environment Reports.

The NSW Estuary Management Policy and NSW Wetlands Management Policy are policies that sit beneath the NSW State Rivers and Estuaries Policy.

NSW Estuary Management Policy

The NSW Estuary Management Policy provides for the production of a sustainable management plan for each estuary in NSW through implementation of the estuary management process outlined above in **Section 1.2**.

The NSW Wetlands Management Policy

In 1996 the NSW Government released *The NSW Wetlands Management Policy*. The State Catchment Management Coordinating Committee oversees the implementation of this Policy. It is the policy of the NSW Government to:

- Encourage the management of the wetlands of the State so as to halt, and where possible, reverse:
  - ⇒ loss of wetland vegetation;
  - ⇒ declining water quality;
  - ⇒ declining natural productivity;
  - ⇒ loss of biological diversity; and
  - ⇒ declining natural flood mitigation.
- Encourage projects and activities which will restore the quality of the State's wetlands, such as:
  - ⇒ rehabilitating wetlands;
  - ⇒ re-establishing areas of buffer vegetation around wetlands; and
  - ⇒ ensuring adequate water to restore wetland habitats. (*DLWC, 1996*).

- Management of wetlands is currently an ad hoc process. Typical influences on wetland management are evident from the role of government agencies, viz:
  - ⇒ 'A DEC officer decides how much industrial effluent can be discharged into a river upstream of a wetland;
  - ⇒ A DNR officer decides how much water to release from a dam or how much water can be extracted from a river upstream of a wetland;
  - ⇒ A council planner decides how a wetland should be zoned or what design or operating conditions to apply to a new development; and,
  - ⇒ A grazier decides how many head of cattle to graze in a swamp paddock.' (*DLWC, 1996*).

Legislation to establish procedural and permit requirements for activities affecting wetlands includes, but is not limited to, the *Environment Planning & Assessment Act 1979*, the *Clean Waters Act 1970*, the *Water Act 1912*, the *Crown Lands Act 1989*, the *National Parks and Wildlife Act 1974*, the *Coastal Protection Act 1979*, and the *Fisheries Management Act 1994* (*DLWC, 1996*).

5.7 LOCAL PLANNING CONTROLS

5.7.1 Regional Environmental Plans

A Regional Environmental Plan (*REP*) provides the broad regional framework and objectives which must be reflected in local planning instruments.

The REPs covering the Eurobodalla Shire are the *Lower South Coast Regional Environmental Plan (No.1) – High Rise Buildings* and the *Lower South Coast Regional Environmental Plan (No.2).*

REP No.1 aims to conserve scenic and environmental character and to protect the coast's visual quality by setting height limits for buildings.

REP No.2 has specific objectives applying to environmental features. Specifically it requires that local governments adhere to particular objectives and guidelines for the following key management areas when developing a Local Environmental Plan (*LEP*):

- **The Environment**, including natural areas, coastal and waterway environments, environmental hazards, and heritage;
- **Rural Land**
- **Natural Resources**, including water, geological, fishery and forestry resources;
- **Urban Land**, including strategic planning, residential development and commercial and industrial development;
- **Tourism and Recreation**; and,
- **Regional Services**, including transport, utility and community services.

5.7.2 Eurobodalla Rural Local Environmental Plan (*1987*) and Urban Local Environment Plan (*1999*)

Based on the requirements of the Lower South Coast Regional Environmental Plans, Eurobodalla Shire Council has prepared two Local Environmental Plans (*LEPs*).

The *Eurobodalla Rural and Urban LEPs* cover the rural and urban areas within the catchment of the Moruya / Deua River estuary. The land use mapping shown in **Figure 7** has been extracted from both LEPs.

The LEPs direct and manage development and its environmental impacts in the Eurobodalla Shire. In relation to environmental protection, the main objectives of the LEPs are:

- "to protect coastal areas, estuaries, wetlands, rainforests and other environmentally sensitive areas from the effects of inappropriate use or development;
- to promote the retention of trees and tree cover and to conserve as far as practicable the existing pattern of vegetation to maintain landscape quality and remaining natural ecosystems;
- to conserve soil, flora and fauna and significant natural features;
- to provide for the existing and potential functions of water courses and floodways for domestic water supply, drainage, aquaculture, recreation and ecological purposes;
- to control development to the catchment areas of the Buckenbowra, Deua and Tuross Rivers and Deep and Dromedary Creeks to protect water quality for domestic purposes;
- to maintain the overall scenic beauty of the rural areas of the Shire of Eurobodalla and protect significant views from public roads, reserves and waterways;
- to maintain air quality and avoid noise pollution, having regard to the nature and extent of the effects and the sensitivity of affected people or things; and,
- to ensure that development or activity in one zone does not adversely affect environmentally sensitive land in adjacent zones".

The Urban LEP (*1999*) also contains the following objectives in relation to *ecologically sustainable development*:

- "to integrate economic, environmental and social goals into policies, practices and decision-making;
- to take a precautionary approach to decision-making to ensure that resources are utilised in a sustainable manner;
- to protect biological diversity;
- to ensure that natural and environmental assets are properly valued; and,
- to provide for equity within and between generations".

The LEPs also address issues relating to management of rural land, heritage conservation, transport, recreation and tourism, housing and industry and commerce.

They aim to address these issues by implementing the following general strategies:

- "by applying general land use controls to land within each zone or for a class of development;
- by providing a framework for development control plans regulating the carrying out of development allowed in any particular zone;
- by preparing and adopting development control plans;

- by making provisions in development control plans or allowing conditions to be imposed on development consents to further the objectives of the LEPs;
- by advertising development proposals where there is a possibility of significant impact on any individual, the environment or the general public;
- by requiring full consideration of possible adverse environmental, economic or social impacts in advance of development in accordance with provisions of the *Environmental Planning and Assessment Act 1979*;
- by providing sufficient flexibility in planning controls to accommodate development proposals in accordance with the objectives of the LEPs;
- by requiring dedication of land, payment of monetary contribution or acceptance of a material public benefit or a combination of these as conditions of development consent, where appropriate, pursuant to section".

There are several areas that fall within the category "Environmental Protection" that can strategically protect significant environmental areas within the Moruya / Deua Estuary.

The zone prohibits development that is likely to have a detrimental effect on a significant environmental area but allow for development that would not have a detrimental effect on the area. Land-use zoning for the environmental protection zone, as specified by the LEPs, is shown in **Figure 7**.

The New Local Environmental Plan

As discussed in **Section 5.3**, Council is required to prepare a new LEP within the next two to three years. It is recommended that the new LEP incorporate the following items:

- Mapping for LEP zones is to be updated to incorporate all areas of SEPP 14 Wetlands. Specifically, the wetland areas at Ryans Creek, Racecourse Creek, Moruya Heads and Pilot Station Backwater should be zoned as Environmental Protection (*7a*) (*refer* **Figure 7**).
- The new LEP should incorporate the requirements currently contained in Council's separate Acid Sulphate Soils Policy (*refer below*) to give statutory effect to these requirements. A separate policy would no longer be required.
- The new LEP is to include provisions for climate change and the associated impact on sea level rise.

5.7.3 Development Control Plans

Development control plans (*DCPs*) are statutory documents formulated by Council to guide and facilitate orderly development within the entire local government area (*LGA*) or portion of the LGA as defined by the DCP. DCPs are planning instruments supplementary to the LEPs. The DCPs relevant to the management of the Moruya / Deua River Estuary have been identified and are briefly described below.

Moruya Valley Floodplain DCP

This Development Control Plan provides detailed controls for development in and around lands affected by flooding of the Moruya River and its tributaries. Specifically, it identifies

the location of areas liable to flooding as contained in the Moruya River Floodplain Management Plan (*1999*) and also provides details regarding the determination of the Flood Planning Level (*FPL*) for new development.

Moruya Town Centre Development Guidelines DCP

This Development Control Plan provides detailed controls to achieve the objectives of the Eurobodalla Urban Local Environmental Plan 1999 (*LEP*) in relation to development in the Moruya Town Centre.

The DCP is applicable for the general CBD area between Moruya River and the Princes Highway at Ford Street. Among other objectives, the DCP aims to:

- "encourage the creation of an effective and attractive commercial precinct;
- reinforce the role of Moruya Town Centre as a service centre to the surrounding hinterland;
- provide design guidelines which reflect the heritage theme and provide guidance for the future direction and appearance of development in the Moruya Town Centre"; and,
- recognise the importance of pedestrian amenity in the Town Centre by reducing conflict with through traffic and providing for the integration of commercial development with open space and pedestrian areas".

DCP Industrial Development Guidelines

This Development Control Plan applies to all land zoned as commercial and industrial, and also road corridors, rural agriculture and urban expansion zones (*refer* **Figure 7**). Of particular relevance to the Moruya River catchment is the North Moruya Industrial Estate, from which stormwater runoff discharges to Malabar Creek and Malabar Lagoon.

The DCP aims to:

- "encourage economic development;
- encourage good design and appearance of industrial development which enhances the character of the Shire;
- ensure that individual industrial developments have minimal adverse effects on surrounding properties and the natural environment; and,
- ensure that waste minimisation and management is thought about in the planning phase of development to encourage long term avoidance reuse and recycling of waste and to reduce the amount of material disposed of at landfills".

In order to ensure minimal adverse effects on the natural environment, the DCP includes provision for drainage and pollution controls to remove gross pollutants and sediment before discharge of stormwater runoff to natural receiving waters.

Specifically in relation to the development of industry in rural zones, the role of the DCP is to ensure that industry be located in rural areas only when no other areas are suitable, that

industry is located to minimise impacts on environmentally sensitive areas and that there is no undue proliferation of industries in any one area.

The Moruya Structure Plan (*2007*) recommends that a new DCP for industrial development be prepared.

DCP 156 – Rural Subdivision

This Development Control Plan applies to all land zoned as *rural agriculture*, *rural residential* and *environment protection* (*refer* **Figure 7**).

Among other objectives, the DCP aims to:

- "provide protection for environmentally sensitive areas such as wetlands, rainforest, closed canopy forest and other significant areas of native vegetation, steep land, watercourses, drainage lines, areas prone to flooding or erosion and Aboriginal archaeological relics;
- encourage retention of trees generally and preserver prominent ridgelines and other scenic areas in their natural state to protect the visual amenity; and,
- promote replanting, with indigenous species, on currently cleared ridges and other scenically significant areas".

The DCP requires that subdivision designs should maximise the retention of native vegetation and minimise the potential for erosion, sedimentation and contamination of watercourses.

DCP 182 – Urban Expansion Zones

This Development Control Plan applies to all land zoned for urban expansion in the Eurobodalla Shire Rural LEP (*1987*) (*refer* **Figure 7**).

The DCP was last updated in 1993. Since that time Council has updated information and requirements for the Urban Expansion Zone regarding environmental constraints and appropriate lot sizes.

Furthermore, the future land use zoning discussed in **Section 5.3** (*refer* **Appendix F**) as part of the new LEP indicates that the Urban Expansion Zone within the Moruya River catchment is to be rezoned as *Large Lots*, *Low Density* or *Environmental Living*.

Zone 2t Residential – Tourism Development Guidelines DCP

This Development Control Plan applies to all land zoned 2t Residential under the Urban LEP (*refer* **Appendix E**). There are parcels of this land within the Moruya Central Business District, near the Moruya Hospital on the south bank of Moruya River and at Moruya Heads.

This DCP primarily relates to appropriate heights for tourism development, the visual character of development, adequate provision of parking and access and waste management.

DCP Residential Design Code 2004

This Development Control Plan is to be used in the preparation of development applications for single dwelling houses and multi-unit developments (*dual occupancy, integrated housing, residential flat buildings*) and subdivision.

In addition to objectives that relate to the quality of housing design and the suitability of housing structures within the community, the DCP includes the following aims that are relevant to management of the Moruya River Estuary:

- "protect and/or re-establish environmental integrity by retaining and enhancing ecological values and environmentally sensitive areas;
- ensure residential development complements and enhances the scenic quality of natural areas and coastal waterway environments of the Shire; and,
- encourage energy and water efficient residential development through the use of solar energy and other design elements in order to promote the principles of sustainable development and reduce greenhouse gas emissions and implement water sensitive urban design".

To address these aims, the DCP includes descriptions of design principles for developers to follow when subdividing or designing residential buildings. In terms of drainage and water use management, the DCP incorporates the principles of Water Sensitive Urban Design (*WSUD*). The principles are accompanied by suggested design methods to meet the requirements of the design principles.

Acid Sulphate Soils Policy

The issue of Acid Sulphate Soils (*ASS*) is not addressed in Council's existing Urban and Rural Local Environmental Plans. However, provision is made for the management of ASS in Council's existing ASS Policy. As part of this policy, Council has prepared maps of acid sulphate soil risk based on the environmental risk categories outlined in **Table 5**. A copy of Council's ASS mapping is contained in **Appendix H**.

Due to the significance of acid sulphate soils to the maintenance of estuary water quality and therefore the health of aquatic ecosystems, the ASS policy requires that any development proposal on land classified as any risk category within **Table 5**, be required to provide evidence of an assessment of the potential for the generation of actual acid sulphate soils as a result of proposed activities for the development, and that where a real risk exists, the developer be required to outline proposed management measures to minimise the potential for acid runoff to the estuary or adjoining wetlands.

As discussed above, it is recommended that the requirements of Council's ASS policy be incorporated into the new LEP for Eurobodalla Shire. This is in accord with a similar recommendation contained in the Eurobodalla Settlement Strategy (*ESC, 2006h*).

Table 5 ENVIRONMENTAL RISK CATEGORIES FOR ACID SULPHATE SOILS

CLASS	DEVELOPMENT CONTROL REQUIREMENTS
1	Any works
2	Works below the ground surface Works by which the water table is likely to be lowered
3	Works beyond one metre below the natural ground surface Works by which the water table is likely to be lowered beyond 1 metre below natural ground
4	Works beyond two metres below the natural ground surface Works by which the water table is likely to be lowered beyond 2 metres below natural ground
5	Works within 500 metres of adjacent Class 1, 2, 3 or 4 land which are likely to lower the watertable below 1 metre AHD on the adjacent Class 1, 2, 3 or 4 land

Water Sensitive Urban Design Policy

Eurobodalla Shire Council is currently preparing a shire-wide policy for Water Sensitive Urban Design (*WSUD*). At the present time a draft code of practice is being developed and reviewed within Council.

As discussed above, WSUD principles are currently included in the existing Residential Design Code DCP. However, the development of a separate policy is strongly supported.

The draft code of practice currently relates to generic requirements issued by the Environment Protection Authority (*EPA*) regarding nutrient and pollutant levels in stormwater discharge from subdivisions. It is planned that requirements for detailed modelling of systems (*such as the industry standard MUSIC modelling*) will be included in the final policy.

5.8 LOCAL STRATEGIES, POLICIES, AND MANAGEMENT PLANS

5.8.1 Strategies and Plans

Southern Rivers Catchment Action Plan 2006

The Catchment Action Plan (*CAP*) was prepared under the *Catchment Management Authorities Act 2003* to integrate, enhance and build upon the South East Catchment and Southern Catchment Blueprints (*2002*) and regional plans and strategies.

A list of priority "hotspots" and issues that require on-ground works, planning information exchange or other targets for investment, have been carried over from the Blueprints to the CAP. Current local priorities and scientific information are also incorporated into the CAP.

The CAP includes five separate programs, which each comprise a Catchment Target and a series of Management Targets that detail the outcomes that are required to achieve the catchment target. The programs for the Southern Rivers CAP are *Community and Partnerships, Biodiversity, Soils and Land Capability, Coast and Marine,* and *Water*.

The CAP recognises that the Southern Rivers region plays host to many "estuaries and coastal lakes that are in surprisingly good condition". Therefore the Coastal and Marine Management Target No.2 (*CM2*) states that "by 2016 the condition of estuaries will be maintained or improved through development and implementation of natural resource management plans (*including estuary management plans*)".

Methods to meet this goal include engaging landholders in measures to protect estuaries, establishing partnerships with estuary users (*e.g., oyster farmers*) and improving the extent of riparian habitat and fish habitat. The SRCMA is currently working with (*or intends to work with*) oyster farmers, recreational and commercial fishers, boaters and tourism operators.

Related targets to CM2 fall within the categories of Community and Partnerships, Water and Soils and Land Capability.

A Eurobodalla Sub-regional Plan is currently being developed by SRCMA, which will address each catchment management target on a local scale in the Eurobodalla Shire. To do this, the Sub-regional Plan will incorporate specific actions and projects required, or currently being undertaken, for each major catchment in the Shire, including the Moruya River catchment. It is envisaged that several actions and recommendations developed for the Moruya / Deua River Estuary Management Plan will feed into the Sub-regional Plan.

Ecosystem Health Monitoring Program 2007

The Southern Rivers CMA has recently prepared a report titled, *'Development of an Ecosystem Health Monitoring Program for the Estuaries and Coastal Lakes in the Southern Rivers Catchment Management Authority Region (2007)'*.

The report outlines the objectives, framework and components of an Ecosystem Health Monitoring Program (*EHMP*) for the Southern Rivers region. The program has not yet been established and requires the support of the Councils in the Southern Rivers region.

Ecosystem health monitoring considers a range of primary ecosystem health indicators, including seagrass depth limits, Chlorophyll *a*, seagrass, mangrove and saltmarsh extents, water clarity/turbidity and wetland health assessments, in addition to the more traditional water quality suite of indicators such as temperature, salinity and pH. Secondary indicators include nutrients, faecal coliforms, reported fish kills and closures to the shellfishery.

The report by SRCMA also contains an indicative sampling regime for each primary health indicator and an estimate of the costs to implement the EHMP. The preliminary costs allow for the selection of up to 8 riverine estuaries across four Local Government Areas to be selected for the program.

Based on vulnerability assessments by the former DNR (*Department of Natural Resources*) and Healthy Rivers Commission classification, Moruya River estuary has been assigned a *medium* priority for inclusion in the EHMP for the Southern Rivers region. The estuary system is considered to be subject to poor dilution, but is also considered to be quick flushing.

However, given the fact that Moruya River is considered to be one of three major tributaries in the Eurobodalla Shire, it is therefore recommended that it be included in the program (*subject to its establishment*).

Eurobodalla Settlement Strategy 2006

The *Eurobodalla Settlement Strategy* (*2006*) is the product of merging the draft Rural Lands Strategy and the draft Urban Settlement Strategy into a combined strategy.

The objectives of the Strategy are in accordance with the principles of ecologically sustainable development (*ESD*). Eurobodalla Shire Council actively markets the South-East Coast of NSW as the 'Nature Coast'.

Accordingly, the Strategy makes provisions for environmental protection of water quality, the coastline, biodiversity, coastal wetlands, endangered fauna and habitat as part of the decision making process for future development in the shire.

These key areas of management are incorporated as data layers into Council's Geographic Information System (*GIS*) for the purpose of undertaking Strategic Environmental Assessment (*SEA*) with regard to land use planning and decision making for development applications.

The Strategy also contains a list of recommended 'actions' to ensure that each aspect of future development is in accordance with the principles of ecologically sustainable development.

Moruya Structure Plan 2007

The Moruya Structure Plan will provide a framework for decisions regarding future land use zoning at Moruya that will assist in the preparation of the new Local Environmental Plan for Eurobodalla. The Plan provides a strategic planning framework for protection of the environment from new housing and business development in and around Moruya and Moruya Heads.

The proposed changes to land use zoning documented in the Plan that are relevant to management of the Moruya River Estuary are discussed above in **Section 5.3**.

The Plan also includes recommendations regarding the following:

- Development of a new DCP for industrial development (*refer* **Section 5.7**).
- The requirement for edge-roads between new urban areas and foreshore reserves to provide views to the foreshore and distant views.
- Height limits for high-rise buildings, including 2 storey maximum for residential dwellings.
- Water Sensitive Urban Design (*WSUD*) principles to be applied to the design of road drainage systems at Moruya Heads.
- Tourist style accommodation to be limited to smaller scale development, not higher than 2 storeys.

Urban Stormwater Quality Management Plan 2001

The USQMP for Eurobodalla Shire includes a specific sub plan for the management of stormwater runoff that discharges to Moruya River from the residential areas at Moruya and Moruya Heads.

The Plan incorporated a list of proposed management options to address stormwater quality key issues and objectives for Moruya River. These options included the following hard works:

- Installation of trash removal devices at the two stormwater outlets located to the east of the Princes Highway bridge;
- Seal road shoulders on South Head Road between Princes Highway and Keightley Street;
- Dust seal Hawdon Street up to Albert Street; and,
- Dust seal the road to the Moruya Sewage Treatment Plant.

According to information from Council's officers, the above works specified in the USQMP have been successfully implemented. In addition, Council is soon to commence the development of a revised Urban Stormwater Quality Management Plan for the shire. This Plan is expected to be ready within about 18 months, and will document a new range of stormwater quality management targets and measures.

As discussed above, the current requirements for stormwater quality control from the industrial estate at North Moruya are included in the existing DCP for Industrial Development (*refer* **Section 5.7.3**). However, the Moruya Structure Plan (*2007*) recommends that a new DCP for industrial development be prepared.

Rather than incorporate stormwater quality management controls for industrial sites within the new DCP, it is recommended that the revised USQMP include specific source control methods to deal with pollutants such as chemicals and nutrients that may be contained in stormwater runoff from industrial areas. Examples include bio-retention swales and other natural filtration techniques.

In addition, it is recommended that the revised USQMP also contain specific measures to ensure that stormwater discharges from the current Urban Expansion Zones (*refer* **Figure 7**) do not impact on the water quality of Moruya River once they have been rezoned as part of the new Local Environmental Plan (*refer* **Section 5.3**). Of particular importance are the areas west of Moruya and at Moruya Heads.

Eurobodalla Integrated Water Cycle Management Strategy 2002

The IWCMS for Eurobodalla includes a brief summary of the water cycle components for Moruya and Moruya Heads. It covers the areas of water supply, sewerage and stormwater management.

The Strategy reports that the current water supply system for Moruya and Moruya Heads will accommodate growth in these areas until at least the year 2032.

The sewerage system was upgraded about five years ago, which involved the construction of a connection line between South Head and the Moruya Sewage Treatment Plant (*STP*). The STP was also upgraded at the time to double its capacity. Increased level of chemical treatment for effluent was also incorporated. Reclaimed water from the plant is used to irrigate the Moruya Golf Course. The remaining effluent discharges to Ryans Creek. The Environment Protection Authority (*EPA*) issued a pollution reduction program to investigate the long term impact of the effluent discharges to the Moruya River estuary. Council is currently undertaking works to sewer the North Moruya Industrial Estate.

The IWCMS includes a Triple-Bottom-Line assessment for three combinations of management options to implement in the medium term and long term. The preferred scenario involves a combination of upgrades to the sewerage system (*which were underway at the time of preparation of the Strategy*), reuse of treated effluent in agricultural and industrial applications, and stormwater management in high priority areas that involves measures for stormwater detention during flood events.

Eurobodalla Sewage Management Strategy 1999

State legislation introduced in 1999 effectively made property owners who use septic and aerated sewage treatment systems more responsible for the management of their systems.

Council has adopted a Sewage Management Strategy that incorporates environmental monitoring programs, landowner reporting requirements and service industry co-ordination. Implementation of the Strategy and approval of systems is aided by a GIS risk classification system called *'SepticSafe'*, which assesses the soil, slope and water characteristics of sites.

Moruya River Floodplain Management Plan (*FPMP*) 1999

The floodplain management plan for Moruya River was developed on the basis of detailed computer flood modelling completed as part of the Moruya River Flood Study (*1992*) and Floodplain Management Study (*1996*).

The Plan includes a summary of the flooding characteristics of the Moruya River channel and floodplain, and categorisation of the flooded areas into '*floodways*', '*flood storage*' and '*flood fringe*'. A copy of mapping that shows these areas is contained in **Appendix F**.

The FPMP also contains cost estimates of flood damages for various design flood events such as the 1 in 100 year flood and the 'extreme' flood. However, it should be noted that these estimates were determined according to 1997 dollars.

More importantly, the Plan contains recommendations for planning and structural measures to mitigate and manage flood risk along Moruya River. These are organised in a schedule of works which includes an estimate of the costs for implementation at the time of preparation of the Plan.

Eurobodalla Bush Fire Risk Management Plan 2002

The Bush Fire Risk Management Plan is particularly relevant for management of riparian vegetation along the foreshore of Moruya River and its tributaries.

The Plan currently incorporates several exclusions under the *Native Vegetation Conservation Act 1997* relating to the Asset Protection Zone (*APZ*) and strategic fire management. These exclusions allow for bush fire hazard reduction works (*vegetation clearing*) to be undertaken up to within 20 metres from watercourses.

These exclusion can be considered to be conflicting with the Riparian Corridor Objective Setting (*RCOS, refer next section*) recommendations when applied to new development areas. It is accepted that the recommendations of the RCOS cannot be applied to all existing developments that have been positioned within or close to riparian corridors.

Riparian Corridor Objective Setting for Selected Streams between Batemans Bay and Moruya

This report was prepared by the Department of Natural Resources (*DNR*) in September 2006.

Riparian Corridor Objective setting includes establishing the following development and clearing setbacks for the protection and restoration of watercourses and their vegetated buffer zones according to the following categories:

- **Category 1** – Environmental Corridor. Minimum width of Core Riparian Zone (*CRZ*) to be 40 metres. An additional width of 10 metres is required for a vegetated buffer.
- **Category 2** – Terrestrial & Aquatic Habitat. Minimum width of Core Riparian Zone (*CRZ*) to be 20 metres. An additional width of 10 metres is required for a vegetated buffer.
- **Category 3** – Bank Stability & Water Quality. Minimum width of Core Riparian Zone (*CRZ*) to be 10 metres. Vegetated buffer zone is not generally required.

The Asset Protection Zone (*APZ*) for bush fire management is not considered to be part of, or contained within, the CRZ or vegetated buffer zone. In other words, the APZ between an asset (*such as a house*) and the closest vegetation should be measured from the outer edge of the vegetated buffer zone. Maintenance of the APZ is not to result in clearing of the CRZ or vegetated buffer.

The Moruya River has a *Category 1* riparian objective classification. As a major estuary, it also requires an increased CRZ of 80 metres plus a 10 metre vegetated buffer. The DNR report recognises that there are existing impediments to achieving a 90 metre wide riparian buffer such as urban developments and agricultural activities. Nonetheless, future opportunities to reclaim the appropriate vegetation widths may arise when changes in land use occur.

Due to the limited potential to implement buffers on private land, Council and other managers of public land need to capitalise on opportunities to the achieve the recommended Category 1 buffer width exist on public reserves adjacent to the Moruya River. Where a public reserve is not wide enough to achieve the recommended buffer width vegetation management measures should be implemented across the widest width possible.

Wamban Creek is classified as a standard *Category 1* stream. *Category 2* streams that feed into Moruya River include Candoin Creek, Dooga Creek, Malabar Creek, Gilmores Creek, Mogendoura Creek and Racecourse Creek. Other streams and unnamed creeks are classified as *Category 3*.

Batemans Marine Park Zoning Plan

The zoning plan for the Batemans Marine Park (*BMP*) came into effect in June 2007. A copy of the plan is provided in **Appendix I**.

The new marine park includes Moruya River as a '*General Use Zon*e' and Malabar Creek/Lagoon as a '*Sanctuary Zone*'. This zoning means that Moruya River is open to all forms of commercial fishing other than trawling, dredge fishing and long line fishing.

As a sanctuary zone, Malabar Creek and Lagoon is closed to all recreational and commercial fishing and materials/food collecting. Sanctuary Zones provide the highest level of protection for the habitat, animals and plants and areas of cultural significance. Only activities that do not harm plants, animals and habitats are permitted.

As shown in **Appendix I**, most of the larger estuaries within the marine park, such as Batemans Bay, Tuross Lake and Wagonga Inlet, are now zoned for '*Habitat Protection*' or as a sanctuary zone. These zoning types also apply to a significant proportion of the coastline within the Marine Park limits.

Habitat protection zones conserve marine biodiversity by protecting habitat and reducing high impact fishing activities. This zoning prohibits most common forms of commercial fishing. As discussed in **Section 4.2.5**, there is concern therefore, that commercial fishing activities will become concentrated within Moruya River and other locations that are zoned for General Use.

Eurobodalla Biodiversity Program

The Eurobodalla Biodiversity Program was established by the Southern Rivers Catchment Management Authority (*SRCMA*) and Eurobodalla Shire Council to develop a targeted program for conservation of biodiversity on private lands.

The program offers a combination of financial incentives and technical advice and support for private landholders. They are provided with training to develop skills to help them prepare property management plans and applications for funding to complete projects.

As part of the program, landholders are required to enter into a 10-year management agreement with Council and the SRCMA. Roughly 60% of participants own farms and the remainder own properties larger than 10 hectares.

The Biodiversity Program provides funding for the following activities:

- Acid Sulphate Soils remediation;
- Erection of fencing for livestock control;
- Installation of watering systems

- Activities for recovery of threatened species;
- Protection of Endangered Ecological Communities; and,
- Works to stabilise creek beds.

Additional Programs by Southern Rivers Catchment Management Authority

The SRCMA operates a *Coast and Estuaries Incentives Program* that has supported various works within the Moruya River catchment, including projects at Ryans Creek, Moruya Riverside Park, Yarragee Reserve and several riverside areas of Endangered Ecological Communities (*EECs*).

The SRCMA's *Roads and Tracks Program* has contributed to maintenance works along Araluen Road to reduce the sediment load to the Deua River. This has included drainage upgrade works and road sealing.

The SRCMA also administers a *Bringing Back the Fish Program*, which offers assistance to projects such as the removal of barriers to fish passage.

It should be noted that these current programs are NHT2 (*Natural Heritage Trust*) funded programs. NHT3 will be introduced in June 2008, which may produce changes in Federal and NSW Government investor preferences for regional natural resource management. Although the SRCMA will continue to support estuary management, these programs may be operated under different names.

Eurobodalla Waterways Infrastructure Strategy 2002

This strategy provides an assessment of the existing and required infrastructure on the shire's waterways, such as wharves, jetties and boat launching ramps.

The Strategy includes the following recommendations for the construction or upgrade of waterway facilities on the Moruya River:

- Sealing of carpark at the Preddys Wharf launching ramp (*refer* **Figure 3**);
- Installation of public toilets at Preddys Wharf;
- Construction of a pontoon at Preddys Wharf;
- Sealing of carpark at Brierleys Ramp at North Head (*refer* **Figure 3**);
- Undertake minor improvement works for Brierleys Ramp and install a new jetty.

The above works have been completed since implementation of the Strategy in 2002.

Council has indicated that a revised Waterways Infrastructure Strategy is currently being developed. It is planned that the revised strategy will incorporate requirements for the shut-down of all informal (*i.e., not maintained by Council*) boat ramps within the Eurobodalla Shire as standard policy.

Eurobodalla Bike Plan 1999

The Bike Plan includes a summary of works to provide cycleway facilities across Eurobodalla Shire. The works are separated into priority one and priority two facilities and priority three (*long term*) facilities.

Priority One works proposed for the Moruya area include sealing the road shoulder on South Head Road between Keightley Street (*about 800 metres from the western limit of South Head Road*) to Native Way at Moruya Heads. As shown in the cycleway plan extracted from the Moruya Structure Plan (*refer* **Appendix F**), a significant length of cycleway has been constructed between Native Way and Millers Crescent near Preddys Wharf.

The five year plan is to continue the cycleway to the Princes Highway. The 20 year plan would be a cycleway along the foreshore to link Moruya Heads with Moruya via the Ryans Creek wetlands and riverside park (*refer* **Appendix F**).

The Bike Plan refers to the foreshore cycleway through Ryans Creek wetland as a Priority Three (*long term*) facility.

5.8.2 Specific Management Plans

Plan of Management for Moruya Riverside Park and Surrounds 2005

This Plan of Management (*PoM*) incorporates the following adjoining areas along the south bank of Moruya River, immediately east of the Princes Highway Bridge:

- Russ Martin Park;
- The Moruya War Memorial Swimming Pool;
- Moruya Town Wharf and Boat Ramps;
- Moruya Riverside Park (*the old Moruya Caravan Park*);
- Ryans Creek Parkland; and,
- Ryans Creek wetland.

The PoM contains several strategies and actions that are to be implemented to better manage the park. Strategies most relevant to riparian foreshore management include:

- the development of carparking areas and an access road for Ryans Creek parkland and wetland;
- installation of park furniture and bins at Ryans Creek parkland and wetland;
- remove weed species and develop a weed removal/control program;
- restriction of grazing and vehicular access in the vicinity of wetland areas and Endangered Ecological Communities (*EECs*);
- fencing for a 60 metre buffer zone to be provided around the riverbank and wetland areas;
- prohibition of camping in all areas, with the exclusion of Moruya Riverside Park during special events.

Other proposed activities at the Riverside Park include cultural, social and recreational initiatives such as:

- preparation of a Cultural Development Action Plan, including provisions for public art, festivals, events and performances;
- development of facilities for regular weekend markets;
- development of a Visual and Performing Arts Centre;
- nomination of Aboriginal places and sites for inclusion in the DECC register and preparation of conservation plans where required;
- development of an outdoor amphitheatre for special events and performances; and,
- development of a marketing and advertising program for the park, including appropriate signage to attract tourists and locals.

Several strategies have been implemented since adoption of the PoM. An unsealed access road and adjacent carparking areas have been provided through Ryans Creek parkland. Interpretive signage has been erected to engage and educate visitors to the park.

Removal of weeds has occurred across a majority of the parkland and foreshore reserve. Fencing to restrict stock access has been installed and new vegetation has been planted. During the community drop-in centre held in April 2007, members of the local community voiced their support for the works completed to date.

Funding has been received from the Southern Rivers Catchment Management Authority and the Department of Environment and Climate Change (*DECC*) to assist in the implementation of works to date.

Plan of Management for Yarragee Reserve 2006

Yarragee Reserve is located on the inside bend in Moruya River approximately seven kilometres upstream from the Moruya township (*refer* **Figure 4**).

The PoM for Yarragee Reserve includes strategies that primarily relate to foreshore access and riparian vegetation management. The main priorities of the Plan are to restrict and formalise vehicular access, improve pedestrian access to the foreshore and revegetate areas with native species to control weeds and promote bank stabilisation.

Based on a site inspection in April 2007, significant work has been completed to formalise the vehicular access to the reserve, including several carparking spaces that are lined with bollards to prevent access to grassed areas. SRCMA and DECC have contributed funding to undertake these works.

Signage has also been installed at the reserve. However, access to the foreshore by four-wheel-drive vehicles is still possible through gates that were previously locked but have now been vandalised. For the moment, gravel tracks to the foreshore appear to continue to provide vehicular access. The informal boat ramp appears to remain in use, as evidenced by fresh vehicular tracks in the sand.

Rehabilitation of Moruya River Foreshore – Glenduart Reserve 2006

This brief report to the Works and Facilities Committee was prepared by Council's Environment Team. Glenduart Reserve is approximately 13 ha in size and is located on the north bank of Moruya River, about three kilometres upstream from the Princes Highway Bridge.

This report is not a formal management plan for Glenduart, but was prepared in order to present options to rehabilitate and protect natural and cultural heritage assets at the site. It summarises a 3 to 5 year program for management of the reserve. Protection and restoration of native riparian vegetation is the primary objective of the program.

The program intends to re-instate riparian and floodplain vegetation communities to Glenduart Reserve, with the first stage aiming to facilitate natural re-growth and planting across a 30 metre wide vegetation zone. Additional stages will extend the width of the riparian buffer with each successive planting.

Stage 1 of this program involves the following:

- protection of cultural heritage assets, in particular the Glenduart Cemetery and Aboriginal sites;
- identification of encroachments into the reserve from adjoining private properties;
- community consultation to determine the social use and values of the reserve;
- control of invasive weeds;
- protection of existing remnants of the riparian corridor, including the two Endangered Ecological Communities (*EECs*) at Glenduart;
- commencement of revegetation works; and,
- preparation of the site for future regeneration works.

Council's Environment Team has already undertaken community consultation activities with local Glenduart residents. This involved informal liaison with residents to discuss potential management options for riparian vegetation.

A Landscape Concept Plan for Glenduart Reserve is currently being prepared. The Plan will identify access locations and fire mitigations strategies and will provide Council with a program and priority list for the proposed environmental works.

6 ESTUARY MANAGEMENT STRATEGIES

6.1 MANAGEMENT OBJECTIVES

The primary objective of the Moruya / Deua River Estuary Management Plan is to develop a range of management options or strategies for maintaining and improving estuary condition and function. These options should include measures that will protect the essential features of the estuary (*e.g., the primary estuary processes*), resolve key issues and improve opportunities for estuary usage. However, prior to developing specific management measures aimed at achieving these goals, it is necessary to identify a set of specific management objectives.

Accordingly, a provisional list of management objectives was prepared based on a review of background documents, site inspections and feedback from the Estuary Management Committee during the first Committee workshop. The objectives were developed with the aim of addressing the key issues facing the future management of the estuary. They also considered the need to preserve or improve the condition of identified essential estuary features and to resolve conflicts between various estuary uses.

6.1.1 Committee Response to Estuary Management Objectives

The provisional list of management objectives was forwarded to the Committee prior to Committee Workshop #2, held in February 2007 (*refer* **Section 2.1.2**). As with the key issues and essential features assessments, a proforma was prepared listing the provisional management objectives. Committee members were asked to review the proforma and to rank the relative importance of the listed management objectives.

At the second Committee Workshop, the management objectives were discussed and prioritised. From the Committee's perspective, the highest ranked objectives are:

- Maintain existing good water quality;
- Protect and restore riparian vegetation;
- Protect and preserve aquatic habitats (*including seagrasses and saltmarsh*);
- Restrict stock access to foreshore and wetland areas; and,
- Rehabilitate eroded sections of the riverbank and damaged sections of existing bank stabilisation works.

These results are consistent with the outcomes of the key issues and estuary attributes assessments. They show that the most important overall objective, as determined through discussions with the Committee, is to improve the environmental health and sustainability of the estuary.

6.1.2 Adopted Estuary Management Objectives

The outcomes from Workshop #2 were combined with the response to key issues from the community at the Community Drop-in Centre to compile a finalised set of adopted management objectives for the estuary (*refer* **Table 6**).

Also considered is the management of potential sea level rise and other issues associated with climate change, as highlighted through consultation with the Department of Environment and Climate Change (*DECC*).

Table 6 MANAGEMENT OBJECTIVES FOR THE MORUYA / DUEA RIVER ESTUARY

ADOPTED MANAGEMENT OBJECTIVES	RANKING
⇒ MAINTAIN EXISTING GOOD WATER QUALITY	**1**
⇒ PROTECT AND RESTORE RIPARIAN VEGETATION	**2**
⇒ PROTECT AND PRESERVE AQUATIC HABITATS (*INCLUDING SEAGRASSES AND SALTMARSH*)	**3**
⇒ RESTRICT STOCK ACCESS TO FORESHORE AND WETLAND AREAS	**4**
⇒ REHABILITATE ERODED SECTIONS OF THE RIVERBANK AND DAMAGED SECTIONS OF EXISTING BANK STABILISATION WORKS	**5**
⇒ CONSIDER AND MANAGE THE IMPACTS OF CLIMATE CHANGE ON ESTUARY PROCESSES	**6**
⇒ IMPROVE EDUCATION AND AWARENESS OF ESTUARY ISSUES	**7**
⇒ INCREASE CONNECTIVITY OF FORESHORE HABITATS (*WILDLIFE CORRIDORS*)	**8**
⇒ REDUCE AND PREVENT FURTHER SEDIMENTATION OF THE ESTUARY	**9**
⇒ UNDERSTAND, SUSTAIN AND IMPROVE FISH PRODUCTIVITY IN THE ESTUARY	**10**
⇒ IMRPOVE FORESHORE ACCESS AND FACILITIES FOR RECREATION	**11**
⇒ PROVIDE FOR SUSTAINABLE DEVELOPMENT OF THE ESTUARY	**12**
⇒ PROMOTE SUSTAINABLE TOURISM FOR THE ESTUARY	**13**
⇒ TIGHTER ENFORCEMENT OF DEVELOPMENT CONTROLS	**14**
⇒ PROTECT AND RESTORE ABORIGINAL AND EUROPEAN HERITAGE	**15**
⇒ RESOLVE CONFLICTS BETWEEN DEVELOPMENT CONTROLS AND OTHER POLICIES	**16**
⇒ MAINTAIN AND ENHANCE VISUAL AESTHETICS AND QUIET RURAL LIFESTYLE	**17**
⇒ PROMOTE SUSTAINABLE INDUSTRY FOR THE CATCHMENT AND FLOODPLAIN	**18**

6.2 POTENTIAL MANAGEMENT OPTIONS AND STRATEGIES

The adopted management objectives have been used to develop strategies and actions for the sustainable management of the estuary and adjoining catchment into the future. To confirm the relevance of each management objective, they have been linked to the adopted key issues that are identified in **Section 4.1.4**. The linkages between the identified issues, the key attributes and the adopted management objectives are represented in **Table 7**. The table is arranged in order of ranked key issues.

As to be expected and shown by comparison of **Table 6** with **Table 7**, the highest ranked objectives are generally aimed at addressing the highest ranked management issues. Examples include *'maintain existing good water quality'* and *'protect and restore riparian vegetation'*. These two objectives are related to most of the top five ranked issues (*refer* **Table 7**).

Technical assessment of available scientific information contained in the *Moruya / Deua River Estuary Processes Study (ESC, 2003c)*, background documents and existing Council and State planning instruments was also undertaken in the development of suitable management options.

A provisional list of potential management strategies was presented to the Estuary Management Committee at Committee Workshop #2, held in February 2007. The Committee was requested that they provide feedback regarding the provisional strategies so that a refined list of preferred measures and strategies could be developed. Several responses were received and considered.

Several of the works-related strategies were also presented to the local community at the Community Drop-in Centre held in April 2007. Local residents offered comments during the Centre and also provided detailed feedback following the event. The strategies were also contained in the Community Information Brochure that was distributed at the Drop-in Centre and later made available on Council's website (*refer* **Appendix C**).

Through consideration of the response from the Committee and the community, a range of recommended measures and strategies were developed with the aim of initiating better management and improvements to the estuary.

The following section describes each recommended management strategy and the actions required to achieve each strategy.

Table 7 LINKAGES BETWEEN KEY ISSUES, ESSENTIAL FEATURES AND MANAGEMENT OBJECTIVES

KEY ISSSUES (*ranked*)	ESSENTIAL FEATURES	ADOPTED MANAGEMENT OBJECTIVES
1. RIVERBANK EROSION	• Mangroves • Riparian vegetation / corridors • Cultural heritage sites • Permanent trained entrance • Camping and caravan parks • Recreational fishing • Scenic amenity • Clean, clear water	• REHABILITATE ERODED SECTIONS OF THE RIVERBANK AND DAMAGED SECTIONS OF EXISTING BANK STABILISATION WORKS • RESTRICT STOCK ACCESS TO FORESHORE AND WETLAND AREAS • REDUCE AND PREVENT FURTHER SEDIMENTATION OF THE ESTUARY • PROTECT AND RESTORE RIPARIAN VEGETATION • MAINTAIN EXISTING GOOD WATER QUALITY • CONSIDER IMPACTS OF CLIMATE CHANGE ON ESTUARY PROCESSES
2. DEVELOPMENT CONTROLS	• Riparian vegetation / corridors • Mangroves • SEPP 14 Wetlands • National Parks and reserves • Foreshore access • Recreational fishing • Industry • Agriculture • Quiet rural lifestyle	• TIGHTER ENFORCEMENT OF DEVELOPMENT CONTROLS • RESOLVE CONFLICTS BETWEEN DEVELOPMENT CONTROLS AND OTHER POLICIES • PROMOTE SUSTAINABLE TOURISM FOR THE ESTUARY • PROMOTE SUSTAINABLE INDUSTRY FOR THE CATCHMENT AND FLOODPLAIN • PROTECT AND RESTORE RIPARIAN VEGETATION • MAINTAIN AND ENHANCE VISUAL AESTHETICS AND QUIET RURAL LIFESTYLE • CONSIDER IMPACTS OF CLIMATE CHANGE ON ESTUARY PROCESSES
3. LACK OF RIPARIAN VEGETATION	• Riparian vegetation / corridors • SEPP 14 Wetlands • Terrestrial fauna • Coastal swamps • Mangroves • Picnicking and foreshore access • Camping and caravan parks	• PROTECT AND RESTORE RIPARIAN VEGETATION • INCREASE CONNECTIVITY OF FORESHORE HABITATS • RESTRICT STOCK ACCESS TO FORESHORE AND WETLAND AREAS • MAINTAIN EXISTING GOOD WATER QUALITY • RESOLVE CONFLICTS BETWEEN DEVELOPMENT CONTROLS AND OTHER POLICIES • TIGHTER ENFORCEMENT OF DEVELOPMENT CONTROLS • CONSIDER IMPACTS OF CLIMATE CHANGE ON ESTUARY PROCESSES
4. UNCONTROLLED STOCK ACCESS	• SEPP 14 Wetlands • Saltmarshes • Riparian vegetation / corridors • Picnicking and foreshore access • Recreational fishing • Clean, clear water • Cultural heritage sites	• RESTRICT STOCK ACCESS TO FORESHORE AND WETLAND AREAS • REDUCE AND PREVENT FURTHER SEDIMENTATION OF THE ESTUARY • PROTECT AND RESTORE RIPARIAN VEGETATION • INCREASE CONNECTIVITY OF FORESHORE HABITATS
5. COMMUNITY EDUCATION AND INVOLVEMENT	• Riparian vegetation / corridors • Clean, clear water • Cultural heritage sites • Swimming • Picnicking and foreshore access • Recreational fishing	• IMPROVE EDUCATION AND AWARENESS OF ESTUARY ISSUES • MAINTAIN EXISTING GOOD WATER QUALITY • PROMOTE SUSTAINABLE TOURISM FOR THE ESTUARY • PROTECT AND RESTORE ABORIGINAL AND EUROPEAN HERITAGE

KEY ISSSUES (*ranked*)	ESSENTIAL FEATURES	ADOPTED MANAGEMENT OBJECTIVES
6. PRIMARY PRODUCTIVITY OF THE ESTUARY	• Recreational fishing • Commercial fishing • Aquatic fauna • Seagrass beds • Tourism • Oyster / aquaculture industry • Clean, clear water	• UNDERSTAND, SUSTAIN AND IMPROVE FISH PRODUCTIVITY IN THE ESTUARY • PROTECT AND PRESERVE AQUATIC HABITATS • IMPROVE EDUCATION AND AWARENESS OF ESTUARY ISSUES • PROMOTE SUSTAINABLE TOURISM FOR THE ESTUARY • CONSIDER IMPACTS OF CLIMATE CHANGE ON ESTUARY PROCESSES
7. ACCESS TO WATERWAY	• Picnicking and foreshore access • Swimming / snorkelling • Recreational fishing • Recreational power-boating and waterskiing • Tourism • Riparian vegetation / corridors • SEPP 14 Wetlands • Quiet rural lifestyle • Cultural heritage sites • Clean, clear water	• IMRPOVE FORESHORE ACCESS AND FACILITIES FOR RECREATION • PROMOTE SUSTAINABLE TOURISM FOR THE ESTUARY • RESTRICT STOCK ACCESS TO FORESHORE AND WETLAND AREAS • MAINTAIN AND ENHANCE VISUAL AESTHETICS AND QUIET RURAL LIFESTYLE • TIGHTER ENFORCEMENT OF DEVELOPMENT CONTROLS • IMPROVE EDUCATION AND AWARENESS OF ESTUARY ISSUES • CONSIDER IMPACTS OF CLIMATE CHANGE ON ESTUARY PROCESSES
8. CONFLICTS OF WATERWAY USE	• Recreational power-boating and waterskiing • Swimming / snorkelling • Recreational fishing • Tourism • Quiet rural lifestyle	• IMRPOVE FORESHORE ACCESS AND FACILITIES FOR RECREATION • IMPROVE EDUCATION AND AWARENESS OF ESTUARY ISSUES • PROMOTE SUSTAINABLE TOURISM FOR THE ESTUARY
9. INCREASED SEDIMENTATION	• Seagrass beds • Saltmarshes • Endangered aquatic birds • SEPP 14 Wetlands • Clean, clear water • Areas of wide open waterway • Recreational power-boating and waterskiing • Oyster / aquaculture industry	• REDUCE AND PREVENT FURTHER SEDIMENTATION OF THE ESTUARY • RESTRICT STOCK ACCESS TO FORESHORE AND WETLAND AREAS • PROTECT AND PRESERVE AQUATIC HABITATS • REHABILITATE ERODED SECTIONS OF THE RIVERBANK AND DAMAGED SECTIONS OF EXISTING BANK STABILISATION WORKS • PROTECT AND RESTORE RIPARIAN VEGETATION
10. DAMAGE TO CULTURAL HERITAGE SITES	• Cultural heritage sites • Picnicking and foreshore access • Tourism • National Parks and reserves	• PROTECT AND RESTORE ABORIGINAL AND EUROPEAN HERITAGE • IMPROVE EDUCATION AND AWARENESS OF ESTUARY ISSUES • IMRPOVE FORESHORE ACCESS AND FACILITIES FOR RECREATION • PROMOTE SUSTAINABLE TOURISM FOR THE ESTUARY • CONSIDER IMPACTS OF CLIMATE CHANGE ON ESTUARY PROCESSES
11. WATER QUALITY	• Clean, clear water • Oyster / aquaculture industry • Swimming / snorkelling • Aquatic fauna • Seagrass beds • Recreational fishing • Commercial fishing • Tourism • Recreational power-boating and waterskiing • Boat cruises • Saltmarshes	• MAINTAIN EXISTING GOOD WATER QUALITY • IMPROVE EDUCATION AND AWARENESS OF ESTUARY ISSUES • PROVIDE FOR SUSTAINABLE DEVELOPMENT OF THE ESTUARY • PROMOTE SUSTAINABLE INDUSTRY FOR THE CATCHMENT AND FLOODPLAIN • RESTRICT STOCK ACCESS TO FORESHORE AND WETLAND AREAS • REDUCE AND PREVENT FURTHER SEDIMENTATION OF THE ESTUARY • PROTECT AND RESTORE RIPARIAN VEGETATION • CONSIDER IMPACTS OF CLIMATE CHANGE ON ESTUARY PROCESSES

6.3 DESCRIPTION OF RECOMMENDED MANAGEMENT OPTIONS

A variety of strategies have been developed to address the management objectives for the estuary. These strategies encompass structural and non-structural measures aimed at protecting significant areas and improving aspects of the estuary to make it more suitable for existing and future waterway users. Many of these options were suggested by Committee and community members during the consultation phases of the study.

Where possible, the strategies aim to harness the natural attributes of the catchment and are sympathetic to the interests of existing land-users. The recommended strategies are presented in the following sections under the following categories:

- Planning controls and policies;
- On-ground works;
- Investigation and research;
- Education and community involvement;
- Monitoring;
- Cultural activities; and,
- Bank and foreshore rehabilitation works.

6.3.1 Planning Controls and Policies

The recommended strategies for planning controls and policies are presented graphically in **Figure 8**.

PCP-1 INCORPORATE ALL AREAS OF SEPP 14 WETLANDS AND ENDANGERED ECOLOGICAL COMMUNITIES INTO LAND USE MAPPING AS PART OF REVIEW OF THE LOCAL ENVIRONMENTAL PLAN (*LEP*)

Actions required:

1. Review latest mapping for SEPP 14 Wetlands and Validated and Potential EECs in reference to existing land use mapping to identify Environmental Protection areas that are currently not accommodated by existing Rural and Urban LEPs.
2. Updated land use mapping for revised LEP to incorporate all environmental protection areas, as required by the South Coast Regional Strategy (*2007*)..
3. Where appropriate, incorporate recommendations from the recent study by Eco Logical Australia (*ESC, 2007c*) into land use mapping for Urban Expansion Zones. These include constraints on development of areas of EECs in 'moderate to good' condition and potential 'biolinks' (*refer* **Section 5.3**).
4. Council staff from Moruya / Deua River Estuary Management Committee to review draft land use mapping produced for the revised LEP.
5. Council planning staff to report changes in mapping to Moruya / Deua River Estuary Management Committee during public exhibition of the LEP.

FIGURE 8

PCP-6
Incorporate stormwater quality management measures for the expanding North Moruya Industrial Estate into next revision of the Urban Stormwater Quality Management Plan for Eurobodalla Shire

To Batemans Bay

Mogendoura Creek

PCP-9
Implement Landscape Plan for Genduart Riverside Reserve

Princes Highway

Dooga Creek

Malabar Creek

YARRAGEE

PCP-14
Purchase / obtain acces to 30 m wide strip of riparian land

Malabar Lagoon

To Broulee

George Bass Drive

North Beach

SOUTH PACIFIC OCEAN

PCP-13
Increase enforcement of restrictions on camping at areas adjacent to the North Head Camping Area

Moruya Aerodrome

MORUYA RIVER

PCP-10
Develop a Boating Management Plan for Moruya River

Quarry Wharf

Moruya Boat Shed

North Head Drive

MORUYA RIVER

Brierley's Boat Ramp

Yarragee Reserve

PCP-10
Develop a Boating Management Plan for Moruya River

The Anchorage

Preddys Wharf

Pilot Station Backwater

Quondolo Island

MORUYA HEADS

Ryans Creek

Moruya STP

Racecourse Creek

MORUYA

South Head Road

Gilmores Creek

Newstead Pond

Luck Street

Kiora Bridge

Tidal Limit

DEUA RIVER

Princes Highway

To Narooma

Note: not all strategies shown

LEGEND

- National Park
- SEPP 14 Wetlands
- Rock training wall
- Rock wall
- Existing bank stabilisation works
- Submerged sandbar / shoaling
- Seagrass beds
- Saltmarshes

N

Scale

300 0 300 600 900

Metres

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PLANNING CONTROLS AND POLICIES
ESTUARY MANAGEMENT STRATEGIES

As shown in **Figure 7**, the areas where current land use mapping does not appear to correlate correctly include Ryans Creek and Racecourse Creek, Moruya Heads and Pilot Station Backwater.

Review of LEP zone mapping for environmental protection areas should also incorporate the potential impacts of climate change (*refer* **Strategy PCP-7**) and consider the findings of **Strategy IR-4**.

PCP-2 INCORPORATE REQUIREMENTS OF COUNCIL'S ACID SULPHATE SOILS (ASS) POLICY INTO REVISED LOCAL ENVIRONMENTAL PLAN (*LEP*)

Actions required:

1. Incorporate details currently contained in Council's ASS Policy into revised LEP, including latest extent mapping for all classes of ASS.
2. Council planning staff to advise when LEP completed.

Incorporation of ASS requirements into the LEP will give statutory effect to these requirements. This action is also recommended within the Eurobodalla Settlement Strategy (*ESC, 2006h*).

PCP-3 INCORPORATE REQUIREMENTS AND RECOMMENDATIONS FROM RIPARIAN CORRIDOR OBJECTIVE SETTING (*RCOS*) REPORT (*2006*) INTO REVISED LOCAL ENVIRONMENTAL PLAN (*LEP*)

Actions required:

1. Extract relevant recommendations regarding the management of Core Riparian Zones and vegetated buffers from 2006 report prepared by DNR, including the appropriate positioning of all future services such as footpaths and cycleways.
2. Incorporate RCOS recommendations into revised LEP.
3. Committee member from DECC to review draft version of LEP and advise of any changes required.
4. Council planning staff to advise when LEP completed.

PCP-4 UNDERTAKE AN AUDIT, EVERY 2 YEARS, OF EROSION AND SEDIMENT CONTROLS FOR ALL DEVELOPMENTS CONSTRUCTED IN THE PREVIOUS 4 YEAR PERIOD

Actions required:

1. Establish auditing program, including auditing methods and training for Council staff.
2. Determine list of new developments constructed in the last 2 or 4 years.
3. Undertake audits of identified sites according to development consent conditions regarding permanent and temporary (*if applicable*) Erosion & Sediment Control requirements.

4. Issue warnings / penalties for where Erosion & Sediment Controls have not been satisfactorily maintained or implemented.

PCP-5 DEVELOP A WATER SENSITIVE URBAN DESIGN POLICY FOR EUROBODALLA SHIRE.

Actions required:

1. Appropriate Council officer to report to the Committee every 6 months regarding progress of development of WSUD Policy.
2. Moruya River Estuary Management Committee to provide input to develop and review WSUD Policy if required.
3. WSUD policy to aim to minimise pollutants to the estuary and consider the potential impacts of climate change (*e.g., changes in catchment hydrology*).

Water Sensitive Urban Design (*WSUD*) is a design approach that integrates stormwater management with the urban water cycle. Some WSUD techniques include the use of rainwater tanks, water efficient fixtures, grassed swales replacing kerb and gutter, bio-retention systems, vegetated filter strips to remove pollutants from stormwater flows, riparian zone protection and re-vegetation.

The use of such techniques would greatly reduce the impacts on receiving waters within the Moruya / Deua River estuary. The implementation of such a policy is in line with the NSW Government's Building Sustainability Index (*BASIX*) requirements.

PCP-6 INCORPORATE APPROPRIATE STORMWATER QUALITY MANAGEMENT MEASURES FOR THE EXPANDING NORTH MORUYA INDUSTRIAL ESTATE INTO THE NEXT REVISION OF THE URBAN STORMWATER QUALITY MANAGEMENT PLAN FOR EUROBODALLA SHIRE.

Actions required:

1. Develop stormwater quality management measures for industrial areas to be included within revised USQMP, in conjunction with requirements of the new Development Control Plan for Industrial Developments (*as recommended in the Moruya Structure Plan, 2007*).
2. Infrastructure Planning Engineer to periodically report to Committee regarding status of new USQMP.

PCP-7 INVESTIGATE THE REZONING OR STRATEGIC PURCHASE OF LAND TO ACCOUNT FOR POTENTIAL IMPACTS OF CLIMATE CHANGE ON ESTUARY PROCESSES AND DEVELOPMENT, AS PART OF THE REVISED LOCAL ENVIRONMENTAL PLAN (*LEP*).

As discussed above, climate change is expected to cause a range of impacts on estuary processes across most areas of the catchment.

Most readily identifiable along the Moruya River estuary is the potential impact from sea level rise, both on the natural environment and urban development. Areas that are most

likely to be threatened by sea level rise are identified in **Figure 9**. These areas have been determined through interrogation of ground surface contour information, land use mapping and the location of vegetation communities and Endangered Ecological Communities.

Actions required:

1. Monitor developments in sea level rise predictions from the Intergovernmental Panel on Climate Change (*IPCC*) and associated research from CSIRO and the Australian Greenhouse Office.
2. Investigate appropriate flood planning levels for development considering climate change projections.
3. Investigate and identify areas suitable for relocation/migration of coastal vegetation, saltmarshes and Endangered Ecological Communities (*EECs*) that may be threatened by sea level rise. Indicative areas that may be susceptible areas are shown in **Figure 9**. It is envisaged that adjacent landward strips of the foreshore could be identified as suitable for vegetation migration.
4. Investigate and confirm areas of existing urban development and future urban expansion that may be threatened by sea level rise. Refer to **Figure 9** for suggested areas.
5. Revise land use mapping or investigate strategic purchase of land to provide buffer zones for vegetation migration and to ensure that future development is outside of areas potentially impacted by sea level rise.
6. Incorporate revised land use mapping and recommendations into new LEP in accordance with the findings of the investigations outlined above.
7. As required, update relevant development controls to account for sea level rise, including design freeboards for sewerage and stormwater infrastructure, dwellings, sea walls and recreational facilities.

PCP-8 DEVELOP A STORMWATER OPERATIONS MANUAL FOR COUNCIL'S OUTDOOR STAFF AND MACHINERY OPERATORS.

Actions required:

1. Lobby for funding to create operations manual, with support from Roads and Recreation department.
2. Incorporate requirements for proper implementation of erosion and sediment control measures for construction and roadworks sites.
3. Conduct a training workshop every 12 months to account for turn over in staff.

PCP-9 PREPARE A LANDSCAPE CONCEPT PLAN FOR GLENDUART RIVERSIDE RESERVE.

Actions required:

1. Landscape Concept Plan is to incorporate access locations and fire mitigation measures.
2. Modify and develop concept designs for rehabilitation based on results of Aboriginal sites assessment.

FIGURE 9

Mogendoura Creek
GLENDUART
Malabar Creek
Dooga Creek
Princes Highway
Malabar Lagoon
George Bass Drive
SOUTH PACIFIC OCEAN
MORUYA RIVER
YARRAGEE
North Head Drive
Ryans Creek
MORUYA RIVER
THE ANCHORAGE
Racecourse Creek
MORUYA
South Head Road
MORUYA HEADS
Kiora Bridge
Warnban Creek
Princes Highway
Congo Creek

LEGEND

- Areas of EECs or development potentially affected by sea level rise
- Validated Endangered Ecological Communities
- Potential Endangered Ecological Communities
- SEPP 14 Wetlands (not included as EECs)
- Eurobodalla National Park
- Urban / industrial area
- Urban expansion zones

Note: areas affected by sea level rise are approximate, as determined through interpretation of contour information

N

Scale

200 0 200 400 600 800 1000

Metres

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fig-sealevelrise.dgn

AREAS POTENTIALLY AFFECTED BY SEA LEVEL RISE AS A RESULT OF CLIMATE CHANGE

3. Prepare detail designs for rehabilitation works, if required.

PCP-10 DEVELOP A BOATING MANAGEMENT PLAN FOR MORUYA RIVER.

Actions required:

1. NSW Maritime to continue to monitor any conflict between users of the estuary and report to Committee on any developments.
2. Moruya River to be the next estuary within the Batemans Bay NSW Maritime Patrol Area to be considered for a Boating Management Plan. NSW Maritime to report regularly to Committee.
3. NSW Maritime to report to the Committee on the status of development and implementation of the Clyde River Boating Management Plan (*BMP*).
4. NSW Maritime to monitor any long terms changes in the location and extent of shoals that may arise due to climate change. The impact on navigation within the estuary, if any, is to be considered when preparing the Boating Management Plan.
5. Investigate impact of wakeboarding on shoreline erosion. If required, implement measures to manage wakeboarding activity to minimise further erosion.

Moruya River does not experience the level of waterway traffic as the Clyde River at Batemans Bay or Wagonga Inlet at Narooma. However, if the Clyde River BMP is shown to be successful, the process for developing a similar Plan should be initiated for Moruya.

PCP-11 COORDINATE WITH EUROBODALLA BUSH FIRE MANAGEMENT COMMITTEE TO UPDATE THE EUROBODALLA BUSH FIRE RISK MANAGEMENT PLAN

This strategy aims to incorporate the recommendations contained in the report, *'Riparian Corridor Objective Setting for Selected Streams between Batemans Bay and Moruya'*, prepared by DNR and ESC (*in Draft, September 2005*). It also recognises modifications to these recommendations as documented in the Eurobodalla Settlement Strategy (*ESC, 2006h*).

Actions required:

1. Update the Plan to exclude the Core Riparian Zone and Vegetated Buffer from the Asset Protection Zone for <u>new developments</u> meaning that vegetation clearing is not permitted for asset protection or strategic fire management within:
   - 100 metres of the shore of Moruya River (*Category 1*);
   - 50 metres of the shore of Wamban Creek (*Category 1*);
   - 40 metres of the shore of Malabar, Dooga, Gilmores, Candoin, Mogendoura, or Racecourse Creeks and other unnamed creeks (*Category 2*); and,
   - 20 metres of the shore of other minor streams (*Category 3*).
2. Representative from Eurobodalla Bush Fire Management Committee to report to Estuary Management Committee when Plan has been updated.

PCP-12 **ENSURE COUNCIL PLANNING STAFF ARE BRIEFED ON THE CONTENTS OF THE MORUYA / DEUA RIVER ESTUARY MANAGEMENT PLAN AND ARE AWARE OF THE IMPACTS OF PLANNING DECISIONS ON ESTUARY WATER QUALITY AND RECENT CHANGES IN LEGISLATION AND POLICIES FOR URBAN DEVELOPMENT.**

Actions required:

1. Strategy to target new staff arriving at Council.
2. Undertake training activities every 6 months, including a one-day seminar and distribution of a brief training manual.

PCP-13 **INCREASE ENFORCEMENT OF RESTRICTIONS ON CAMPING IN THE MORUYA RIVER RIPARIAN ZONE. PROGRAM TO TARGET AREAS ADJACENT TO NORTH HEAD CAMPING AREA AND THE REHABILITATED RESERVE NEAR THE MOUTH OF RYANS CREEK.**

Actions required:

1. Undertake survey and site inspections to determine and document the most popular sites for illegal camping.
2. Erect up to 30 new signs at identified sites to warn campers of penalties against illegal camping activities and illegal overnight stays.
3. Incorporate a *camping exclusion zone* along the foreshore in the vicinity of North Head on Council's existing brochure: *'Bush Camping by the Beach'*.
4. Increase patrolling by Council Rangers at the documented target sites, particularly during warmer months and in the evenings.
5. Refer **Strategy BFR-1** as part of bank and foreshore rehabilitation works.

PCP-14 **PURCHASE / OBTAIN ACCESS TO 30 METRE WIDE STRIP OF RIPARIAN LAND ON THE FORESHORE OF MORUYA RIVER UPSTREAM FROM THE RIVER BREEZE CARAVAN PARK.**

Actions required:

1. Investigate options to establish easement across land or negotiate access without changing land tenure.
2. If required, negotiate with landholders to determine suitable price for purchase of the land and the provision of any works to move stock fencing if required.
3. Purchase / acquire land and undertake any required works.

Acquirement of the land would allow connectivity of the foreshore reserve between Moruya Bridge and Glenduart Reserve, thereby facilitating the implementation of **Strategy OGW-7**.

6.3.2 On-Ground Works

The recommended on-ground works are presented graphically in **Figures 10** and **11**.

OGW-1 MAINTAIN ROCK PROTECTION WALLS ALONG THE LOWER ESTUARY.

The primary sites of rock wall deterioration are shown in **Figures 5** and **6**. Several of these sites have been identified based on information contained in the *Moruya / Deua River Estuary Processes Study (ESC, 2003c).*

The maintenance of rock protection walls is covered by Council's Asset Management Plan, as the walls are considered to be a flood protection measure. Notwithstanding, the condition of the rock walls can impact on the recreational and visual amenity of the estuary and therefore, a brief summary of maintenance tasks is included in the following.

Actions required:

1. Develop procedures and determine locations for assessment of the condition of existing rock protection walls.
2. Undertake survey and assessment of existing rock walls.
3. Identify and prioritise sites for rehabilitation works.
4. Develop concept and detail designs for high priority rehabilitation works. Impacts on riparian vegetation should be considered.
5. Seek funding to undertake high priority rehabilitation works.
6. Future maintenance works are to consider raising wall crests to account for sea level rise as a result of climate change.

Survey, assessment, and remediation of damage to existing rock protection works should be undertaken according to guidelines provided in the *Estuary Processes Study (ESC, 2003c).* A copy of the recommend actions is included in **Appendix J**. Tasks involve:

- detailed mapping of all sections of riverbank that have rock protection or have had rock protection in the past;
- identification of sections of rock wall requiring rehabilitation, including areas of undermining, collapse and erosion behind the wall;
- for identified sites of failure undertake detailed survey and assessment of the mode of failure;
- prepare and assess concept designs for remediation of damage, including assessment of environmental impacts for each design;
- develop detailed designs for remediation of high priority sites, including cost estimates.

Based on information contained in the Estuary Processes Study (*ESC, 2003c*) and allowing for rise in the CPI since preparation of that report, the cost of replacing a section of rock wall would be in the order of $1,100 per metre length of wall.

FIGURE 10

To Batemans Bay

To Broulee

Malabar Creek

Dooga Creek

Princes Highway

George Bass Drive

North Beach

SOUTH PACIFIC OCEAN

Malabar Lagoon

OGW-2
Repair of replace Quarry Wharf

OGW-4
Formalise foreshore facilities and close informal boat ramp

Moruya Aerodrome

Quarry Wharf

MORUYA RIVER

Moruya Boat Shed

North Head Drive

Brierley's Boat Ramp

OGW-11
Install BBQ facilities

The Anchorage

Ryans Creek

Preddys Wharf

Pilot Station Backwater

Quondolo Island

MORUYA HEADS

OGW-6
Install pump-out facilities, potentially at Moruya Town Wharf

Moruya STP

Racecourse Creek

OGW-3
Construct a boardwalk through wetlands

Gilmores Creek

Newstead Pond

OGW-10
Install storage facilities for oyster spat growers

MORUYA

South Head Road

Princes Highway

To Narooma

LEGEND

- National Park
- SEPP 14 Wetlands
- Rock training wall
- Rock wall
- Submerged sandbar / shoaling
- Seagrass beds
- Saltmarshes

N

Scale

200 0 200 400 600

Metres

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ON-GROUND WORKS
ESTUARY MANAGEMENT STRATEGIES
LOWER ESTUARY

FIGURE 11

LEGEND

- SEPP 14 Wetlands
- Rock wall
- Existing bank stabilisation works
- Submerged sandbar / beach
- Seagrass beds
- Saltmarshes

GLENDUART

Mogendoura

Creek

OGW-8
Offer incentives to landholders to install stock control measures

OGW-7
Pedestrian / cycleway to Glenduart Riverside Reserve

Larrys Mountain Road

To Batemans Bay

Princes Highway

RIVER

MORUYA

OGW-9
Canoe / Kayak launching facilities

OGW-11
Install BBQ facilities

Yarragee Reserve

YARRAGEE

River Breeze Caravan Park

Moruya Boat Shed

River Street

Shore Street

Hawdon Street

Campbell Street

Murray Street

MORUYA

Luck Street

Kiora Bridge (1km)
Wamban Creek (2km)
Tidal limit (4km)

N

Scale

100 0 100 200 300 400 500

Metres

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fig-strategies-ogw2.dgn

ON-GROUND WORKS
ESTUARY MANAGEMENT STRATEGIES
UPPER ESTUARY

OGW-2 REPAIR OR REPLACE QUARRY WHARF.

Actions required:

1. Council to assess the Development Application (*DA*) by Department of Lands to demolish Quarry Wharf.
2. If DA is approved, Council to take ownership of the site once wharf has been demolished. Apply to NSW Maritime for funding assistance to construct pontoon wharf for recreational boating.
3. If DA is denied on the grounds of heritage value, negotiate with Department of Lands for restoration of the wharf prior to Council taking ownership.

OGW-3 CONSTRUCT A BOARDWALK THROUGH RYANS CREEK WETLAND TO CONSOLIDATE PEDESTRIAN ACCESS AND PROTECT RIPARIAN VEGETATION.

Actions required:

1. Develop concept design for boardwalk alignment and construction features. Incorporate future plans to extend the cycleway from South Head to Moruya which would involve a bridge over Ryans Creek (*refer* **Strategy IR-7**).
2. Consult with community and Local Aboriginal Land Councils regarding concept design.
3. Undertake environmental assessment of the proposed works and seek funding and approvals.
4. Prepare detail design and construct boardwalk.

OGW-4 FORMALISE FORESHORE FACILITIES AND CLOSE INFORMAL BOAT RAMP AT POPULAR RECREATION AREA ON NORTH HEAD DRIVE, 600 METRES WEST OF MALABAR WEIR.

The popular recreation area for water-skiers is shown in **Figure 10**.

Actions required:

1. Develop concept design to formalise facilities for the reserve area between North Head Drive and the existing natural beach on Moruya River (*refer* **Figure 3**).
2. Liaise with recreational users of the beach, particularly waterskiing families, to obtain feedback regarding the concept design.
3. Undertake works to formalise the gravel parking area beside North Head Drive and to provide garbage bins near the foreshore. Bollards or boulders to be installed to restrict access the existing beach by vehicles that currently use it for launching boats.
4. Install signage along North Head Drive to indicate the location of the new facilities.

OGW-5 SEEK FUNDING TO REMEDIATE HIGH PRIORITY FISH BARRIERS IN THE MORUYA RIVER CATCHMENT.

This strategy has been developed based on the recommended works identified in the report by NSW DPI titled, *'Reducing the impact of road crossings on aquatic habitat in coastal waterways - Southern Rivers, NSW'* .

Actions required:

1. Obtain details of the causeway assessments and recommendations for each priority site from Department of Primary Industries.
2. Prepare concept designs for additional culverts or a bridge at the Neringla Road causeway at Telowar Creek.
3. Prepare concept designs for increasing the size of culverts at the Dwyers Creek Road crossing of Candoin Creek.
4. Designs are to consider the impacts of climate change on fish passage, including migration of fish habitat as a result of changed flow regimes and sea level rise.
5. Seek funding to undertake detail design and construction of proposed remediation works.

OGW-6 INSTALL VESSEL PUMP-OUT FACILITIES, POTENTIALLY AT MORUYA TOWN WHARF.

This strategy has been developed based on feedback from the local community. With the town wharf being very close to the town centre, there is an opportunity to develop a unique facility for the south coast, which could translate to increased tourist business for town with fuel and water supplies also provided.

Actions required:

1. Determine the best location and layout for facilities, including wastewater pump-out, fuel supply and water supply.
2. Undertake a comprehensive environmental impact assessment for the potential facilities, including the impact of accident scenarios and spills on water quality and aquatic life. This is also to include consideration of the increased vessel traffic along Moruya River resulting from the facilities.
3. Undertake consultation with local community regarding the proposed facilities.
4. Subject to environmental approval and community feedback, prepare designs for the proposed systems.
5. Construct facilities and associated infrastructure such as footpaths and amenities.

Hydraulic modelling of the dispersal of accidental spills at Moruya Wharf has been undertaken during investigations for the Moruya / Deua Estuary Processes Study (*ESC, 2003c*). The model results indicated that there is potential for spills at the wharf to spread into Malabar Lagoon and Ryans Creek, which would be detrimental to the fragile ecosystems at these locations.

Accordingly, the proposed environmental impact assessment for the facilities should be undertaken thoroughly and the results carefully considered.

OGW-7 CONSTRUCT COMBINED PEDESTRIAN WALKWAY AND CYCLEWAY ALONG NORTH BANK OF MORUYA RIVER BETWEEN RIVER BREEZE CARAVAN PARK AND GLENDUART RIVERSIDE RESERVE (2.4 KM LENGTH).

Actions required:

1. Construction of walkway/cycleway will require permission from the Crown and will be subject to purchase of private property along the foreshore (*refer* **Strategy PCP-14**) or will require permission from landholders.
2. Investigate methods and materials to construct walkway/cycleway along foreshore with alignment not further than 5 metres landward from the existing fence between riparian vegetation and privately owned / leased land.
3. Provide formalised access to viewing platforms at the foreshore every 500 metres.
4. Undertake works in conjunction with vegetation management activities in the riparian zone (*refer* **Strategy 18**). Ensure that works do not impact on existing or future riparian vegetation.

Consultation with the community resulted in some concern regarding the use of this foreshore land for further riparian vegetation works and construction of public access. This concern was primarily from farmers who are the owners or occupiers of the property adjacent to the foreshore.

Works to create a path for pedestrian and cycle use may be acceptable to the affected farmers if measures are taken to limit the intrusion of any works into their leased land to a strip not more than three to five metres wide, extending from the existing riparian fencing.

OGW-8. OFFER INCENTIVES TO LANDHOLDERS AT MOGENDOURA TO PROVIDE STOCK CONTROL MEASURES TO PREVENT STOCK ACCESS TO THE FORESHORE AND NATURAL BEACH ON THE NORTH BANK OF MORUYA RIVER UPSTREAM FROM THE CONFLUENCE WITH MOGENDOURA CREEK.

Actions required:

1. Determine whether stock access is causing significant degradation of the riparian vegetation and natural beaches.
2. If required, encourage landholders to enter into Property Vegetation Plans with SRCMA under the Eurobodalla Biodiversity Program (*refer* **Strategy ECI-4**).
3. If suitable, install stock fencing to prohibit stock access to the foreshore and natural beach.

OGW-9 INCORPORATE CANOE / KAYAK LAUNCHING AREA INTO YARRAGEE RESERVE PLAN OF MANAGEMENT.

Actions required:

1. Update the works schedule detailed in the Plan of Management to provide a foreshore pathway with sufficient width to allow pedestrian transport of recreational water craft to the beach.
2. Prevent vehicular access to the beach by installing bollards at the widened pathway. Undertake revegetation works as shown in the landscaping plan from the Yarragee Reserve Plan of Management.
3. Council's Environment Team to report to Committee to provide updates on the status of work at Yarragee Reserve.

OGW-10 INSTALL STORAGE FACILITIES FOR OYSTER GROWERS AT PILOT STATION BACKWATER.

Actions required:

1. Undertake consultation with oyster spat farmers at Pilot Station Backwater to determine the likely demand for small-scale storage facilities for oyster growing materials.
2. Undertake general consultation with the community at Moruya Heads to gauge public support for the installation of storage facilities.
3. If required, apply for funding to erect up to five small storage structures. It is envisaged that the dimensions of facilities would not exceed 2 metres in length/width and 1.5 metres in height. Facilities should be permanently fastened to the ground to avoid theft, vandalism and loss of materials.

OGW-11 INSTALL BBQ FACILITIES AT YARRAGEE RESERVE AND RYANS CREEK PARKLAND ADJACENT TO PROPOSED CARPARK AND WETLAND AREAS.

Actions required:

1. Investigate feasibility of installing appropriate gas BBQ facilities.
2. Install up to three BBQs at each location to compliment low key level of amenities such as bins and park furniture, to be installed at Yarragee Reserve and Ryans Creek Parkland in accordance with the relevant Plans of Management.

Council reports that vandalism of facilities at Ryans Creek and Yarragee Reserve has become a significant problem. Works to incorporate additional facilities such as BBQs should consider methods to avoid or deter vandalism, especially due to safety concerns associated with flammable fuels.

6.3.3 Investigation and Research

The recommended strategies for investigation and research are shown in **Figure 12**.

IR-1 INVESTIGATE THE POTENTIAL IMPACTS OF CLIMATE CHANGE ON THE MORUYA RIVER ESTUARY.

Actions required:

1. Monitor information from IPCC, CSIRO, DECC and other information relating to climate change predictions for the South Coast of NSW.
2. Work with state and federal governments, universities and industry groups to fund investigations into the potential impacts of climate change on the natural and built assets within and around the estuary.

IR-2 UNDERTAKE AN AUDIT OF ALL FORESHORE STRUCTURES ON MORUYA RIVER AND ITS TRIBUTARIES, ADDRESSING THE CONDITION AND LEGALITY OF STRUCTURES.

Actions required:

1. Department of Lands to undertake audit internally or commission independent party to undertake audit.
2. If required, independent party to undertake audit and report to Council and Department of Lands.
3. Use results of audit to identify illegal structures, including any disused and derelict oyster leases.
4. Request that landholders appropriately modify or remove any illegal foreshore structures on their properties.
5. Remove illegal structures on public foreshore land with funding assistance from the Department of Lands.

IR-3 UNDERTAKE AUDIT OF STOCK FENCING SURROUNDING SEPP 14 WETLANDS, ENDANGERED ECOLOGICAL COMMUNITIES, MANGROVES AND SALTMARSH AREAS.

Investigations are to focus on wetlands and EECs at Malabar Lagoon, The Anchorage, Ryans Creek and Mogendoura Creek (*refer* **Figures 5** *and* **6**).

Actions required:

1. Audit fencing and stock access at rural properties surrounding target areas.
2. If stock fencing found to be in need of repair or replacement on private land, encourage landholder to enter into a Property Vegetation Plan with SRCMA (*refer* **Strategy ECI-4**).
3. Repair or install appropriate stock fencing on public land if found to be inadequate. Seek funding assistance from SRCMA.

FIGURE 12

Mogendoura Creek

To Batemans Bay

Princes Highway

Dooga Creek

Malabar Creek

IR-3
Audit stock fencing at SEPP 14 Wetlands, EECs, mangroves and saltmarsh areas

To Broulee

George Bass Drive

North Beach

SOUTH PACIFIC OCEAN

IR-6
Audit stock fencing along riparian zone

YARRAGEE

IR-9
Survey of benthic flora and fauna

Malabar Lagoon

IR-8
Investigate feasibility of additional boat moorings at North Head

Moruya Aerodrome

MORUYA RIVER

IR-2
Audit of all foreshore structures

Quarry Wharf

Moruya Boat Shed

North Head Drive

MORUYA RIVER

Brierley's Boat Ramp

Yarragee Reserve

IR-7
Investigate feasibility of cycleway between Ryans Creek and Preddys Wharf

The Anchorage

Preddys Wharf

Pilot Station Backwater

Quondolo Island

MORUYA HEADS

Ryans Creek

Moruya STP

Racecourse Creek

MORUYA

South Head Road

Gillmores Creek

Newstead Pond

Luck Street

IR-3
Audit stock fencing at SEPP 14 Wetlands, EECs, mangroves and saltmarsh areas

Kiora Bridge

Tidal Limit

DEUA RIVER

Princes Highway

To Narooma

LEGEND

- National Park
- SEPP 14 Wetlands
- Rock training wall
- Rock wall
- Existing bank stabilisation works
- Submerged sandbar / shoaling
- Seagrass beds
- Saltmarshes

Note: not all strategies shown

N

Scale

300 0 300 600 900

Metres

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INVESTIGATION AND RESEARCH ESTUARY MANAGEMENT STRATEGIES

Permission to pass through private land is to be sought from the owner and granted prior to any site audits.

IR-4 COMPILE GIS MAPPING AND INFORMATION FROM ALL PREVIOUS INVESTIGATIONS AND WORKS TO CLEARLY IDENTIFY EXISTING ENDANGERED ECOLOGICAL COMMUNITIES (*EECs*) WITHIN THE MORUYA RIVER CATCHMENT.

This strategy is based on recommendations from the report titled, *'Flora and Fauna of the Moruya Estuary'* prepared by Mike Crowley Environmental Planning & Assessment for Eurobodalla Shire Council, which focus on the confirmation of the extent of two particular EEC types – Forest Ecosystem 25 – South Coast Swamp Forest Complex and Forest Ecosystem 186 – Mudflats/Saltmarshes.

Works to address these recommendations has been commenced through recent investigations such as the *Environmental Study* prepared by Eco Logical Australia (*ESC, 2007c*). Council's Environment Team has completed a number of on-ground projects to help protect and rehabilitate EECs adjacent to the Moruya River estuary.

Actions required:

1. Council's GIS team to update all mapping for EECs, including the compilation and merging of previously estimated EEC extents and recently ground-truthed vegetation extents. This work could be contracted to Wetland Care Australia, a not-for-profit organisation that works with CMAs to manage wetlands.
2. Council's GIS system to be updated to incorporate and display all works previously undertaken by Council and SRCMA to protect and rehabilitate areas of EECs.
3. Prepare report to show all current mapping for EECs and location of previous rehabilitation works. Report to also identify locations where ground-truthing is required for estimated EEC extents, and to prioritise the location and type of future on-ground works for Council and SRCMA to undertake.

IR-5 UNDERTAKE AN AUDIT OF INFRASTRUCTURE WITHIN THE MORUYA RIVER CATCHMENT, SUCH AS UNSEALED ROADS AND TRACKS IN ORDER TO IDENTIFY POINT SOURCES OF SEDIMENT AND POLLUTANTS.

Actions required:

1. Compile an inventory of all Council owned, National Parks and State Forests unsealed roads and tracks within the Moruya River catchment.
2. Develop criteria for assessment of infrastructure, such as soil type, site slope and potential for sediment mobilisation and proximity to waterways.
3. Undertake site inspections to audit and assess sites.
4. Use results of audit to develop a list of priority sites for erosion and sediment control works along roads and tracks.
5. Apply for funding assistance from SRCMA to design and implement appropriate sediment control measures under the *Roads and Tracks Programs*.

IR-6 UNDERTAKE AUDIT OF STOCK FENCING ALONG RIPARIAN ZONE BETWEEN PRINCES HIGHWAY AND TIDAL LIMIT OF MORUYA RIVER.

Actions required:

1. Commission independent party to undertake audit of fencing for properties fronting Moruya River or the riparian zone.
2. If stock fencing found to be inadequate on private land, encourage landholder to enter into a Property Vegetation Plan with SRCMA (*refer* **Strategy ECI-4**).
3. Identify encroachments into and illegal use of public foreshore land.
4. Order cessation of illegal uses of public land.
5. Repair or install appropriate stock fencing on public land if found to be inadequate. Seek funding assistance from SRCMA.

IR-7 INVESTIGATE THE FEASIBILITY OF CONSTRUCTING A PEDESTRIAN / CYCLEWAY BETWEEN RYANS CREEK AND PREDDYS WHARF AS PART OF THE CYCLEWAY LINKING SOUTH HEAD TO MORUYA TOWNSHIP.

Actions required:

1. Prepare a preliminary concept design for the cycleway alignment. Take into account any previously cleared corridors through the Ryans Creek wetland, special design features such as a bridge over Ryans Creek and bank and foreshore management options identified in the Bank and Foreshore Rehabilitation Plan (*refer* **Appendix K**).
2. Investigate the social benefit of constructing the cycleway link by undertaking community consultation to gauge interest and support for the concept design.
3. Undertake a detailed assessment of the environmental impact of the cycleway and of the cost for construction, including for the bridge over Ryans Creek.
4. If found feasible, apply for further funding to undertake detail design and construction of the cycleway.

IR-8 UNDERTAKE INVESTIGATIONS TO DETERMINE THE FEASIBILITY OF INSTALLING ADDITIONAL BOAT MOORINGS AT NORTH HEAD, AND IF APPROPRIATE, INSTALL MOORINGS.

This strategy has been suggested by a member of the local community. It is envisaged that the existing two fore-and-aft moorings behind the breakwater at North Head could be replaced with several moorings that span from the breakwater wall. Access to the moorings could be provided through a gate and pedestrian path along the breakwater.

Actions required:

1. Develop basic concept design for mooring layout and access requirements.
2. Undertake environmental impact assessment for the proposed facilities, including the impact of moorings and increased boat traffic on valuable seagrass beds and water quality in the vicinity of North Head.

3. Undertake assessment of the impact of additional moorings from a planning perspective.
4. Undertake consultation with local community regarding the proposed facilities.
5. If there are no significant environmental impacts and community feedback is supportive, prepare detail designs for the proposed moorings.
6. Install moorings and construct associated infrastructure such as the access-way, gates and amenities.

IR-9 UNDERTAKE A DETAILED SURVEY OF THE EXTENT AND CONCENTRATION OF BENTHIC FLORA AND FAUNA IN THE ESTUARY DOWNSTREAM FROM KIORA BRIDGE.

Actions required:

1. Approach local Universities for any opportunities to undertake investigations as part of an undergraduate or post-graduate research project.
2. Use results from survey in conjunction with results from fisheries data gained through work for **Strategy M-3** to determine any potential impacts of benthic flora and fauna on fish habitats and therefore fish populations.

6.3.4 Education and Community Involvement

The recommended strategies for education and community involvement are presented graphically in **Figure 13**.

ECI-1 PREPARE AND DISTRIBUTE COMMUNITY EDUCATION MATERIAL THAT OUTLINES THE IMPORTANCE OF ESTUARY PROCESSES AND DETAILS OF PERMITTED ACTIVITIES FOR CROWN AND COUNCIL LAND ON THE FORESHORE OF MORUYA RIVER AND ITS TRIBUTARIES.

Actions required:

1. Prepare information material containing a brief summary of estuary processes and the potentially adverse impacts of stormwater pollution, vegetation clearing and unapproved development on the health of the Moruya River Estuary.
2. Include examples of permitted and prohibited activities for public land at the foreshore to Moruya River and tributaries. Include graphics and photographs where appropriate.
3. Material is to include details of the penalties that offenders may face if they undertake prohibited activities and development works on public land, such as the construction of dams and fencing, without approval.
4. Material is to include commentary on the potential impacts of climate change and sea level rise on estuary processes, to raise awareness of climate change issues.
5. Deliver material in a variety of ways, including brochures and digital information on Council's website, when and where appropriate.
6. Conduct targeted education campaigns to specific audiences where appropriate, including at the North Moruya Industrial Estate and local schools

FIGURE 13

To Batemans Bay

Princes Highway

Mogendoura Creek

Dooga Creek

Malabar Creek

YARRAGEE

Malabar Lagoon

To Broulee

George Bass Drive

North Beach

SOUTH PACIFIC OCEAN

ECI-4
Encourage rural landholders to enter into Property Vegetation Plans with SRCMA to protect ecologically sensitive areas

ECI-4
Encourage rural landholders to enter into Property Vegetation Plans with SRCMA to protect ecologically sensitive areas

MORUYA RIVER

ECI-4
Encourage rural landholders to enter into Property Vegetation Plans with SRCMA to protect ecologically sensitive areas

Moruya Aerodrome

Quarry Wharf

Moruya Boat Shed

North Head Drive

MORUYA RIVER

Brierley's Boat Ramp

Yarragee Reserve

ECI-1
Prepare and distribute community education material

Ryans Creek

Moruya STP

Racecourse Creek

MORUYA

South Head Road

The Anchorage

Preddys Wharf

Pilot Station Backwater

Quondolo Island

MORUYA HEADS

Gilmores Creek

Newstead Pond

Luck Street

Kiora Bridge

Tidal Limit

DEUA RIVER

Princes Highway

To Narooma

Note: not all strategies shown

LEGEND

- National Park
- SEPP 14 Wetlands
- Rock training wall
- Rock wall
- Existing bank stabilisation works
- Submerged sandbar / shoaling
- Seagrass beds
- Saltmarshes

N

Scale

300 0 300 600 900

Metres

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EDUCATION AND COMMUNITY INVOLVEMENT ESTUARY MANAGEMENT STRATEGIES

During the community consultation process it was suggested by local residents that the community should be more clearly informed of the human activities that can affect the natural processes within the estuary. Of particular focus is the impact of land-based activities which can appear removed and separate from the estuary.

Education of the community will lead to conscious decisions to make an effort to preserve the state of the estuary and therefore provide the community with a sense of ownership of the estuary.

ECI-2 DEVELOP A COMMUNITY EDUCATION PROGRAM TARGETED AT RIPARIAN LANDOWNERS TO RAISE AWARENESS OF THE IMPORTANCE OF RIPARIAN VEGETATION.

Actions required:

1. Prepare fact sheets and brochures that show examples of acceptable and prohibited vegetation clearing in the riparian zone. Include details of the penalties applicable for illegal activities and contact information to report illegal vegetation clearing.
2. Prepare and distribute a foreshore planting guide to inform riparian landholders of native species suitable for the riparian zone. Digital copy to be made available on Council's website.
3. Prepare and distribute an information brochure to encourage riparian landowners to enter into Voluntary Conservation Agreements (*VCA*), Property Vegetation Plans or other conservation agreements, specifically targeted towards providing foreshore areas for landward migration of saltmarsh and other riparian vegetation in response to sea level rise (*refer susceptible areas shown in* **Figure 9**).
4. Conduct field days at demonstration sites to educate riparian landholders (*and the greater community*) on appropriate vegetation species and planting techniques.

ECI-3 REVIEW THE FORMAT AND TERMS OF REFERENCE OF THE MORUYA / DEUA ESTUARY ADVISORY COMMITTEE WITH A VIEW TO CREATE A COASTAL ADVISORY COMMITTEE THAT INCORPORATES THE MANAGEMENT OF THE MORUYA / DEUA RIVER ESTUARY AS WELL AS THE SURROUNDING COASTLINE.

Actions required:

1. Appoint a Coastal Advisory Committee Coordinator under a part-time agreement, subject to work load.
2. Committee to meet annually to assess the progress of the implementation of the Estuary Management Plan and determine works for the immediate future.
3. Committee Coordinator and relevant Committee members are to report on the status of specific projects and works.

ECI-4 DEVELOP A TARGETED CAMPAIGN TO ENCOURAGE RURAL LANDHOLDERS TO ENTER INTO PROPERTY VEGETATION PLANS WITH COUNCIL AND THE SOUTHERN RIVERS CATCHMENT MANAGEMENT AUTHORITY.

Riparian landholders would be encouraged to enter into Property Vegetation Plans through participation in the Eurobodalla Biodiversity Program.

For many residents, recognition of their efforts towards biodiversity conservation or stormwater management is sufficient to motivate further participation and action. Community recognition of individuals who undertake environmentally responsible practices on their property could include a local award scheme, signage, or an awards ceremony facilitated by the Council.

Such public recognition, acknowledgement and encouragement could be assisted by sponsorship from local businesses and industry. Participating landowners could also receive a sign to display on their property gate to show that they are part of a specific project or that they have taken the initiative to start their own local project (*DEC, 2004b*).

Actions required:

1. Work with SRCMA to develop and distribute an information brochure that clearly outlines the process of developing and implementing a Property Vegetation Plan, including the level of funding and other incentives offered through SRCMA and Council.
2. Invite rural landholders within the Moruya / Deua River catchment to attend information nights and field days to demonstrate the benefits of entering into a Property Vegetation Plan.
3. Encourage landholders to enter into 10-year management agreements with Council and SRCMA.

A property vegetation plan (*PVP*) is a voluntary but legally binding agreement between the landholder and the Southern Rivers Catchment Management Authority. The Plan will clarify what can be done with native vegetation on a property and give certainty that the agreement will continue for the period of the plan. The clearing provisions of a property vegetation plan last for up to 15 years. There are no fees associated with preparing the Plan.

A PVP has the following benefits:

- provides long term security so that native vegetation on a property can be better managed for both financial and environmental outcomes;
- provides clearing provisions that last up to 15 years, reducing the need for repeated development applications;
- provides the basis for providing financial support to farmers to improve the condition of native vegetation on their property;
- provides consistency between agreed management actions on a property and priorities in the local Catchment Action Plan; and
- provides clarification for existing use.

Although a PVP is voluntary, a PVP:

- is required when applying for natural resource incentive funding;
- is an alternative to a development application to clear any remnant native vegetation or protected re-growth that is not exempt under the *Native Vegetation Act 2003*; and,
- is required when seeking to secure offsets associated with clearing proposals.

ECI-5 DISTRIBUTE COPIES OF THE FINAL MORUYA / DEUA RIVER ESTUARY MANAGEMENT PLAN TO LOCAL COMMUNITY GROUPS AND BUSINESSES TO ATTRACT FUNDING, SPONSORSHIP AND VOLUNTEERS.

Government agencies such as the Department of Environment and Climate Change (*DECC*) typically provide up to 50% of funding for estuary management initiatives. The remaining 50% of funding needs to be sourced by Eurobodalla Shire Council.

Actions required:

1. Distribute copies of the final Estuary Management Plan (*EMP*) document to local community groups such as Landcare groups, Apex, Rotary and Scouts to call for volunteers to assist in semi-skilled works and non-technical investigations as part of the strategies detailed above.
2. Distribute copies of the EMP to local businesses to attract funding support or sponsorship to undertake the above strategies (*or part thereof*).
3. Make a digital copy of the EMP available on Council's website for any interested parties to download.

6.3.5 Monitoring

The recommended monitoring strategies are shown in **Figure 14**.

M-1 MONITOR THE IMPLEMENTATION OF THE ESTUARY MANAGEMENT PLAN.

Actions required:

1. Reporting on progress of works to be undertaken in conjunction with **Strategy ECI-3**, and the development of a Coastal Advisory Committee.
2. Management areas and strategies found to be lacking in progress are to be made high priority by the Committee and Coordinator and actioned accordingly.
3. Results and findings of monitoring strategies outlined below and investigation strategies included in **Section 6.3.3** are to be fed back into future works undertaken as part of the Estuary Management Plan. If required, the direction of future investigations and works are to be adjusted based on latest available information.

FIGURE 14

NORTH MORUYA INDUSTRIAL ESTATE

Mogendoura Creek

GLENDUART

Malabar Creek

Dooga Creek

Princes Highway

George Bass Drive

M-9
Monitor spread of mangroves into saltmarsh areas

M-5
Monitor density of riparian vegetation

M-6
Trial a community-based seagrass monitoring program

M-3
Monitoring of fish populations and fishing activities

SOUTH PACIFIC OCEAN

Malabar Lagoon

MORUYA RIVER

YARRAGEE

M-8
Monitor recent bank stabilisation measures

North Head Drive

Brierley's Boat Ramp

Ryans Creek

Racecourse Creek

THE ANCHORAGE

Preddys Wharf

MORUYA HEADS

MORUYA

South Head Road

M-5
Monitor density of riparian vegetation

M-3
Monitoring of fish populations and fishing activities

Kiora Bridge

Tidal limit

Warmban Creek

Princes Highway

Congo Creek

LEGEND

- Area of high risk Acid Sulphate Soils
- M-2 Proposed sampling site for Ecosystem Health Monitoring Program
- M-4 Proposed sampling site for supplementary water quality monitoring
- Rock training wall
- Seagrass beds

N

Scale

200 0 200 400 600 800 1000

Metres

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ESTUARY MONITORING STRATEGIES

M-2 INVESTIGATE THE INCLUSION OF THE MORUYA RIVER ESTUARY IN THE SOUTHERN RIVERS REGION ECOSYSTEM HEALTH MONITORING PROGRAM (SUBJECT TO ITS ESTABLISHMENT).

The report titled, *'Development of an Ecosystem Health Monitoring Program for the Estuaries and Coastal Lakes in the Southern Rivers Catchment Management Authority Region (2007)'*, prepared by Southern Rivers CMA, includes an indicative sampling regime for estuaries that will be participating in the program.

The recommended sampling regime for a riverine estuary, such as Moruya River, should comprise sampling of the following health parameters at five separate locations:

- Water Quality Suite, including pH, temperature, salinity and turbidity;
- Chlorophyll *a*; and,
- Water clarity/turbidity.

In addition to the above parameters, seagrass depth limits (*SDL*) and seagrass, mangrove and saltmarsh extents should also be monitored. Wetland health assessments should also be undertaken.

The program is intended to be conducted in partnership between SRCMA and local government.

Actions required:

1. Lobby Council and Southern Rivers CMA for the Moruya River estuary to be included in the Southern Rivers region Ecosystem Health Monitoring Program (*EHMP*).

   This is to involve demonstration that inclusion of Moruya River in the program is justified according to the relatively high potential for the Moruya River catchment to undergo development in the future and also because of the supporting strategies that will be implemented through this Estuary Management Study and Plan.

2. If the Moruya River estuary is accepted into the EHMP, undertake sampling for water quality, chlorophyll ***a*** and water clarity at the following five sites (*refer* **Figure 14**):
   - near the entrance to Malabar Lagoon;
   - near the Moruya township;
   - at Pilot Station Backwater;
   - at the confluence of Mogendoura Creek; and,
   - at the confluence of Wamban Creek.
3. In accord with recommendations by SRCMA (*2007b*), sampling for the Water Quality Suite and turbidity is to be undertaken monthly and after rainfall events.
4. In accord with recommendations by SRCMA (*2007b*), sampling for Chlorophyll ***a*** is to be undertaken at fortnightly intervals over summer and monthly for other periods and after rainfall events.

5. Seagrass Depth Limits are to be first determined through a pilot study. It is suggested that the findings of monitoring for **Strategy M-6** (*see below*) could be used to determine seagrass depth limits.
6. Monitor changes in seagrass, saltmarsh and mangrove extents using the findings from the proposed investigations for **Strategy M-9** (*saltmarsh and mangroves*), **Strategy M-5** (*foreshore vegetation*) and **Strategy M-6** (*seagrasses*).
7. Monitor wetland health by first mapping and prioritising the wetlands based on the findings of investigations for **Strategy IR-4** (*mapping for EECs*) and with assistance from Wetland Care Australia. Wetland health assessment is to be undertaken in accord with the wetland health assessment manual, the results of which are to be incorporated into the regional wetland database for the Southern Rivers region.
8. Present simplified results of ecosystem health monitoring for Moruya River in a yearly report card, to be made available to the local community. Refer to **Appendix L** for a sample ecosystem health report card for Lake Illawarra (*SRCMA, 2007b*).
9. Detailed results of the EHMP are to be compiled each year and used by SRCMA and Council to develop and prioritise future estuary management initiatives for Moruya River.
10. Compare any future changes in ecosystem health with observed impacts of climate change, including sea level rise and changes to river and estuarine flow regimes. If required, investigate measures to mitigate the impacts of climate change on ecosystem health.

The sampling sites for water quality parameters have been located to incorporate monitoring of areas with high risk Acid Sulphate Soils (*ASS*) as shown in **Figure 14**.

As indicated above, several of the estuary management strategies included in the Moruya / Deua River Estuary Management Study and Plan will overlap and facilitate the monitoring activities covered by the EHMP.

This should be clearly demonstrated to the SRCMA in order to gain support for inclusion of Moruya River in the Ecosystem Health Monitoring Program for the Southern Rivers region.

M-3 DEVELOP AN ONGOING MONITORING PROGRAM FOR FISH POPULATIONS AND FISHING ACTIVITIES IN THE MORUYA RIVER.

Actions required:

1. Apply for funding to undertake student research projects using the resources of Wollongong University, as detailed in the existing research proposal by Professor Ron West. If required, investigate the use of other resources.
2. Adopt existing proposal and modify to comprise ongoing investigations at Moruya River only.

3. Research to be undertaken each spring and summer to determine catch and effort during peak holiday season, juvenile fish recruitment, fish habitat characteristics, bait collection methods and locations and monitor invasive aquatic pest species.
4. Combine findings with information on seagrass extent, depth limits and epiphyte load (*refer* **Strategy M-6**) to compare any change in fish stocks with observed changes in ecosystem health.
5. Data to be combined with commercial fisheries data from DPI to determine the potential impact of commercial fishing on fish stocks
6. Where appropriate, incorporate the findings of investigations into future management initiatives, such as review of marine park zoning.

During 2008, the Department of Primary Industries (*Fisheries*) is planning to allocate four staff members to the South Coast for scientific investigations. This will provide a good opportunity to commence actions shortly thereafter.

M-4 DEVELOP A SUPPLEMENTARY WATER QUALITY MONITORING PROGRAM FOR ADDITIONAL TARGET SITES.

Inclusion of Moruya River in an Ecosystem Health Monitoring Program for the Southern Rivers region would involve monitoring of particular water quality parameters, such as pH, temperature, salinity, turbidity and chlorophyll *a* (*refer* **Strategy M-2**). Nutrient modelling and faecal coliform sampling are considered to be secondary indicators of ecosystem health.

Therefore, it is recommended that supplementary water quality monitoring be undertaken in addition to any monitoring activities as part of an EHMP, that would be targeted towards management of specific sources of potential pollutants to the estuary.

Actions required:

1. Develop a water quality monitoring program to undertake periodic monitoring for *nutrients* at the following sites (*refer* **Figure 14**):
   - at Malabar Creek, near the confluence of Dooga Creek, to target stormwater runoff from the North Moruya Industrial Estate, which may soon be expanded;
   - at the Pilot Station Backwater, to target stormwater runoff from Gilmores Creek and Newstead Pond;
   - near the Moruya Township, to target stormwater runoff from the urban area.
2. Undertake periodic monitoring for *nutrients and faecal coliforms* at the following sites:
   - at the Ryans Creek entrance, to target discharges of treated effluent from the Moruya Sewage Treatment Plant;
   - near the confluence of Wamban Creek, to target any contaminants from agricultural activities that originate in the upper catchment.

It is recommended that monitoring also be undertaken at these sites following significant rainfall events.

It is envisaged that the results of supplementary water quality monitoring could be used to identify potential sources of pollutant load to the estuary. If significant increases in loading are observed, the source(*s*) should be investigated and site-specific strategies developed to manage any future discharges.

M-5 DEVELOP A MONITORING PROGRAM TO RECORD AND MONITOR EXISTING AND FUTURE DENSITY OF VEGETATION AT ALL WATERFRONT PROPERTIES ALONG MORUYA RIVER AND TRIBUTARIES.

Actions required:

1. Assess aerial photography and undertake site inspections to detail the existing extent and density of riparian vegetation along Moruya River and tributaries at the frontage to urban and rural private properties. Particular attention to be paid to the foreshore reserves fronting urban properties such as at The Anchorage and Moruya Heads, including properties on the southern side of South Head Road.
2. Undertake further site inspections every 6 months to identify locations where decrease in vegetation cover has occurred.
3. If required, update the Bank and Foreshore Rehabilitation Plan (*refer* **Section 6.3.7**) with any additional sites where rehabilitation of riparian vegetation is required.
4. Target residents in the vicinity of observed vegetation loss for involvement in the community education program detailed in **Strategy ECI-2**.
5. Apply penalties to landholders that are proven to be responsible for illegal vegetation clearing.

Riparian vegetation plays a key role maintaining and improving water quality in estuarine waterways. Riparian vegetation is important because it:

- stabilises riverbanks;
- reduces overland flows; and,
- reduces sediment, nutrient and pathogen loads to the estuary by filtering runoff before it reaches the waterways.

M-6 TRIAL A COMMUNITY-BASED SEAGRASS MONITORING PROGRAM FOR MORUYA RIVER.

This strategy is based on recommendations contained in the report prepared for Eurobodalla Shire Council titled, *'Assessment of Seagrass Habitats in the Clyde, Tomaga and Moruya Rivers'* (*ESC, 2002c*).

Actions required:

1. Facilitate community recruitment events to gauge interest and support for program.
2. Approach SRCMA to provide funding for a trial program and invite Landcare volunteers to participate in program.
3. If sufficient support is achieved, develop trial monitoring program based on similar community program undertaken at Wallaga Lake.

4. Purchase equipment, undertake training of volunteers and organise monitoring activities, including seagrass extent, Seagrass Depth Limits and a qualitative assessment of epiphyte load (*algal growth*) on seagrass leaves.
5. Undertake seagrass monitoring for a trial period of 6 months and assess benefits vs effort/cost of program. Apply for funding to continue program if shown to be successful.
6. Program to be used to identify changes in the location, extent and composition of seagrass beds, to be used as an indicator of general ecosystem health (*refer* **Strategy M-2**).
7. Compare any future changes in seagrass health and extent with observed impacts of climate change, including sea level rise, movement of shoals and water quality impacts.

The extent and density of seagrass beds gives an indication of the extent of habitat that is suitable for benthic fauna. The proliferation of aquatic fauna is important for maintaining and boosting fish stocks in the Moruya River.

M-7 MONITOR THE IMPACT OF THE BATEMANS MARINE PARK ON FISH STOCKS IN THE ESTUARY.

Actions required:

1. DPI Fisheries to report at meetings of the Estuary Management Committee regarding implementation of Batemans Marine Park and specifically the impact of the Park on the number of commercial fishing operators on Moruya River and other estuaries.
2. If suitable, information is to be used in conjunction with results from **Strategy M-3** to investigate the impact of the Batemans Marine Park on the fish stocks of Moruya River.

M-8 MONITOR THE EFFECTIVENESS OF RECENT BANK STABILISATION MEASURES COMPRISING LOGS AND REVEGETATION AT VARIOUS LOCATIONS ON MORUYA RIVER.

Bank stabilisation measures involving large logs and vegetation works have been undertaken at various locations along the Moruya River, including upstream from Moruya Hospital (*refer* **Plate 5**).

Actions required:

1. Monitor stability, durability and function of bank stabilisation works, including progress of vegetation growth above the log walls.
2. Undertake community education and consultation to gauge public opinion regarding the potential use of these structures elsewhere on Moruya River.
3. If bank stabilisation method proven to be effective over 3 year period, further assess feasibility and cost to implement similar rehabilitation works at sites specified in the Bank and Foreshore Rehabilitation Plan (*refer* **Section 6.3.7**).

Plate 5: View of existing bank stabilisation measures on southern bank of Moruya River

M-9 MONITOR AND MANAGE THE SPREAD OF MANGROVES ON THE FRINGES OF SALTMARSH AND WETLAND COMMUNITIES, PARTICULARLY AT MALABAR LAGOON, THE ANCHORAGE, RYANS CREEK AND PILOT STATION BACKWATER.

Proliferation of mangroves in areas of low water depths such as saltmarsh and wetlands can be directly related to the volume and rate of sediment supply to the area. Hence, the spread of mangroves is a good indicator of sedimentation that could be impacting on important estuarine habitat such as saltmarshes.

It should be noted that the spread of mangroves is also related to other factors, such as low rainfall and sea level rise that would increase salinity.

Actions required:

1. Undertake site inspections to assess and record the current extent of mangrove communities on the fringe of Malabar Lagoon, The Anchorage and Pilot Station Backwater. Consider additional sites as required.
2. Undertake further site inspections every 6 months to identify growth or decline in mangrove extents.
3. Investigate sites of mangrove growth to determine influence of sedimentation. If found to be significant, investigate source of sediment supply (*in conjunction with results from* **Strategy IR-5**).
4. Apply to SRCMA and DNR for funding assistance to implement sediment control measures, if required.
5. Consider the potential impacts of climate change, including sea level rise and altered catchment hydrology.

6.3.6 Cultural Activities

Recommended cultural strategies are shown in **Figure 15**.

C-1 REPATRIATE THE SITE OF THE 'SCARRED TREE' ON THE NORTH BANK OF MORUYA RIVER AND USE THE RESERVE AS A CULTURAL AWARENESS TOOL.

This strategy has been extracted from the Aboriginal Cultural Heritage Report prepared by Environmental & Cultural Services for this management study (*refer* **Appendix D**).

The former location of the *'Scarred Tree'* is in The Boat Shed Park, near Moruya Boat Shed (*refer* **Figure 3**).

Actions required:

1. Consult with the Local Aboriginal Land Councils and the broader community regarding the best methods to repatriate the site.
2. Prepare design for the site and undertake works, including signage and associated graphics/displays to demonstrate cultural significance.

C-2 INSTALL INTERPRETATIVE EDUCATIONAL SIGNS AT KEY LOCATIONS THROUGHOUT THE ESTUARY.

Actions required:

1. Determine and prioritise a list of up to 20 locations to install educational signs to highlight significant estuary features and attributes. It is recommended that the following sites be included (*if not already sign-posted*):
   - Quarry sites and associated features;
   - Malabar Lagoon;
   - The wreck of the sand barge near Malabar Lagoon;
   - Brierley's Boat Ramp;
   - Preddys Wharf;
   - Pilot Station Backwater;
   - Glenduart Cemetery and Reserve;
   - Yarragee Reserve;
   - Moruya Bridge; and
   - The Scarred Tree (*refer* **Strategy C-1**).
2. Develop the design and graphics for each sign. Signs to include information on how to preserve estuary features and the impact of human activities.
3. Incorporate input from Local Aboriginal Land Councils to include Aboriginal place names on signs where applicable.
4. Manufacture and install signs.

FIGURE 15

To Batemans Bay

Princes Highway

Mogendoura Creek

Dooga Creek

Malabar Creek

Malabar Lagoon

To Broulee

George Bass Drive

North Beach

SOUTH PACIFIC OCEAN

YARRAGEE

MORUYA RIVER

C-1
Repatriate the former site of the 'Scarred Tree'

C-5
Determine impact of tidal and freshwater flows on Aboriginal sites

Moruya Aerodrome

Quarry Wharf

Moruya Boat Shed

North Head Drive

Brierley's Boat Ramp

C-2
Install interpretative educational signs at key locations

Yarragee Reserve

Ryans Creek

Moruya STP

Racecourse Creek

The Anchorage

Preddys Wharf

Pilot Station Backwater

Quondolo Island

MORUYA HEADS

MORUYA

Gilmores Creek

Newstead Pond

South Head Road

Luck Street

C-3
Monitor progress of works at Moruya Riverside Park

Kiora Bridge

Tidal Limit

DEUA RIVER

Princes Highway

To Narooma

LEGEND

- National Park
- SEPP 14 Wetlands
- Rock training wall
- Rock wall
- Existing bank stabilisation works
- Submerged sandbar / shoaling
- Seagrass beds
- Saltmarshes

Note: not all strategies shown

N

Scale

300 0 300 600 900

Metres

Patterson Britton & Partners Pty Ltd

rp6570 - Moruya EMP

fig-strategies-c.dgn

CULTURAL STRATEGIES

C-3 COUNCIL REPRESENTATIVE TO REPORT TO THE ESTUARY MANAGEMENT COMMITTEE ON THE PROGRESS OF WORKS AND INITIATIVES AS PART OF THE MORUYA RIVERSIDE PARK.

As discussed above, recommendations contained in the Plan of Management for Moruya Riverside Park and surrounds (*ESC, 2005b*) include several cultural and social initiatives.

Implementation of these recommendations will be beneficial to the Moruya community.

Actions required:

1. Relevant Council officer to report every 12 months to the Committee of the progress for:
   - development of a Cultural Development Action Plan
   - construction of an amphitheatre, market stalls, picnic facilities
   - development of a Marketing and Advertising Program for the park.

C-4 SPECIFY A NEW HERITAGE CONSERVATION AREA FOR ALL LAND WITHIN 30 METRES OF THE MORUYA RIVER, IN WHICH ANY PROPOSED DEVELOPMENT IS SUBJECT TO CULTURAL SITE PROTECTION PROTOCOLS IMPOSED BY EUROBODALLA SHIRE COUNCIL AND THE LOCAL ABORIGINAL LAND COUNCILS.

This strategy is based on recommendations outlined in the Aboriginal Cultural Heritage Report that was prepared by Environmental & Cultural Services for this study (*refer* **Appendix D**).

Actions required:

1. Compile a list of all existing relevant DCPs and management plans that should incorporate the heritage conservation area.
2. Incorporate appropriate protocols for 30 metre wide foreshore strip into relevant planning documentation as they are revised.

C-5 UNDERTAKE INVESTIGATIONS TO DETERMINE THE IMPACT OF TIDAL AND FRESHWATER FLOWS THROUGH THE MALABAR WEIR ON ABORIGINAL SITES AT MALABAR LAGOON.

This strategy has been extracted from the Aboriginal Cultural Heritage Report prepared by Environmental & Cultural Services for this management study (*refer* **Appendix D**).

Actions required:

1. Undertake archaeological survey of the banks and surrounds of Malabar Lagoon. Record identified Aboriginal sites with DECC.
2. Undertake investigations to determine the impact of tidal and freshwater flows through and adjacent to Malabar Weir on identified Aboriginal sites. Consider potential future impacts associated with climate change.

3. Develop and investigate options to rehabilitate and prevent further erosion of the lagoon banks at susceptible Aboriginal sites, in consultation with local and Aboriginal communities (*refer* **Section 6.3.7**).
4. Apply to DECC for funding assistance to undertake rehabilitation works. Aboriginal Community Support Officers of the Southern Rivers CMA to work with Council and the Aboriginal community to seek funding.

6.3.7 Bank and Foreshore Rehabilitation Works

A Bank and Foreshore Rehabilitation Plan (*BFRP*) has been developed as a sub-plan of the Moruya / Deua River Estuary Management Plan.

The works proposed as part of this sub-plan are considered separately to the ongoing maintenance of existing rock protection walls (*refer* **Strategy OGW-1**). The measures are primarily soft structural measures, which are focused on restoration of riparian vegetation and natural river bank conditions (*where possible*).

The Bank and Foreshore Rehabilitation Plan includes a total of 22 sites that were identified as requiring rehabilitation. The locations of the sites are shown in **Figures 16** and **17**. As shown, the extent of the sites have been mapped thematically according to whether bank stabilisation is required, or if rehabilitation of riparian vegetation is required.

These figures also indicate a priority ranking for each site. The priority ranking has been determined qualitatively, according to a variety of factors, including the severity of existing bank erosion and its threat to assets (*natural and man-made*) and the relative importance of riparian vegetation at each location in terms of its benefit to natural estuarine processes.

The extent of areas that require enhancement of riparian vegetation was determined through site inspections and also assessment of latest available aerial photography. Accordingly, it is possible that revegetation works may have been undertaken at some sites (*e.g., Yarragee Reserve*) since the date of inspections and recording of airphotos.
The location and extent of erosion sites have been determined based on site inspections and information contained in the Estuary Processes Study (*ESC, 2003c*).

Up to three rehabilitation options have been considered for each site identified in **Figures 16** and **17**. These options include:

- Brushing – anchoring large organic debris or trees to the base of the bank
- Gravel or cobble fillet behind a rock toe
- Mangrove planting behind a low rock wall
- Revegetation of the riparian corridor
- Fencing to prevent stock access to revegetated areas
- Regrading of the riverbank
- Installation of coir logs at the base of the bank

FIGURE 16

To Batemans Bay

To Broulee

Malabar Creek

Dooga Creek

Princes Highway

George Bass Drive

North Beach

SOUTH PACIFIC OCEAN

Malabar Lagoon

Moruya Aerodrome

Quarry Wharf

Moruya Boat Shed

MORUYA RIVER

Brierley's Boat Ramp

North Head Drive

The Anchorage

Preddys Wharf

Pilot Station Backwater

Quondolo Island

MORUYA HEADS

Ryans Creek

Moruya STP

Racecourse Creek

Gilmores Creek

Newstead Pond

MORUYA

South Head Road

Princes Highway

To Narooma

LEGEND

- Rehabilitation site - HIGH priority
- Rehabilitation site - MEDIUM priority
- Rehabilitation site - LOW priority
- River bank stabilisation site
- Vegetation rehabilitation site
- National Park
- SEPP 14 Wetlands
- Rock training wall
- Existing rock protection wall

N

Scale

200 0 200 400 600

Metres

Patterson Britton & Partners Pty Ltd

rp6570 - Moruya EMP

fig-bfrp1.dgn

BANK AND FORESHORE REHABILITATION PLAN
POTENTIAL OPTIONS - LOWER ESTUARY

FIGURE 17

LEGEND

- (12) Rehabilitation site - HIGH priority
- (10) Rehabilitation site - MEDIUM priority
- (9) Rehabilitation site - LOW priority
- River bank stabilisation site
- Vegetation rehabilitation site
- SEPP 14 Wetlands
- Existing rock protection wall
- Existing bank stabilisation works
- Boat launching

GLENDUART

Mogendoura

Larrys Mountain Road

To Batemans Bay

Princes Highway

Creek

RIVER

MORUYA

YARRAGEE

Yarragee Reserve

River Breeze Caravan Park

Moruya Boat Shed

River Street

Shore Street

Hawdon Street

Campbell Street

Murray Street

MORUYA

Luck Street

Kiora Bridge (1km)
Wamban Creek (2km)
Tidal limit (4km)

N

Scale

100 0 100 200 300 400 500

Metres

Patterson Britton & Partners Pty Ltd
rp6570 - Moruya EMP
fig-bfrp2.dgn

BANK AND FORESHORE REHABILITATION PLAN
POTENTIAL OPTIONS - UPPER ESTUARY

- Timber post retaining wall
- Localised rock protection for valuable trees

Further information on each option is provided in **Appendix K**, including basic sketches. A cost estimate has been determined for each foreshore rehabilitation option at each site. These cost estimates are based on the indicative unit costs provided in **Table 8**.

Table 8 INDICATIVE COSTS FOR BANK REHABILITATION OPTIONS

OPTION	COST ($)
Brushing	100 – 300 *per metre*
Gravel or cobble fillet behind a rock toe	200 – 400 *per metre*
Mangrove planting behind a low rock wall	200 – 300 *per metre*
Revegetation of the riparian corridor	100 – 200 *per metre*
Fencing to prevent stock access	30 – 50 *per metre*
Regrading of the riverbank	100 – 200 *per metre*
Installation of coir logs	100 – 200 *per metre*
Timber post retaining wall	1,000 – 1,200 *per metre*
Localised rock protection for trees	8,000 – 10,000 *per tree*

It should be noted that these indicative costs include an allowance for labour, which may be otherwise provided voluntarily through Landcare or other community groups, particularly for revegetation works. The above cost estimates may be substantially less if volunteer labour can be sourced for non-technical or non-skilled work.

Actions required:

1. Refer to **Appendix K** for a summary of recommended options for bank and foreshore rehabilitation at each site.
2. Undertake detailed survey and assessment of rehabilitation sites prior to design and commencement of works.
3. Consult with affected landholders for instances where work is on private land. Encourage landholder to seek assistance from SRCMA (*refer* **Strategy ECI-4**).
4. Seek funding to undertake rehabilitation works.
5. Undertake community consultation to explain the process of how rehabilitation sites have been selected and prioritised.

Based on the estimated costs for each option (*refer* **Appendix K**), the total cost to undertake revegetation and fencing works at all sites would be in the order of $2.2 Million (*exclusive of GST*).

Implementation of the most costly bank stabilisation options for each site, in conjunction with the recommended revegetation works, is expected to cost in the order of $3.8 Million (*exclusive of GST*).

Rehabilitation works at 'high priority' sites are estimated to cost approximately $1.0 Million (*exclusive of GST*). It is recommended that available funds are first targeted towards the implementation of works at these sites.

7 ASSESSMENT OF MANAGEMENT STRATEGIES

7.1 TRIPLE BOTTOM LINE ASSESSMENT

The Triple Bottom Line (*TBL*) approach for assessing and prioritising management strategies involves the assessment of each strategy in terms of Environmental, Social and Economic benefits.

The TBL assessment method has been employed regularly in the preparation of management studies and strategies that have been previously completed for Eurobodalla Shire, including the *Batemans Bay and Clyde River Estuary Management Plan* (*2005*) and the *Eurobodalla Integrated Water Cycle Management Strategy* (*ESC, 2002a*).

For assessment and prioritisation of management strategies for the Moruya / Deua River estuary, each strategy was scored according to the following Triple Bottom Line criteria.

Environmental criteria:

- Benefit to water quality;
- Benefit to riparian zone biodiversity and connectivity;
- Potential to reduce sediment load; and,
- Benefit to aquatic life and habitat.

Social criteria:

- Benefit to estuary aesthetics;
- Benefit to recreational amenity;
- Benefit to community awareness / education;
- Potential to resolve user conflicts; and
- Benefit to preservation of cultural heritage.

Economic criteria:

- Benefit to fishing industry (*recreational and commercial*);
- Benefit to tourism;
- Benefit to agriculture and land productivity; and,
- Benefit to industrial growth.

In assessing each management strategy, a score between 0 and 3 was given to each of these assessment criteria according to the following scale:

- 0 = no expected benefit
- 1 = low (*or indirect*) benefit
- 2 = moderate benefit
- 3 = high benefit

Due to the heavy environmental focus of estuary management, the scores for the environmental assessment criteria were given an increased weighting of 1.2. The environmental benefit and value of the strategies is considered to be of higher importance than social or economic considerations.

A summary of the Triple Bottom Line assessment for the estuary management strategies is provided in **Appendix M**. Output from the TBL assessment is in the form of a total score for each strategy. These scores were used to determine the relative importance of the strategies and hence determine the relative priority in which the strategies should be implemented.

8 RECOMMENDATIONS

8.1 PRIORITISED STRATEGIES

A prioritised list of estuary management strategies is required for inclusion in the Estuary Management Plan for the Moruya / Deua River Estuary. Due to the importance of strategies that aim to address the most urgent management issues, it is recommended that these strategies be implemented sooner than other strategies.

Prioritisation of strategies was undertaken through consideration of the results of the Triple-Bottom-Line (*TBL*) assessment detailed above, which were also cross-checked with the ranked key issues and corresponding objectives to ensure that the strategies addressing the most pressing issues have been assigned the highest priority.

Each strategy has been assigned a priority ranking. The priority rankings are defined as follows:

- High Priority – Implementation should proceed immediately and is required to address major issues considered to require urgent attention. Physical implementation of works or changes to policy should be achieved within the next three (3) years.
- Medium Priority – Implementation should proceed at some time during the next five (5) years and is required to address less urgent issues, or issues that have proved to be a consistent problem, but which require further investigation prior to implementing a course of action.
- Low Priority – Implementation should proceed at some time 5 - 10 years from now and is required for the long term benefit of the estuary. Low priority strategies are less urgent and can be built into other investigations or activities within the region.

It is recommended that the estuary management strategies for Moruya / Deua River estuary be assigned a priority rank as specified below. The prioritised strategies have been grouped into the following categories:

- Planning controls and policies;
- On-ground works;
- Investigation and research;
- Education and community involvement;
- Monitoring; and,
- Cultural activities.

As discussed above, the works proposed as part of the Bank and Foreshore Rehabilitation Plan have been assigned a priority ranking as a separate exercise, according to a variety of factors, including the severity of existing bank erosion and its threat to assets (*natural and man-made*) and the relative importance of riparian vegetation at each location in terms of its benefit to natural estuarine processes.

8.1.1 Planning Controls and Policies

High Priority Strategies

- Incorporate all areas of SEPP 14 Wetlands and Endangered Ecological Communities into land use mapping as part of review of the Local Environmental Plan (*LEP*)
- Incorporate requirements of Council's Acid Sulphate Soils (ASS) policy into revised LEP
- Incorporate requirements and recommendations from Riparian Corridor Objective Setting (*RCOS*) report (*2006*) into revised LEP
- Undertake an audit, every 2 years, of erosion and sediment controls for all developments constructed in the previous 4 year period
- Develop a Water Sensitive Urban Design Policy for Eurobodalla Shire
- Incorporate appropriate stormwater quality management measures for the expanding North Moruya Industrial Estate into the next revision of the Urban Stormwater Quality Management Plan for Eurobodalla Shire
- Investigate the rezoning or strategic purchase of land to account for potential impacts of climate change on estuary processes and development, and incorporate findings into the revised LEP
- Develop a stormwater operations manual for Council's outdoor staff and machinery operators
- Prepare a Landscape Concept Plan for Glenduart Riverside Reserve
- Develop a Boating Management Plan for Moruya River

Medium Priority Strategies

- Coordinate with Eurobodalla Bush Fire Management Committee to update the Eurobodalla Bush Fire Risk Management Plan to exclude Asset Protection Zones from riparian and wetland areas
- Ensure Council planning staff are briefed on the contents of the Moruya / Deua River Estuary Management Plan and are aware of the impacts of planning decisions on estuary water quality and recent changes in legislation and policies for urban development along the estuary
- Increase enforcement of restrictions on camping in the Moruya River riparian zone. Program to target areas adjacent to North Head Camping Area and the rehabilitated reserve near the mouth of Ryans Creek

Low Priority Strategies

- Purchase / obtain access to 30 metre wide strip of riparian land on the foreshore of Moruya River upstream from the River Breeze Caravan Park

8.1.2 On-Ground Works

High Priority Strategies

- Maintain rock protection walls along the lower estuary
- Repair or replace Quarry Wharf

Medium Priority Strategies

- Construct a boardwalk through Ryans Creek wetland to consolidate pedestrian access and protect riparian vegetation
- Formalise foreshore facilities and close informal boat ramp at popular recreation area on North Head Drive, 600 metres west of Malabar Weir
- Seek funding to remediate high priority fish barriers in the Moruya River catchment
- Install vessel pump-out facilities, potentially at Moruya Town Wharf

Low Priority Strategies

- Construct combined pedestrian walkway and cycleway along north bank of Moruya River between River Breeze Caravan Park and Glenduart Riverside Reserve (*2.4 km length*)
- Offer incentives to landholders at Mogendoura to provide stock control measures to prevent stock access to the foreshore and natural beach on the north bank of Moruya River upstream from the confluence with Mogendoura Creek
- Incorporate canoe / kayak launching area into Yarragee Reserve Plan of Management
- Install storage facilities for oyster growers at Pilot Station Backwater
- Install BBQ facilities at Yarragee Reserve and Ryans Creek Parkland adjacent to proposed carpark and wetland areas

8.1.3 Investigation and Research

High Priority Strategies

- Investigate the potential impacts of climate change on the Moruya River estuary
- Undertake an audit of all foreshore structures on Moruya River and its major tributaries, addressing the condition and legality of the structures
- Undertake audit of stock fencing surrounding SEPP 14 wetlands, EECs, mangroves and saltmarsh areas
- Compile GIS mapping and information from all previous investigations and works to clearly identify existing Endangered Ecological Communities (*EECs*) within the Moruya River catchment

- Undertake an audit of infrastructure within the Moruya River catchment, such as unsealed roads and tracks in order to identify point sources of sediment and pollutants
- Undertake audit of stock fencing along riparian zone between Princes Highway and tidal limit of Moruya River

Medium Priority Strategies

- Investigate the feasibility of constructing a pedestrian / cycleway between Ryans Creek and Preddys Wharf as part of the cycleway linking South Head to Moruya Township

Low Priority Strategies

- Undertake investigations to determine the feasibility of installing additional boat moorings at North Head, and if appropriate, install moorings
- Undertake a detailed survey of the extent and concentration of benthic flora and fauna in the estuary downstream from Kiora Bridge

8.1.4 Education and Community Involvement

High Priority Strategies

- Prepare and distribute community education material that outlines the importance of estuary processes and details of permitted activities for Crown and Council land on the foreshore of Moruya River and its tributaries
- Develop a community education program targeted at riparian landowners to raise awareness of the importance of riparian vegetation
- Review the format and terms of reference of the Moruya / Deua Estuary Advisory Committee with a view to create a Coastal Advisory Committee that incorporates the management of the Moruya / Deua River Estuary as well as the surrounding coastline.
- Develop a targeted campaign to encourage rural landholders to enter into Property Vegetation Plans with Council and the Southern Rivers Catchment Management Authority
- Distribute copies of the final Moruya / Deua River Estuary Management Plan to local community groups and businesses to attract funding, sponsorship and volunteers

8.1.5 Monitoring

High Priority Strategies

- Monitor the implementation of the Estuary Management Plan
- Investigate the inclusion of the Moruya River Estuary in the Southern Rivers region Ecosystem Health Monitoring Program, subject to its establishment
- Develop an ongoing monitoring program for fish populations and fishing activities

Medium Priority Strategies

- Develop a supplementary water quality monitoring program for additional target sites
- Develop a monitoring program to record and monitor existing and future density of vegetation at all waterfront properties along Moruya River and tributaries
- Trial a community-based Seagrass Monitoring Program for Moruya River

Low Priority Strategies

- Monitor the impact of the Batemans Marine Park on fish stocks in the estuary
- Monitor the effectiveness of recent bank stabilisation measures comprising logs and revegetation
- Monitor and manage the spread of mangroves on the fringes of saltmarsh and wetland communities, particularly at Malabar Lagoon, The Anchorage, Ryans Creek and Pilots Station Backwater

8.1.6 Cultural Activities

Medium Priority Strategies

- Repatriate the site of the 'Scarred Tree' on the north bank of Moruya River and use the reserve as a cultural awareness tool
- Install interpretative educational signs at key locations throughout the estuary
- Council representative to report to the Estuary Management Committee on the progress of works and initiatives as part of the Moruya Riverside Park
- Specify a new heritage conservation area for all land within 30 metres of Moruya River, in which any proposed development is subject to cultural site protection protocols imposed by Eurobodalla Shire Council and the Local Aboriginal Land Councils

Low Priority Strategies

- Undertake investigations to determine the impact of tidal and freshwater flows through the Malabar Weir on Aboriginal sites at Malabar Lagoon

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APPENDIX A
GLOSSARY

GLOSSARY OF TECHNICAL TERMS

Algae	Non-rooted aquatic plants, specifically non-vascular photosynthetic organisms with unicellular reproductive organs, including phytoplankton and seaweeds.
Advective Transport	The transport of dissolved material by water movement.
Aerobic Bacteria	Bacteria that obtain metabolic energy by aerobic (oxygen requiring) respiration.
Algal Bloom	The excessive growth of phytoplankton, generally caused by high nutrient levels. Can result in deoxygenation of the water mass, leading to the death of aquatic flora and fauna.
Amenity	Those features of an estuary that foster its use for various purposes; e.g., clear waters and sandy beaches make beach-side recreation attractive.
Amphibian	"Any frog or other member of the class amphibia that is native to Australia, including the eggs and the young thereof".
Amphipods	Laterally compressed crustacea, e.g. sand hoppers.
Anaerobic Bacteria	Bacteria that obtain metabolic energy by a variety of non aerobic (not oxygen dependent) pathways, including the reduction of nitrates ('denitrification') and/or sulphates.
Animal	Any animal, whether vertebrate or invertebrate, and at whatever stage of development, but does not include fish within the meaning of the Fisheries and Oyster Farms Act, 1935, other than amphibians or aquatic or amphibious mammals or aquatic or amphibious reptiles'.
Annual Exceedance Probability	The chance or likelihood that an event of a nominated size or greater (e.g. flood discharge) will occur in any year.
Anoxic Conditions	Conditions typified by very low to zero dissolved oxygen concentrations.
Arbovirus	A virus transmitted by blood sucking arthropods, e.g. insects.
Balanced Development	The weighing of ecological, social and economic consequences in determining the nature, location and degree of estuarine development.
Baseline Monitoring	A monitoring program aimed at determining long-term and possibly pre-disturbance levels and variation in some parameter of interest, e.g. dissolved oxygen.
Bed Load	That portion of the total sediment load that flowing water moves along the bed by the rolling or saltating of sediment particles.
Benthos, Benthic Organisms	Organisms living in or on the bed of a waterbody.
Biological Oxygen Demand	Oxygen required by aerobic bacteria in metabolising detritus.
Biomass	The mass of living material contained in a system of interest (includes both plant and animal matter).
Biota	Living organisms.
Bird	"Any bird that is native to, or is of a species that periodically oroccasionally migrates to, Australia, and includes the eggs and the young thereof and the skin, feathers or any other part thereof".
Degradation	A reduction in the area of estuarine habitat; or in the well-being,health and viability of estuarine ecosystems; or in estuarine amenity.
Denitrification	See anaerobic bacteria.

Depauperate	A condition which is generally poor or impoverish.
Detritus	All non-living organic material, including animal waste products and the remains of animals, plants and micro-organisms/ together with the associated microbial community {bacteria and fungi).
Diatoms	Single celled water plants.
Diffuse Source Pollution	Pollution originating from a widespread area, e.g. urban stormwater runoff, agricultural runoff.
Discharge	Volumetric flow rate of water, typically measured in terms of cubic metres per second (m^3/s).
Dispersive Transport	The transport of dissolved matter through the estuary by vertical, lateral and longitudinal mixing associated with velocity shear.
Dissolved Oxygen	Atmospheric oxygen that dissolves in water. The solubility of oxygen in water depends upon temperature and salinity.
Diurnal	A daily variation, as in day or night.
Ebb Tide	The outgoing tidal movement of water within an estuary.
Ecologically Sustainable Development	Development that does not interfere with the short and long term well-being, health and viability of estuarine ecosystems.
Ecosystem	A community of living organisms, together with the environment in which they live and with which they interact.
Eddies	Large, circular, swirling movements of water, often metres or tens of metres across.
Elevated Half-Tide Levels	An increase in half-tide level caused by the 'trapping' of tidal water in upstream estuary reaches.
Endangered Fauna	"Protected Fauna of a species named in Schedule 12"of the National Parks and Wildlife Act 1974.
Entrance Bar	A deposit of sand or silt across the entrance to an estuary. The material may be either fluvial or marine in origin.
Environmental Impact Statement	"An assessment of the impact of a proposed development".
Epibiota	Organisms (plants and animals) attached to other organisms.
Epiphytic	(Of living organisms) attached to and growing on the surface of a plant, but not obtaining food or nutrients from the plant.
Estuarine Processes	Those processes that affect the physical, chemical and biological behaviour of an estuary, e.g. predation, water movement, sediment movement, water quality, etc.
Estuarine Resources	The totality of the animal, vegetable and mineral matter associated with an estuary and its environs' including estuarine waters, together with the amenity of the estuary.
Estuary	An enclosed or semi-enclosed body of water having an open or intermittently open connection to coastal waters in which water levels vary in a periodic fashion in response to ocean tides.
Estuary Management Process	A sequence of activities starting with the formation of an Estuary Management Committee and culminating in the implementation of an Estuary Management Plan that will foster the balanced and sustainable use of estuaries.

Eutrophication	The build-up of nutrient levels in a water body leading to the excessive growth of aquatic plants, which in turn depletes dissolved oxygen levels in the waterbody.
Fauna	"Any mammal, bird, reptile or protected amphibian".
Fish (In the context of the Fisheries & Oyster Farms Act, 1935)	"All or any of the varieties of marine, estuarine or freshwater fishes "whether indigenous or not} and their young, fry and spawn, and unless the contrary intention be expressly stated or the context otherwise requires, includes crustacea and oysters and all marine, estuarine and freshwater animal life, and any part of a fish as hereinbefore defined, but does not include any species of whales".
Flocculate	The coalescence, through physical and chemical processes, of individual suspended particles into larger particles ('floes').
Flood Mitigation Works	Structures that are designed to manage floodwaters (e.g. levees, retarding basins).
Flood Tide	The incoming tidal movement of water within an estuary.
Fluvial	Pertaining to non-tidal flows.
Fluvial Processes	The erosive and transport processes that deliver terrestrial sediment to creeks, rivers, estuaries and coastal waters.
Fluvial Sediments	Land-based sediments carried to estuarine waters by rivers.
Foreshore	The area of shore between low and high tide marks and land adjacent thereto.
Fortnightly Tides	The variation in half-tide levels caused by the monthly cycle of Spring and Neap Tides.
Geomorphology	The study of the origin, characteristics and development of land forms.
Gravitational Circulation	A residual circulation in the lower reaches of an estuary characterised by landward flowing bottom currents and ocean flowing surface currents, driven by the gravitational forces associated with differences in salinity levels along the estuary.
Habitat	The places in which an organism lives and grows. Many estuarine organisms require different habitats at different stages of their life cycles.
Half-Tide Level	The average of successive high tide and low tide levels.
Heavy Metals	Generally, those metals that occur in Groups IS to VIIIB of the Periodic Table with atomic numbers between 21 and 84, but excluding Rare Earth elements. Heavy metals generally have a specific gravity of 5.0 or more and include chromium, iron, nickel, copper, zinc, silver, cadmium, platinum, gold, mercury and lead. Although essential in trace concentrations, some heavy metals are toxic to aquatic organisms at higher concentrations, e.g. mercury, lead, copper and zinc. Even when present in sub-lethal concentrations, heavy metals may adversely affect the health of aquatic organisms.
Herbivores	Grazing animals.
Humic Acid	Acidity resulting from the decomposition of organic materials.
Hydraulic Regime	The variation of estuarine discharges in response to seasonal freshwater inflows and diurnal tides.
Hydrolyse	Decompose by chemical reaction with water.
Hypersaline	Having a salinity greater than seawater (i.e. above 35 parts per thousand). (generally caused by salt concentration through evaporation.

Induration	The cementing together of sand particles by natural physical and chemical processes.
Intertidal	Pertaining to those areas of land covered by water at high tide, but exposed at low tide, e.g. intertidal habitat.
Invertebrate	Animal without a backbone, e.g. jellyfish.
Isohaline	A line connecting parts of the water mass having the same salinity, i.e. a contour of equal salinity levels.
Large-Scale Boundary Effects	The promotion of mixing in estuarine waters caused by the presence of large boundary features, such as headlands, bays and channels, that disturb flood and ebb tide flow patterns and provide storage for waters on the flood tide and release of these waters on the ebb, and so facilitate mixing across the estuary.
Levee	A man-made embankment or wall built to exclude floodwaters, or a natural embankment adjacent to a waterway built by the deposition of silt from floodwaters..
Littoral Zone	An area of the coastline in which sediment movement by wave, current and wind action is prevalent.
Littoral Drift Processes	Wave, current and wind processes that facilitate the transport of sediments along a shoreline.
Macroalgae	Small to large attached algae of several types (red, brown and green). Green algae may become detached and accumulate in shallow waters.
Macrophytes (aquatic)	Rooted aquatic plants, e.g. Eelgrass.
Mangroves	An intertidal plant community dominated by trees.
Marine Sediments	Sediments in coastal waters moved along the coast by littoral processes.
Mollusc	A large phylum of animals, mostly aquatic, including mussels, snails and octopus, which are soft-bodied, often with a hard shell, unsegmented, and having a head and muscular foot.
Neap Tides	Tides with the smallest range in a monthly cycle. Neap tides occur when the sun and moon lie at right angles relative to the earth (the gravitational effects of the moon and sun act in opposition on the ocean).
Numerical Model	A mathematical representation of a physical, chemical or biological process of interest. Computers are often required to solve the underlying equations.
Pelagic Organisms	Organisms living in the water column of the ocean and capable of moving independently of currents.
Phase Lag	Difference in time of the occurrence between high (or low water} and maximum flood (or ebb) velocity at some point in an estuary.
Physical Model	The representation of physical processes of interest, e.g. water movement or sediment movement, by a scale model of the estuary and the process.
Phytoplankton	Microscopic free-floating aquatic plants (algae).
Pneumatophores	Air breathing roots.
Point-Source Pollution	Specific localised source of pollution, e.g. sewage effluent discharge, industrial discharge.
Polychaete	A segmented worm with bristles.
Poorly-Mixed Estuary	An estuary characterised by poor vertical mixing, pronounced vertical salinity gradients and a discrete body of saltwater (a salt wedge) underlying freshwater.

Protected Amphibian	An amphibian of a species named in Schedule 12A of the National Parks and Wildlife Act 1974.
Protected Fauna	Fauna of a species not named in Schedule 11of the National Parks and Wildlife Act 1974.
Protected Native Plant	A native plant of a species named in Schedule 13n of the National Parks and Wildlife Act 1974.
Receiving Waters	Waters into which effluent or waste streams are discharged or discharge.
Reptile	"A snake, lizard, crocodile, tortoise, turtle or other member of the class reptilia (whether native, introduced or imported), and includes the eggs and the young thereof and the skin or any other part thereof".
Residual Sediment Flux	The net upstream or downstream movement of sediment over a tidal cycle, often determined by tidal distortion and gravitational circulation.
Revetments	Walls built parallel to the shoreline to limit shoreline recession.
Riparian Vegetation	Vegetation growing along banks of rivers, including the brackish upstream reaches of an estuary.
Runoff	That proportion of rainfall that drains off the land's surface.
Salinity	The total mass of dissolved salts per unit mass of water. Seawater has a salinity of about 35 g/kg or 35 parts per thousand.
Salinity Limit	The landward limit of salinity intrusion along an estuary. The location of the salinity limit changes with freshwater discharge, high freshwater inflows moving the limit downstream, whilst low flows allow salt and the salinity limit to migrate upstream.
Saltation	The movement of sediment particles along the bed of a waterbody in a series of 'hops' or 'jumps'. Turbulent fluctuations near the bed lift sediment particles off the bed and into the flow where they are carried a short distance before falling back to the bed.
Saltmarsh	A coastal wetland subject to tidal flooding and vegetated by grasses, herbs and low shrubs that are tolerant of high salinity.
Salt Wedge	The wedge-shaped body of saltwater that underlies freshwater in poorly-mixed estuaries.
Sediment Load	The quantity of sediment moved past a particular cross-section in a specified time.
Semi-diurnal	A twice-daily variation, e.g. two high waters per day.
Shear Strength	The ability of the bed to accommodate flowing water without the movement of bed sediments. The shear strength of the bed depends upon bed material, degree of compaction and armouring,
Shear Stress	The stress exerted on the bed of an estuary by flowing water. The faster the velocity of flow' the greater the shear stress.
Shoals	Shallow areas in an estuary created by the deposition and build up of sediments.
Slack Water	The period of still water before the flood tide begins to ebb (high water slack) or the ebb tide begins to flood (low water slack).
Spring Tides	Tides with the greatest range in a monthly cycle, which occur when the sun, moon and earth are in alignment (the gravitational effects of the moon and sun act in concert on the ocean).

Storm Surge	The increase in coastal water levels caused by the barometric and wind setup effects of storms. Barometric setup refers to the increase in coastal water levels associated with the lower atmospheric pressures characteristic of storms. Wind setup refers to the increase in coastal water levels caused by an onshore wind driving water shorewards and piling it up against the coast.
Stratigraphy	That branch of geology dealing with the ordering of rocks into their relative ages.
Sub-Aerial Sand Barrier	A sand barrier with crest level above high tide; usually vegetated.
Super-Elevation	See Storm Surge.
Surface Pollutants	Floating pollutants that do not mix effectively with water, e.g. Oil.
Suspended Sediment Load	That portion of the total sediment load held in suspension by turbulent velocity fluctuations and transported by flowing water.
Swale	A topographic depression in a dune system that may retain water.
Tailings	The residue of mined ores after the target mineral has been extracted.
Tidal Amplification	The increase in the tidal range at upstream locations caused by the tidal resonance of the estuarine waterbody, or by a narrowing of the estuary channel.
Tidal Celerity	The speed of travel of the tidal wave along estuaries. Celerity depends upon the depth of water; the deeper the water, the greater the celerity.
Tidal Delta	The build-up of shoals in the lower reaches of an estuary due to the gradual accumulation of marine sands transported into the estuary through its entrance.
Tidal Distortion	The distortion of the tidal variation of water levels in shallow estuaries caused by the differences in the celerity of rising (faster) and falling (slower) water levels.
Tidal Exchange	The proportion of the tidal prism that is flushed away and replaced with 'fresh' coastal water each tide cycle.
Tidal Excursion	The distance travelled by a water particle from low water slack to high water slack and vice versa.
Tidal Lag	The delay between the state of the tide at the estuary mouth (e.g. high water slack) and the same state of tide at an upstream location.
Tidal Limit	The most upstream location where a tidal rise and fall of water levels is discernible. The location of the tidal limit changes with freshwater inflows and tidal range.
Tidal Planes	A series of water levels that define standard tides, e.g. 'Mean High Water Spring' (MHWS) refers to the average high water level of Spring Tides.
Tidal Prism	The total volume of water moving past a fixed point on an estuary during each flood tide or ebb tide.
Tidal Propagation	The movement of the tidal wave into and out of an estuary.
Tidal Pumping	The generation of Elevated Half-Tide Levels because of the greater celerity of the flood tide compared to the ebb tide.
Tidal Range	The difference between successive high water and low water levels. Tidal range is maximum during Spring Tides and minimum during Neap Tides.
Tidal Trapping	The process whereby a discrete body of water is trapped over shallow shoal areas on the flood tide and separated from other water moving up the estuary. This facilitates mixing.

Tidally Averaged Models	Models that predict estuarine behaviour over periods greater than a tidal cycle, i.e. the temporal resolution is of the order of days, weeks or months.
Tidally Varying Models	Numerical models that predict estuarine behaviour within a tidal cycle, i.e. the temporal resolution is of the order of minutes or hours.
Tides	The regular rise and fall in sea level in response to the gravitational attraction of the sun, moon and planets.
Total Catchment Management	"The coordinated and sustainable use of land, water, vegetation and other natural resources on a water catchment basis so as to balance resource utilisation and conservation".
Training Walls	Walls constructed at the entrances of estuaries to improve navigability.
Turbidity	A measure of the ability of water to absorb light.
Velocity Shear	The differential movement of neighbouring parcels of water brought about by velocity gradients. Velocity shear causes dispersive mixing, the greater the shear (velocity gradient), the greater the mixing.
Vertebrate	Animal with a backbone, e.g. fish, birds.
Water Quality	The suitability of the water for various purposes, as measured by the concentration or level of a wide variety of contaminants.
Well-Mixed Estuary	Estuary characterised by strong vertical mixing and weak or non-existent vertical salinity gradients.
Wind Shear	The stress exerted on the water's surface by wind blowing over the water. Wind shear causes the water to pile up, against downwind shores and generates secondary currents.

APPENDIX B

MEMBERS OF THE MORUYA / DEUA RIVER
ESTUARY MANAGEMENT COMMITTEE

Table B MEMBERS OF THE MORUYA / DEUA RIVER ESTUARY MANAGEMENT COMMITTEE

NAME	ORGANISATION	ROLE / TITLE
Clr C Kowal	Eurobodalla Shire Council	Councillor / Estuary Management Committee Chair
Clr P Cairney	Eurobodalla Shire Council	Councillor
Ms M Edmonds	Eurobodalla Shire Council	Committee Coordinator
Mr R Toohey	Eurobodalla Shire Council	
Ms D Lenson	Eurobodalla Shire Council	
Mr N Lenehan	Eurobodalla Shire Council	
Mr R Cumming	Eurobodalla Shire Council	
Ms P Pollock	Eurobodalla Shire Council	
Ms B Nicholson	Eurobodalla Shire Council	
Mr A Parkinson	Eurobodalla Shire Council	
Mr M Kinred	Department of Environment and Climate Change	
Ms G Wiltshire	DECC	
Mr C Howard	DECC (NPWS)	
Dr T Daly	Dept Primary Industries (*Fisheries*)	
Mr M Richardson	Dept Primary Industries (*Fisheries*)	
Ms J Keating	Southern Rivers Catchment Management Authority	
Mr R Moldovan	NSW Maritime Authority	
Mr L Ziegler		
Mr K Dance		
Ms R Corringham	Coastwatchers	
Mr M Vidgen	Commercial Boat Operator	
Mr M Crowley	Environmental Planning and Assessment	
Mr I Barnes	State Forests NSW	
Mr G Scobie	Moruya & District Chamber Commerce	
Mr R Snape	Commercial Fishers Advisory Council	
Mr M Taylor	Oyster Farmer representative	
Mr D Hunt		
Mr B Kelaher	Marine Park Authority	
Mr N Parsons	Cobowra LALC	
Mr N Russell	Mogo LALC	
Mr J Brierley		
Mr G Thomas	Moruya Rotary	

APPENDIX C

COMMUNITY INFORMATION BROCHURE

MORUYA / DEUA RIVER ESTUARY MANAGEMENT PLAN

Community Information Brochure

Work is underway to prepare an Estuary Management Plan for the Moruya / Deua River Estuary. Environmental Consultant, Patterson Britton & Partners, has been engaged to facilitate the preparation of the Plan.

The primary aim of the Plan is to encourage the ecologically sustainable use of the Moruya/Deua River Estuary into the future. The Plan is to reflect the agreed position of all regulatory authorities and interested parties in relation to future nature conservation and development within the estuary. It will also outline measures that can be implemented to rehabilitate degraded areas of the estuary.

RECREATION

LOSS OF RIPARIAN VEGETATION

MANAGING EXISTING PROBLEMS

- Damage to existing bank stabilisation works
- Loss of terrestrial biodiversity and the connectivity of riparian corridors for wildlife
- Uncontrolled stock access to the estuary foreshore
- Loss of riparian vegetation
- River bank erosion
- Conflicts between waterway users

BANK EROSION

KEYS TO MANAGING FUTURE GROWTH AND DEVEVELOPMENT

- Understanding of primary productivity of the estuary
- Sound planning and use of regulatory powers
- Preservation of cultural heritage sites
- Tourist and recreational access, facilities and activities

COMMUNITY VALUES

- Lifestyle and recreation
- History and nature conservation
- Responsibility to future generations

MORUYA / DEUA RIVER ESTUARY MANAGEMENT PLAN

	Potential Management Strategies	Benefits
A	Bank stabilisation and revegetation works in the vicinity of Glenduart Cemetery and Glenduart Riverside Reserve.	Restore riparian vegetation, reduce bank erosion, preserve cultural heritage sites, provide for improved recreational and visual amenity
B	Reinstate riparian vegetation at cleared sections along the banks of the Moruya River	Improve runoff quality, provide wildlife corridors, improve visual amenity
C	Undertake works to protect and enhance riparian vegetation along the north bank of the Moruya River between River Breeze Caravan Park and Glenduart Riverside Reserve	Restore riparian vegetation, reduce bank erosion, and provide wildlife corridors
D	Construct combined pedestrian walkway and cycleway along north bank of Moruya River between River Breeze Caravan Park and Glenduart Riverside Reserve	Provide for recreational access and protection of riparian vegetation
E	Incorporate canoe / kayak launching area at Yarragee Reserve	Recreational amenity
F	Repair or replace Quarry Wharf	Recreational amenity and safety, tourism
G	Install BBQ facilities at Yarragee Reserve and Ryans Creek parkland	Recreational and cultural amenity, tourism
H	Formalise foreshore facilities at popular recreation area on North Head Drive	Recreational amenity and safety, reduce bank erosion, protect riparian vegetation
I	Construct a boardwalk through Ryans Creek wetland	Recreational access, protect wetland areas, tourism, community awareness
K	Develop a Bank Erosion Program for Moruya River Estuary	Prioritise sites for bank stabilisation, prevent future bank erosion, restore riparian vegetation, improve visual amenity
L	Investigate the feasibility of constructing a pedestrian / cycleway between Ryans Creek and Preddys Wharf as part of the cycleway linking South Head to Moruya Township	Recreational amenity and tourism

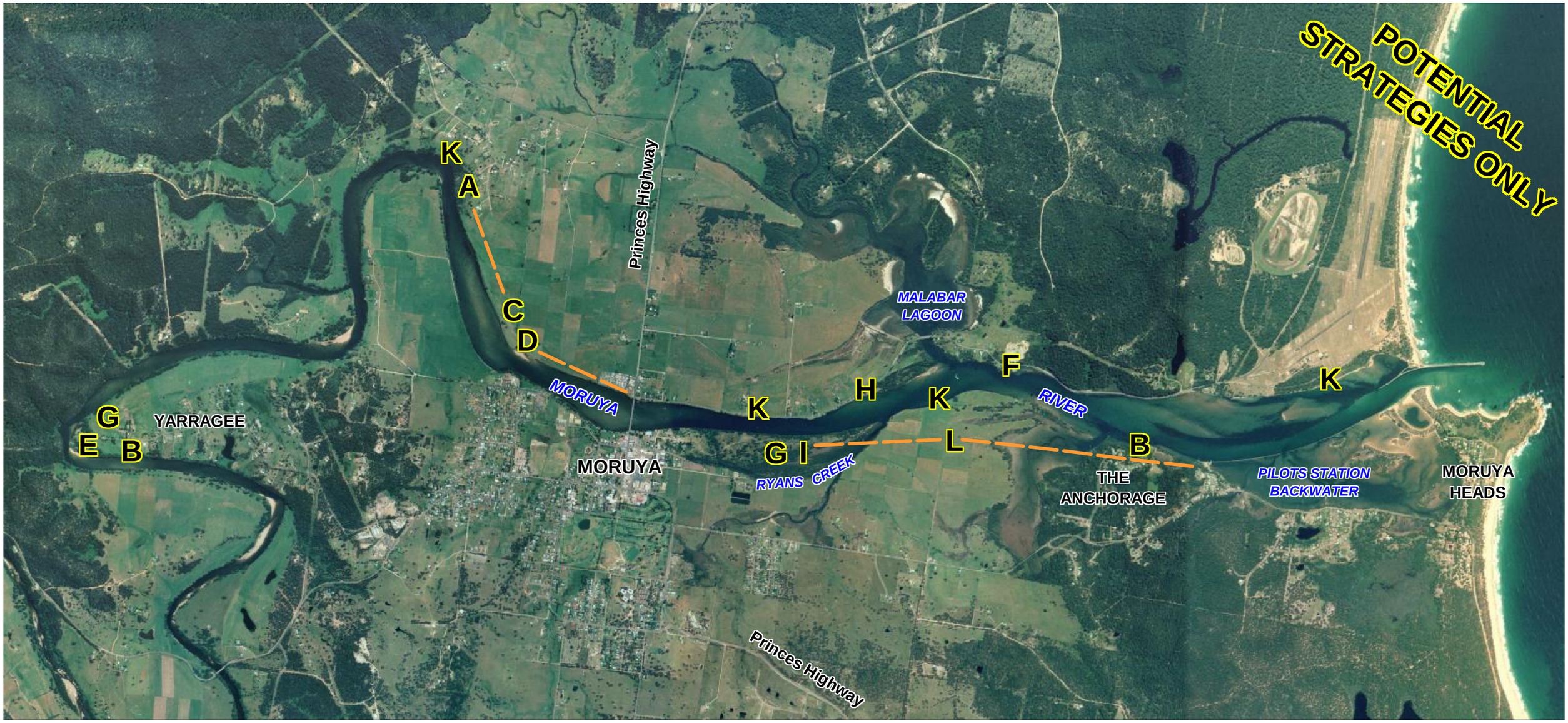
EXAMPLE OF BANK STABILISATION WORKS

Eurobodalla Shire Council and the Estuary Management Committee invite you to become involved in the project.

We are keen to hear your views about estuary issues for Moruya / Deua River and the potential management strategies. Please forward your comments or completed questionnaire by 21st May 2007 to:

Warick Honour
Patterson Britton & Partners
PO Box 515
NORTH SYDNEY NSW 2059

You may also forward your comments by email to warickh@patbrit.com.au



STRATEGY A - Bank stabilisation and revegetation works in the vicinity of Glenduart Cemetery and Glenduart Riverside Reserve

STRATEGY B - Reinstate riparian vegetation at cleared sections along the banks of the Moruya River

STRATEGY C - Undertake works to protect and enhance riparian vegetation along the north bank of the Moruya River between River Breeze Caravan Park and Glenduart Riverside Reserve

STRATEGY D - Construct combined pedestrian walkway and cycleway along north bank of Moruya River between River Breeze Caravan Park and Glenduart Riverside Reserve

STRATEGY E - Incorporate canoe / kayak launching area at Yarragee Reserve

STRATEGY F - Repair or replace Quarry Wharf

Patterson & Partners Britton Pty Ltd

STRATEGY G - Install BBQ facilities at Yarragee Reserve and Ryans Creek parkland

STRATEGY H - Formalise foreshore facilities at popular recreation area on North Head Drive

STRATEGY I - Construct a boardwalk through Ryans Creek wetland

STRATEGY K - Develop a Bank Erosion Program for the Moruya River Estuary

STRATEGY L - Investigate the feasibility of constructing a pedestrian / cycleway between Ryans Creek and Preddys Wharf as part of the cycleway linking South Head to the Moruya Central Business District

Have Your Say about
Potential Management Strategies for
Moruya / Deua River Estuary

If you wish to register your views or outline alternative estuary management strategies for Moruya / Deua River Estuary, please complete this form and return it to the address overleaf. Please note that not all potential management strategies are presented in this information brochure.

PERSONAL DETAILS

Your Name: _____

Your Address: _____

Your Telephone Number: _____

.....

QUESTIONS (please tick a box)		YES	NO	NO VIEW
(1)	How many years have you lived in the Moruya area? _____			
(2)	Are you in favour of Management Strategy A?	☐	☐	☐
(3)	Are you in favour of Management Strategy B?	☐	☐	☐
(4)	Are you in favour of Management Strategy C?	☐	☐	☐
(5)	Are you in favour of Management Strategy D?	☐	☐	☐
(6)	Are you in favour of Management Strategy E?	☐	☐	☐
(7)	Are you in favour of Management Strategy F?	☐	☐	☐
(8)	Are you in favour of Management Strategy G?	☐	☐	☐
(9)	Are you in favour of Management Strategy H?	☐	☐	☐
(10)	Are you in favour of Management Strategy I?	☐	☐	☐
(11)	Are you in favour of Management Strategy K?	☐	☐	☐
(12)	Are you in favour of Management Strategy L?	☐	☐	☐

Are there any other Estuary Management Strategies that you believe should be considered?
If so, please list and describe (please include additional sheets if required):

(i) _____

_____

(ii) _____

_____

APPENDIX D

ABORIGINAL CULTURAL HERITAGE
PUBLIC REPORT

MORUYA DEUA RIVER ESTUARY MANAGEMENT STUDY

ABORIGINAL CULTURAL HERITAGE

PUBLIC REPORT

PREPARED FOR
PATTERSON AND BRITTON AND PARTNERS

PREPARED BY
SUSAN DALE DONALDSON
ENVIRONMENTAL & CULTURAL SERVICES
In consultation with Cobowra and Mogo Local Aboriginal Land Councils

DECEMBER 2006

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ACKNOWLEDGEMENTS

I wish to acknowledge the Aboriginal people who participated in this study and to their ancestors who had the opportunity to pass stories onto them. Aboriginal cultural heritage, including the physical, the intangible and the associated stories and mythologies belong to the Aboriginal community.

DISCLAIMER

A great deal of cultural information is not contained within this report, as a result of the traditional laws relating to the restriction of Aboriginal peoples' cultural knowledge. As such the author warns that this report should not be considered a complete documentation of all the places of Aboriginal cultural significance within the Moruya Deua River area; to many Aboriginal people the entire landscape is sacred, not just isolated middens, campsites and dreaming tracks.

1. INTRODUCTION

The State policies administered by the Department of Natural Resources, the NSW Estuary Management Policy 1992 and the NSW Coastal Policy 1997, aims to ensure that local governments properly manage coastal waterways within their area. Sydney based engineering company Patterson, Britton and Partners are overseeing the Moruya Deua River Estuary Study and Management Plan, within the Eurobodalla Shire. As a local anthropological researcher, Environmental and Cultural Services has been engaged to work with the local Aboriginal community to investigate the Aboriginal cultural heritage aspects of the project.

The Moruya Deua River Estuary extends from the coastal headwaters to the Kiora vicinity. The primary estuarine waterways feeding into the Moruya Deua River Estuary include Gilmores Creek, The Anchorage, Ryans Creek, Malabar Creek, Malabar Lagoon and Mogendoura Creek. The upper catchment area, including the Deua River through to Bendethra, is also relevant to the study area, particularly when conditions upstream affect the lower estuarine areas. Primary waterways in the upper catchment area include Moodong Creek, Majors Creek, Araluen Creek, Con Creek, McGregors Creek, Burra Creek and Wamban Creek.

In relation to Aboriginal cultural heritage, this report aims to address the following tasks as outlined in the Eurobodalla Shire Council tender documentation, in consultation with Mogo LALC and Cobowra LALC.

- Identify historic and current Aboriginal land uses.
- Identify local and / or regional Aboriginal values of the river.
- Recommend on protection and management of known Aboriginal sites and areas of cultural heritage significance.
- Recommend strategies to promote an awareness and respectful response to Aboriginal cultural heritage issues.

Under the NSW Aboriginal Land Rights Act, the Moruya - Deua River marks the boundary between two Local Aboriginal Land Council [LALC] regions. The Mogo LALC region lays to the north of the river and the Cobowra LALC region to the south[1]. In accordance with proticols concerning the possession of cultural knowledge, only non-restricted cultural information is contained within this report. A complementary restricted report containing details on site locations and associated significances has been provided to the Local Aboriginal Land Councils.

[1]The proposed amalgamation of Mogo LALC and Cobowra LALC is likely to alter this boundary.

1.1 METHODOLOGY

Background research materials held by the research institutions, the LALCs, as well as a search of the NSW Department of Environment and Conservation Aboriginal Heritage Information Management System [AHIMS] were assessed.

Baseline research was followed by a number of planning meetings with the LALCS, in order to establish a fieldwork plan. Advice was received from Mogo and Cobowra Local Aboriginal Land Councils in regards to interested participants. The two Local Aboriginal Land Councils offered site officer s and field assistants. The fieldwork process aimed to ensure a balance across gender, family and community groupings. Fieldwork took place between October and December 2006. Consultation aims were achieved to a large extent, however a number of people did not wish to or were unable to participate in the project.

Fieldwork consultations took place with Trisha Ellis [23.10.06]; Mary Duroux, Dave Tout, Christine Lee, Cherie Buchert and Michelle Davis [6.11.2006]; Adrian Andy, Arthur Andy, Thomas Butler and John Brierly [15.11.2006]; Norman Russell, Keith Nye, Thomas Butler and James Nye [31.10.2006]; Karen Lee, Michelle Davis and Trisha Ellis [20.11.2006]; Cherie Buchert and Trisha Ellis [21.11.2006]; Michelle Davis and Trisha Ellis [29.11.2006] and John Brierley, Thomas Butler and Norman Russell [1.12.2006]. Discussions were also had with Norman Lenehan, Environment Team, Project Officer, Eurobodalla Shire Council [17.11.206] and Ronald Nye, Aboriginal Liaison Officer, Eurobodalla Shire Council [4.12.2006]; whilst a site inspection took place with Vanessa Mason, Aboriginal Heritage Conservation Officer, Department of Environment and Conservation [23.11.2006].

2 CULTURAL INTERPRETATIONS OF THE STUDY AREA

Underlying the study area is an Aboriginal land tenure system present prior to the European settlement of the area[2]. The term Moruya was recorded during the early contact period as *Moorooya* [Flanagan 1833], *Moriuaa* [Flanagan 1837] and *Moyoru* [Oldrey 1843] being the name of an Aboriginal group occupying the present day Moruya area[3]. It is thought that the term Moruya may also refer to the shallow crossable section of the Moruya River, although in Dhurga, the local Aboriginal language, the term for this feature is *Cobowra*[4].

Also recorded during the early contact period was the Aboriginal group named *Kiyora* [Flanagan 1833] or *Kiora* [Oldrey 1842] who occupied territory to the west of Moruya [= Kiora]; the Aboriginal group named *Gundaree* [Oldrey 1842] who occupied territory on the south side of the Moruya River [=Gundary]; the Aboriginal group named *Mullinderry*

[2] See Robinson 1844, Mathews 1902, Morris 1832, Oldrey 1842 in Goulding 2005.
[3] Wesson 2000: 141.
[4] T Ellis 29.11.2006 in a northern Aboriginal language. See also Donaldson [2006: 68].

[Morris 1832] or *Mullandaree* [Flanagan 1833] or *Mulendary* [Oldrey 1843] who occupied the Mullenderre Creek area; and the Aboriginal group named *Dooga* [Oldrey 1842] who occupied the Dooga Creek area. The term *Mokondoora* was also recorded [Oldrey 1842] as a place name, rather than the name of a group of people and refers to the Mogendoura Creek area[5]. These localities are known by the same names today, although with differing orthographies.

On a regional scale, the Yuin [Djuwin] tribal area extends from the Shoalhaven River in the north, to the Murray River in the south and west to the Great Dividing Range. Within the Yuin tribal area, thirteen [13] sub tribal groupings exist. The mythological basis to the Yuin tribal division is said to involve the mythical ancestor "Bundoola' who had thirteen [13] wives each representing the different tribal groups.

It is understood that the Moruya River acts as a tribal boundary on two levels[6]. Firstly, the broader Yuin area is divided into the Guyangal and Kurial sub tribes, the Guyangal tribal area located to the south of the Moruya River and the Kurial to the north[7]. The Moruya River also acts as the boundary between two of the thirteen Yuin tribal groups, as described above. The Bringa – Yuin tribal area is located to the south of the Moruya River, whilst the Walbanja – Yuin tribal area is located to the north of the Moruya River[8].

On a linguistic level, the study area is primarily associated with the *Dhurga* [Thoorga / Durga] language. The Dhurga language is a dialect of a language that existed in a variety of forms including *Dhurga [*Thoorga/Durga], *Djirringanj*, *Thurumba* or *Mudthung* and *Tharawal*[9].

The Moruya River has provided economic and spiritual sustenance to Aboriginal people for thousands of years. The particular tangible cultural attributes of the river relate to the collection of natural resources, from shellfish for food, to reeds for making baskets, to bark for making canoes; whilst the intangible values relate to the Dreamtime past and totemic connections

> '.... The whole river is part of our culture, not just this place and that. At different times we use different places for different reasons. .... One day will be good for collecting pipis, another day for muscles and another day for fish...We don't use bark canoes any longer, a tinny

[5] Wesson 2000: 140 – 141, 167.
[6] The description of tribal boundaries can vary according to context and level of knowledge.
[7]See Warner [nd] and Howitt 1904: 82. See also Wesson 2000: 153.
[8] See Howitt 1904 [1996]; Egloff, Peterson and Wesson [2005]. T Ellis 20.11.06.
[9] Egloff, Peterson and Wesson [2005]: 17.

does the same job...we still use spears and nets to gather food like our ancestors did'. [10]

Scale, depth, time and context are all dimensions relevant to the investigation of heritage values. What is important at the family / clan level may not necessarily be of importance at the regional level. Attributed values also vary over time, seasonal cycles and political and social contexts. No less value is attributed to a place as a result of it only being utilised once every winter or even once every decade.

2.1 CULTURAL USAGE: PAST AND PRESENT

Archaeological investigations, combined with the historical documentation by Goulding [2005] and the oral histories outlined in Donaldson [2006] reveal a vibrant community, which has held onto culturally based practises whilst participating in local developments. Past and present day usage of the Moruya Deua River Estuary and the immediate environment by Aboriginal people primarily relate to resource collection, living and camping, recreational activities, traditional traveling routes, conflict, work and the establishment of government reserves.

Aboriginal occupation of the south coast, took place at least 20,000 years ago[11]. Archaeological investigations provide evidence of how Aboriginal people utilised the Moruya - Deua River and surrounding land and waterways. Archaeological evidence of past usage holds contemporary significance for present day Aboriginal custodians, as it provides a physical link to their ancestors.

The presence of artefact scatters represent evidence of campsite inhabitation, maintenance and manufacture of tools and food preparation; shell middens found along coastlines and in estuarine areas are the deposited remains of the local diet; and scarred trees are caused by the removal of bark for use in manufacturing canoes, containers, shields or shelters[12].

All of these physical features are present in the immediate Moruya Deua River Estuary and upper catchment environments. Archaeological evidence reveals that the tidal flats of the Moruya River provided access to fish and shellfish species exploited by Aboriginal people prior to European settlement of the area, whilst in the upper catchment, inland ridgelines from Eurabene Mt through to Majors Creek and Araluen were utilised as travelling routes linked to Burra Creek and the Deua Moruya River[13].

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[10] J Brierley 15.11.2006.
[11] See Lampert, R 1971 regarding Burrill Lake, 60 km to the north of the study area.
[12] Although the locations of these sites are known to the local Aboriginal community only general descriptions are provided in this publicly available report.
[13] The Deua River Archaeological survey is currently being undertaken by A Andy, K Lee, T Ellis and D Williams et al 15.11.2006.

Although a number of early European explorers, including Captain Cook in April 1770, would have passed by the headwaters of the Moruya River, it was not until the late 1820s that people other than the original inhabitance penetrated the area and began to documented local customary practises[14]. In the 1830s Rose estimated there to be 400 Aboriginal people residing in the Moruya area[15].

The impact of disease and restrictive government policies on Aboriginal society saw the introduction of segregated government reserves, forcing Aboriginal people to adopt the European - Australian way of life. In 1875 the Moruya [Campbell] Reserve was gazetted over 24 acres of land in the south Moruya Heads area and an additional 320 acres was gazetted nearby in 1883[16]. Throughout this period Aboriginal people continued to undertake traditional practises such as thoes documented in relation to the intertribal conflict in the Kiora area and regional ceremonial gatherings in the south[17].

Natural resources are used now and in the past as a food source, as a base for medicines, for altering the weather pattern, to construct shelters and shades and to make tools, for instance. The use and significance of a variety of natural resources across the Eurobodalla Shire was investigated by Donaldson [2006] who found that over 90% of natural resource collection places documented related to the coastal ecosystem, including tidal creeks and nearby lagoons, whilst 10% were found within 20km of the coast in bush land areas. Several of the culturally valued plant species identified are considered rare such as the Pinkwood [*Eucryphia moorei*], whilst others are quite common such as the Black Wattle [*Acacia Mearnsii*] and Inkweed [*Phytolacca*].

Fishing, considered by some as a recreational activity, is for many Aboriginal people across the region, a means to feed families and reconnect with traditional waterways. The participation of Aboriginal families in the fishing industry is found in varying intensities the length of the coastline. From catching fish to feed a family, to trading fish for butter and bread and hauling in tonnes of fish and selling at market value. Each of these endeavours allowed Aboriginal families to remain close to their traditional waterways and adjacent lands, and maintain traditional customary practises.

Resource collection places are closely related to living and camping places, as well as teaching and work places. Where families camped, they make use of nearby natural resources. Where families worked, they make use of nearby natural resources; and where natural resources are being collected, elders pass on traditional ecological knowledge to the next generation, teaching them how to collect, prepare and cook / make, the food, medicine or object. Large family gatherings along the banks of the Moruya River, in particular at the Moruya Weir at the entrance to Malabar Lagoon, Ryans Creek, Yarragee, Glenduart, North Heads, Garlandtown and Kiora relate to

[14] Goulding 2005: 23-31.
[15] Goulding 2005: 43..
[16] Goulding 2005: 52-3.
[17] Howitt 1904: 527, 537.

resource collection and teaching. Family get-togethers, no matter how big or small, continue to be a primary avenue for the transmission of cultural knowledge and the maintenance of spiritual links to the land and waterways.

2.2. CULTURAL VALUES: LOCAL AND REGIONAL

In accordance with Australia's International Council on Monuments and Sites (ICOMOS) Burra Charter, assessment of the cultural significance of a place relates to scientific, social, historic and or aesthetic values[18]. Social values are broadly defined as 'the qualities for which a place has become a focus of spiritual, political, natural or other cultural sentimental to a majority or minority group'[19]. Aboriginal cultural significance of a place refers to the value attributed to a place by Aboriginal community, usually based on cultural affiliations with particular sites. The cultural significance or value attributed to a place may be part of contemporary Aboriginal culture or relate to connections with spiritual beliefs and histories.

The Moruya - Deua River Estuary has a rich combination of heritage values associated with spiritual significances held by the Aboriginal community. "The Dreamtime"[20], as it is called in English, refers to the creative era when the landscape was given form by the activities of Spirit Beings, the spiritual ancestors of Aboriginal people today. In the southeast coastal region, the focal Creation Beings were *Biame* and his wife *Birrahgnooloo*, who gave form to waterways, landforms, animals [including totems], humans, power to 'clever people' and the overarching Aboriginal Lore[21]. Some Dreamtime mythologies cover vast distances, traversing tribal and linguistic boundaries, whilst others are more localised and mark discrete territories. To many Aboriginal people however, the entire landscape is imbued with a spirituality, which is intertwined with them as custodians of the land and waterways. A river can be seen as a brother and a mountain a mother; kinship ties link people to people and people to the land.

Gulaga [Mount Dromedary], located immediately west of Tilba Tilba, is known as the place of ancestral origin for Yuin people. *Gulaga* itself symbolises the mother and provides a basis for Aboriginal spiritual identity, for both Aboriginal women and men throughout the region[22]. Moruya people's mythological interpretion of *Gulaga* relates to a flood in the Dreamtime past when people took refuge on the mountain:

> ".....The waters rose so swiftly that many people were taken and drowned. Others tried to save their kin but were drowned too. Dharramullin (what we call Biaami here) seeing what was happening

[18] The Burra Charter provides guidance for the conservation and management of places of cultural significance (cultural heritage places).
[19] ICOMOS 1999: 30.
[20] The term 'Dreaming' covers a range of interconnected concepts including Dreaming ancestors and their creative journeys, religious laws and sacred ceremonies.
[21] Rose, James, Watson 2003: 21-22.
[22] See Egloff, Peterson and Wesson [2005] and Donaldson 2006: 9.

> thought he may have been too harsh on all people and relented some. He turned the brave rescuers into diving birds, cormorants, darters, shags, etc so that they could dive deeper and swim stronger to rescue their kin. Many were saved and remember their kinship to the diving birds.....'.[23]

Many 'totems' in the region relate to water birds for this reason. The term 'totem' is used to describe the complex inter-relationship between people and the natural world, the two providing mutual benefits to each other through a spiritual, yet tangible inter-dependency. There are a number of different forms or categories of totems including personal totems, gender totems, family totems, tribal totems and totems relating to the specialised powers of 'clever people'[24]. People speak of protecting their totemic species, not eating or killing it, as well as taking care of the habitat that sustains it.

The totem for the Moruya area is the Black Swan [*Cygnus atratus*], known in the Dhurga language as *Gunyung*. Personal totemic species from the local area include the Crow known as *Waagura* [*Corvus coronoides*], Laughing Kookaburra [*Dacelo novaeguineae*], White-headed Pigeon known as *Guriwal* [*Columba leucomela*], Willy Wagtail [*Rhipidura leucophrys*], Australian Magpie known as *Diriwun* [*Gymnorhina tibicen*] and the Boobook [Mopoke] known as *Googoog* [*Ninox novaeseelandiae*] [25].

Other places imbued with spiritual values relate to ancient regional ceremonial meeting grounds, as well as places where Aboriginal families simply know not to go due to the feeling or messages they received from the spiritual ancestors within the land. Such places usually relate to gender restricted areas and burial sites, for instance.

As noted above, contemporary values may be attributed to archaeological sites dating back to the pre contact era. These sites may hold local cultural significance, whilst being of regional scientific value. A shell midden, for instance, may be cared for and controlled by present day local Aboriginal custodians, and hold regional scientific value as a result of its rarity and state of preservation. Either way, the ongoing relationship Aboriginal people have to archaeological sites is evidence of the cultural heritage value attributed to these places.

Details of the cultural values and usages associated with the study area are detailed by location in section 3 below.

[23] T Ellis 20.11.2006.
[24] Rose, James and Watson 2003: 3.
[25] Hale 1846 [1968]. See also Eades 1976 and Donaldson 2006.

3. PLACES OF ABORIGINAL CULTURAL HERITAGE

Places associated with the Moruya Deua River Estuary, identified as being used for cultural purposes or being of cultural heritage value to the Aboriginal community, range from being highly significant to most Aboriginal people in the region, to other places, which are highly significant on a group/ family scale. Both of these perspectives are important and together form the basis of strong and enduring links to the landscape. Cultural heritage values and usages outlined in this section combine both pre and post-contact significances[26].

3.1 NORTH MORUYA HEADS

Aboriginal cultural heritage in the **North Moruya Heads** and **Garlandtown** area combine pre-contact values such as burial sites and ceremonial grounds through to post contact uses relating to residential, work, recreation, teaching and resource collection. Camping use throughout the mid 1900s related to fishing, seasonal picking and break wall construction work.

The presence of the midden material reveals how Aboriginal occupants' utilised the area to consume seafoods. Resource collection and living / camping in the area continue to be highly valued today. Native cherries [*Exocarpos cupressiformis*], native raspberries [*Rubus rosifolius*], native yams [*Thysaotus spp*.], honey suckle [*Lonicera japonica*.], pig face [*Carpobrotus glaucescens*] and 'gum' from black wattle trees [*Acacia Mearnsii*] can be found in the area[27].

Oral histories record usage of the area throughout the 1940s and 1950s as families walked along the coast, particularly between Wallaga Lake and Ulladulla, camping along the way on the flatlands at Garlandtown, Moruya[28]. The area is closely associated with the Brierleys, a fishing family who reside and utilise the river, primarily in the area adjacent to the airport now known as 'Brierley's Boat ramp'. Fresh water could be collected under the surface, with the rising tide.[29].

3.2 SOUTH MORUYA HEADS

Cultural heritage values attributed to the **South Moruya Heads** area relate to resource collection, education and living / camping. As with the entire coastline, South Moruya Heads is part of a coastal travelling route linking people and resources together.

Midden material and artefacts suggest the area was utilised for food consumption in past centuries[30]. Oral histories describe Shelley Beach as a

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[26] Only non-restricted cultural information has been outlined here.
[27] Donaldson 2006: 14, 59.
[28] Donaldson 2006: 10.
[29] J Brierley 15. 11.06.
[30] Williams 1997:14.

place to camp and collect resources whilst Toragy Point was and continues to be utilised as a fishing lookout[31].

Nearby on the estuarine foreshore, pre contact use of the tidal flats adjacent to the mouth of the Moruya River has been documented. Estuarine shell material including mud welks [*P ebinius*], bimbulas or Sydney Cockles [*Anadara trapezia*] and oysters [*Ostrea angasi*] were located, along with seafood materials such as periwinkles [*N atramentosa*] sourced from the nearby ocean waters[32]. Stone artefacts present in the same area indicate people also camped near the site.

Also on the estuarine foreshore in the Moruya South Heads area, a well-preserved estuarine shell midden rated as being of high local significance and moderate regional significance has been'[33].

In accordance with past practises, natural resources continue to be collected in the South Moruya Heads area, including bimbulas or Sydney Cockles [*Anadara trapezia*], and oysters [*Ostrea angasi*] at Shelley Beach and within Pilot Station backwaters around Quandolo Island[34].

3.3 MALABAR LAGOON

The catchment for **Malabar Lagoon** includes **Malabar Creek**, **Dooga Creek** and **Mullenderee Creek**. The '**Moruya Weir'** is situated at the junction of Malabar Lagoon and the Moruya River. Two small, unnamed swamps are located along the Moruya River banks between Garlandtown and Malabar Lagoon.

As noted above the terms Mullenderee and Dooga were recorded in the late 1800s as the names of two Aboriginal groups who occupied the Mullenderee and Dooga Creek areas respectively[35].

A scarred tree was located on the northern bank of the Moruya River, east of the Moruya Bridge, in the Mullenderee area. The site originally consisted of the scarred tree, but has been relocated to the Australian Museum, Sydney. This site indicates previous use of the area, related to canoe or shield manufacture[36].

Other evidence of pre contact use of the area exists throughout the area. Site containing oysters [*Ostrea angasi*], mud welks [*P ebinius*], pipis [*Donax deltoides*], Black periwinkles [*Bembicium spp*] and Bimbulas or Sydney Cockles [*Anadara trapezia*] were located during research for this project[37].

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[31] Donaldson 2006: 72.
[32] Carter 2004:18
[33] Hughes 2002:15 – 16.
[34] J Brierley 15.11.2006.
[35] Wesson 2000: 141.
[36] Ellis and Nye 2001: 9.
[37] T Ellis, K Lee 20.11.2006.

Malabar Lagoon has been utilised throughout the 1900s and to the present day as a resource collection place. Camping also took place here from time to time. Rocks near the weir and mud flats at Malabar Lagoon provided habitat for oysters [*O angasi*], mud crabs [*Scylla serrata*], pipis [*Donax deltoides*], Sea Mullet [*Mugil cephalus*] and Flathead [*Platycephulus sp*]. Ducks were also collected from the surrounding area[38].

Malabar Lagoon, as well as the wetlands situated along North Head Road, east from Malabar Lagoon Weir, also provide habitat for local totemic bird species. These locations are valued for this reason[39].

Malabar Lagoon continues to be valued as a recreational place. Families meet here to fish, swim, and eat. Access into the lagoon throughout the 1970s was via Malabar Drive to the north. This access is now blocked off [private property]. The area is utilised mainly throughout the day, as spiritual beings taunt users after dark[40].

3.4 THE ANCHORAGE.

Archaeological evidence in '**The Anchorage'**, within the southern banks of the Moruya River, indicates that the collection of natural resources and manufacturing of stone tools took place here at least 5,000 years ago[41].

Oral histories document conflict between settlers and local Aboriginal people took place in the early 1900s in the vicinity of the swamp to the west of The Anchorage[42].

A number of different types of shellfish continue to be collected in The Anchorage amidst the mangroves, including oysters and crabs[43].

3.5 RYANS CREEK.

The **Ryans Creek** area is documented as containing pre contact significances, through the early contact period to the present day. A midden is located in the area[44]. The midden site indicates prior use of the area as a gathering for resource consumption site. An artefact scatter and midden material has also been located in the upper reaches of Ryans Creek[45].

Aboriginal families visiting Moruya to work in the seasonal farm industry throughout the mid 1900s would camp at Ryans Creek and collect natural resources from the creek, river, riverbanks, and nearby bushland. Seasonal peas, corn, potatoes and beans pickers based at Macintosh's farm, located on Ryans Creek, would regularly visit Ryans Creek to collect mussels and go for

[38] Arthur Andy, Adrain Andy, Thomas Butler and John Brierley 15.11.2006.
[39] Donaldson 2006: 61.
[40] M Davis and T Ellis 20.11.2006.
[41] O'Halloran C 2006. K Lee 20.11.2006.
[42] Donaldson 2006: 71.
[43] T Ellis 4.2.2006 / J Brierly 15.11.2006.
[44] Ellis and Nye 2001: 11.
[45] Dibden 2005: 23.

a swim. The area continues to be valued today for its natural resources and as a place to camp and pass on cultural practises[46].

There are naturally occurring and man made fish traps located in an inlet draining into the Moruya River in the Ryans Creek vicinity. Foods found in the Ryans Creek area include flathead [*Platycephulus sp*], black bream [*Acanthopagrus butcheri*], blackfish [*Girella elevata*], stingray [*Myliobatis australis*], green eel [*Alabes dorsalis*], shark [*Galeorhinus galeus*], oysters [*Ostrea angasi*], cockles [*Anadara trapezia*], leather jackets [*Nelusetta ayraudi*], mud and mangrove crabs [*Scylla serrata / Decapoda: Brachyura*], gum from the black wattle [*Acacia Mearnsii],* parrots, mistletoe [*Amyema sp*], bracken fern [*pteridium esculentum*], native cherry [*Exocarpos cupressiformis*], river oak [*Casurina cunninghamiana*], bush tobacco [*Solanum mauritianum*], white-headed pigeon [*Columba leucomela*], ink weed [*Phytolacca octandra*], warrigal spinach [*tetragonia tetragonioides*], native raspberry [*Rubus rosifolius*], spiky matrush [*Lomandra longifolia*] and stinging nettle [*urtica sp*][47].

The area continues to be used today as a place to collect bush and water resources, to camp and meet family[48].

3.6 MORUYA TOWNSHIP & SURROUNDS

The riverside township of Moruya contains a combination of interrelated places of Aboriginal cultural heritage. Burial grounds throughout the area range between pre-contact to early contact to the present day. Documented ceremonial grounds remain in people's memories, but have in most part been destroyed during the course of the growth of the area. The collection of natural resources took place throughout the 1900s, continuing through to the present day.

Oral histories document how Aboriginal families camped at the Moruya Lagoon in the early 1900s, located in the vicinity of the present day Gundary Oval. The families camped there would spear eels and fish[49]. The term *Gundaree* [= Gundary] was recorded as the name of an Aboriginal group who occupied the Moruya and Deua area[50]. A number of Aboriginal people in the area today directly descend from Sally, an Aboriginal woman from the Gundary tribe[51].

Throughout the 1900s Moruya maintained seasonal farm and saw mill industries, supported by a predominantly Aboriginal labour force. Aboriginal people worked along the Moruya River from farm to farm including at the McKay, Loutitt and Hunt farms on along the north side of the Moruya River, and Dionts, Palmers, Turners, Murphys and Macintoshs

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46 Donaldson 2006: 68 – 70.
47 Donaldson 2006: 69.
48 Arthur Andy, Adrain Andy, Thomas Butler and John Brierley 15.11.2006.
49 Donaldson 2006: 65.
50 Wesson 2000: 131 – 147.
51 Donaldson 2006: 67.

on the south side of the Moruya River. At various times, Booth, Smith, Crocker and Fitzgerald operated sawmills in the Moruya Township, all of which employed Aboriginal staff.

Despite the impact of settlement and the ongoing pressure related to residential and industrial development, Aboriginal people continue to maintain their connections to the Moruya area in a variety of ways including residing in the area, participating in family gatherings and making regular camping and fishing trips to places previously used by their ancestors.

3.7 GLENDUART

Archaeological evidence in the immediate vicinity of the historic Glenduart Cemetery indicates prior use of the area, as a tool manufacture, trade, storage and or campsite. [52]. Technology located at the site is dated at around 5,000 years old. A wide variety of both locally sourced and traded / imported materials were identified at the site as well as midden materials indicating food consumption took place at the site[53].

Glenduart is well regarded as a place to collect natural resources, both from the river and the surrounding landscape. This practise continues today. Foods found in the immediate Glenduart area include: black wattle [*Acacia Mearnsii*], mistletoe [*Amyema sp*], bracken fern [*pteridium esculentum*], native cherry [*Exocarpos cupressiformis*], native raspberry [*Rubus rosifolius*] and wombat berry [E*ustrephus latifolius*]. Sedge grass and spiky mat rush [*Lomandra longifolia*] can also be found in the immediate area and are used to make baskets. Medicinal species include inkweed [*Phytolacca*], river oak [*Casurina cunninghamiana*], ribgrass [*plantago spp*] and violet [*viola betonicifolia*]. Other resources include bush tobacco [*Solanum mauritianum*], flax lily [*Dianella caerulea*] to make whistles, stringy bark [*Eucalyptus botryoides*] for rope, lichen as a fire starter, and pittosporum [*Pittosporum undulatum*] for spiritual spells[54].

A number of Aboriginal families directly descend from Richard Piety who is buried at the Old Moruya Cemetery, Glenduart[55].

3.8 MOGENDOURA CREEK

Mogendoura Creek, including the Golden Gully Creek catchments is fed from Larrys Mountain to the west. Immediately to the southwest of the Mogendoura Creek and Moruya River intersection is a small swampland adjoining the northern banks of the Moruya River. The term *Mokondoora* [= Mogendoura] was recorded as the name of an Aboriginal group who occupied the Moruya and Deua area.[56]. Senior people know Mognedoura Creek as 'Shirlocks' Creek.

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[52] Ellis and Nye 2002: 10.
[53] T Ellis and K Lee 20.11.2006.
[54] T Ellis, K Lee, M Davis 20.11.2006.
[55] Per comm John Brierly 15.11.2006 / Trisha Ellis 1.6.2006.
[56] Wesson 2000: 131 – 147.

Up stream from Glenduart, archaeological materials located 15 – 20 m beyond tidal mark indicate pre contact use of the area. The area has eroded 2m in the years between 1988 and the present day[57]. Stone tool technology was also located along the riverbanks as well as on the secondary bank of Mogendoura Creek. Although not located during the course of this investigation, scarred trees in the area indicate past canoe building practises were undertaken here[58].

Mogendoura Creek, also known as 'Shirlocks' Creek, as continues to be utilised for fishing. The area is also viewed as a teaching place[59].

3.9 YARRAGEE.

Aboriginal sites in the Yarragee area indicate use of the area for canoe manufacturing and or ceremonial purposes[60]. Yarragee continues to be used for recreation purposes and family gatherings[61].

Natural resources found and utilised in the Yarragee area include gum from the black wattle [*Acacia Mearnsii],* ink weed [*Phytolacca octandra*], warrigal spinach [*tetragonia tetragonioides*], stinging nettle [*urtica sp*], mistletoe [*Amyema sp*], bracken fern [*pteridium esculentum*], native cherry [*Exocarpos cupressiformis*], river oak [*Casurina cunninghamiana*], bush tobacco [*Solanum mauritianum*], native raspberry [*Rubus rosifolius*] and spiky mat rush [*Lomandra longifolia*].

3.10 KIORA.

The term *Kiyora* [= Kiora] was recorded as the name of an Aboriginal group who occupied territory west of Moruya[62]. Aboriginal sites in the area indicate previous use of the area for canoe building or other ceremonial purposes[63]. An intertribal fighting ground [between Aboriginal tribes from Braidwood and Moruya] in the Kiora area, west of Moruya has been documented. The area accords with the Aboriginal inter tribal 'Kiora Barnyard battle'[64].

Like Yarragee, the Kiora area is utilised as a meeting and recreation place. The area between Kiora and the junction of Wamban Creek and the Moruya River continues to be used as a fishing place[65].

3.11 DEUA RIVER: UPPER CATCHMENT AREA.

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[57] Buchert 21.11.2006.
[58] Ellis and Nye 2001: 10.
[59] Per comm. John Brierley 15.11.2006.
[60] Ellis and Nye 2001: 10.
[61] Michelle Davis and Trisha Ellis 20.11.2006. Arthur and Adrian Andy 15.11.2006. Norman Russell and Keith Nye 31.10.2006.
[62] Wesson 2000: 131 – 147.
[63] Ellis and Nye 2001: 10.
[64] Goulding 2003: 33.
[65] Michelle Davis and Trisha Ellis 20.11.2006. John Brierley, Arthur and Adrian Andy 15.11.2006.

Aboriginal cultural heritage in the upper **Deua River** catchment area is associated with a number of spiritually imbued waterholes. **Bood-jarn [Hanging Mountain],** at the headwaters of Donalds Creek, acts as a beacon throughout the surrounding bushlands and is spiritually linked to the Deua River and Gulaga [Mt Dromedary] in the south[66].

Gulaga, the mythological mother mountain, had seven daughters. The seven daughters left their mother and brothers, Najanuka [Little Dromedary Mt] and Baranguba [Montague Island], to travel north. Upon passing Bood-jarn they turned around to look for their family, but could no longer see them. They cried as they continued walking north making seven rock pools along the Deua River. The seven rock pools along the Deua River hold spiritual value to Aboriginal people[67].

In the vicinity of Bood-jarn, Pinkwood trees [Eucryphia moorei] hold medicinal value. The sap and bark are utilised for specific purposes and the bark was used to make canoes. Other species found in the upper catchment area, provide direct linkages between flora and the weather cycle. Protection of these species is important, so knowledge pertaining to them is restricted[68].

Aboriginal families regularly camp and swim at **8 Mile** along the Deua River. Natural resources are found and utilised in the immediate area including sarsaparilla [Smilax glyciphylla], bloodwood [Corymbia gummifera], yam [Thysaotus spp.], spiky mat rush [*Lomandra longifolia*], river oak [*Casurina cunninghamiana]*, water cress, bush lemon, black wattles [*Acacia Mearnsii*], bracken fern [*pteridium esculentum*], burrawang palm [*Macrozamia communis*], bush tobacco [*Solanum mauritianum*], minga [*Xanthorrhoea resinosa*], raspberry [*Rubus rosifolius*] and fresh water mussels. The area highly regarded as a teaching ground holding spiritual value[6970].

Known archaeological sites and 'birthing pools' exist along **Donald's Creek.** There are also important caves in the area[71]. Aboriginal sites also exist along **Kennys Creek[72]**.

There are ceremonial grounds and spiritually imbued stone formations in the **McGregors Creek** area. Aboriginal families regularly camp here. The *dulagarl* walks around here at night and the area is part of the dreaming track connected to Buckenbowra[73].

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66 Trisha Ellis 20.11.2006.
67 Dave Tout in Donaldson 2002: 9 – 10.
68 Duroux 2005.
69 Michelle Davis and Trisha Ellis 20.11.2006.
70 Michelle Davis, Karen Lee and Trisha Ellis 20.11.2006
71 Karen Lee and Trisha Ellis 20.11.2006.
72 Karen Lee and Trisha Ellis 20.11.2006
73 Trisha Ellis 20.11.2006. See also Donaldson 2002: 69.

Bendethra, at the junction of the Con Creek and Deua River, is recognised as a traditional meeting place holding regional significance. As documented by Barlow in 1890, a ceremonial gathering took place at Bendethra involving Aboriginal people from the Gundary tribe, Moruya[74]. People use to go to Bendethra to collect the seasonal influx of bogong moths and to drink the water, which filtered through limestone rocks. The water is known to have healing qualities[75].

In relation to the Deua - Moruya River catchment, travelling routes are primarily associated with the ridge tops. Archaeological evidence suggests that the ancient trails aligned with the ridgetops, now associated with the Majors Creek Mountain Road to Araluen, along the present day Araluen Road to Mt Merricumbean. From Mt Merricumbean along the Oulla Fire Trail to Burra Creek and Moruya River. Along the link between the ranges and the coast, beach shells were found further up stream providing evidence of trade and travel[76].

4. ADVERSE IMPACTS TO ABORIGINAL CULTURAL HERITAGE

4.1 SEDIMENTATION.

Sedimentation hinders ecological processes and the supply of natural resources. Access to and consumption of natural resources and the quality of recreational activities is adversely affecting by sedimentation.

Places of cultural heritage identified as suffering from sedimentation include Ryans Creek and 8 Mile, along the Deua River.

4.2 WATER QUALITY.

Activities in the upper catchment can adversely affect water quality down stream. Farming, sewerage and other developments along the estuarine waters, including the use of fertilisers throughout the Moruya Township, are also thought to reduce the water quality. This impacts upon a variety of cultural values as basic as being able to drink the water directly from the upper catchment area. Recreational and natural resource collection activities are also adversely affected.

Places of cultural heritage identified as suffering from poor water quality include The Anchorage, Yaragee, Malabar Creek, Ryans Creek and 8 Mile.

4.3 RIVER BANK EROSION.

River bank erosion is causing damage to a number of identified Aboriginal sites, and more than likely to numerous unidentified sites. As the riverbank erodes, ancient stone artefacts and midden materials are being washed into the river. The integrity and value of these sites are being diminished.

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[74] See related discussion in Wesson 2000: 164.
[75] Trisha Ellis and Karen Lee 20.11.2006. See also Donaldson 2002: 74.
[76] Per comm. Adrian Andy 15.11.2006 /Trisha Ellis and Karen Lee 20.11.2006.

Although a natural occurrence, in part, it is also thought that erosion is exacerbated by increased wave actions by water users and unfenced cattle.

Areas particularly identified as being adversely affected by erosion include Ryans Creek and Malabar Creek [in relation to unfenced cattle]; Glenduart [in relation activities on the banks] and the Glenduart Riverside Reserve and Malabar Lagoon weir [in relation to wave and tidal action].

4.4 RIVER ACCESS.

Access to a variety of natural resources, provides Aboriginal families with the opportunity to undertake cultural activities and maintain traditional connections to the land and waterways. Transmission of cultural knowledge is enhanced when family members from multiple generations meet together.

Access to the river in the Glenduart area, associated with a well-used fishing rock platform, is adversely affected by erosion. The erosion was initially cause by the placement of a carpark, which has since been relocated. As the area continues to erode, access to the river worsens. In the process of bank stabilisation, a single access point to the river here needs to be incorporated, to ensure the long term use of the area as a fishing place is maintained. This process will also offer protection to an identified archaeological site in the immediate area.

Pedestrian access along the northern banks of the Moruya River, from the Moruya Township to Glenduart, will not only provide appropriate access for people to natural resources, but will also allow movement of wildlife.

Currently, the disabled and aged have limited access into the Ryans Creek area for cultural purposes. Use of the areas is hindered by the 500m [1km return] distance to the primary fishing site.

Native wildlife are hindered from accessing the river from surrounding bushlands as a result of fences and roadways.

4.5 VEGETATION PRESERVATION.

Native vegetation not only provides support to the riverbank, but many species also hold cultural significance as natural food resources. Native vegetation, including black wattles [*Acacia Mearnsii],* need to be preserved / revegetated along the riparian buffer zone.

As is traditional practise, food is most often eaten close to where it is caught. In well used fishing / gathering places, people will make a fire, potentially using surrounding wood, if there is no gas BBQ area provided.

4.6 DEVELOPMENT CONTROLS.

Developments along the river in relation to residential developments, environmental rehabilitation works and or the construction of public

infrastructure such as car parks, pipelines and walking tracks for instance, have the potential to adversely impact upon known and unknown archaeological sites as well as other tangible and intangible places holding cultural heritage value to the Aboriginal community.

Kennys Creek and Donalds Creek are particularly vulnerable to damage through lack of development controls.

5 RECOMMENDATIONS

5.1 CULTURAL HERITAGE: PROTECTION AND MANAGEMENT.

The following recommendations were developed in conjunction with Mogo and Cobowra Local Aboriginal Land Councils. Each of these recommendations should be undertaken in partnership with the Local Aboriginal Land Councils. A number of government departments will also need to be involved, but have not been identified here.

RECOMMENDATION ONE: Development controls.

For Ellis and Nye [2002], the process of surveying Aboriginal sites along the banks of the Moruya River Estuary was hindered by a lack of visibility caused by the presence of granite rock walls and or dense vegetation. Visibility was also poor in areas were the secondary bank was submerged. Accordingly, although there are Aboriginal sites recorded along the banks of the Moruya River Estuary, the absence of *recorded* sites cannot be taken to indicate the absence of Aboriginal sites.

It is recommended that *any* developments within 30m either side of the Moruya River Estuary, including the Deua River be the subject of the currently operational Eurobodalla Shire Council / Local Aboriginal Land Council cultural heritage site protection protocols.

This recommendation particularly relates to bank stabilisation works, causeway construction, maintenance of river side camp grounds, pipeline and drainage works and the upgrading and or construction of vehicular / pedestrian river access points.

DEC advises that a Section 87 and 90 Permits [NSW NPW Act 1974] may be required for such works. It is noted that the LALC may impose conditions on such works.

RECOMMENDATION TWO: Glenduart - site assessment and recording.

As recommended by Ellis and Nye [2002] Aboriginal sites in the Glenduart Cemetery area must be recorded.

In consultation with Mogo LALC, DEC is currently investigating part of this site.

It is recommended that the site survey process take place immediately, as the riverbank is rapidly eroding.

RECOMMENDATION THREE: Glenduart –stabilisation of riverbank.

The riverbank beneath the Glenduart Cemetery is eroding due to pressure from the top of the bank. As a result of the erosion, Aboriginal sites are being washed into the river.

In accordance with Ellis and Nye [2001: 11 – 12], it is recommended that the riverbank in the immediate vicinity of the Glenduart Cemetery be stabilised. It is recommended that the topsoil be replaced in exposed areas and native revegetation occurs. These works are of high priority and need to be addressed immediately, however, it is recommended that the site be formally recorded by DEC [as per recommendation two] prior to construction work proceeding.

DEC advises that a Section 87 and 90 Permits [NSW NPW Act 1974] are required for such works. It is also noted that the LALC may impose conditions on such works.

RECOMMENDATION FOUR: Glenduart –maintenance of access to river.

Access to a variety of natural resources, provides Aboriginal families with the opportunity to undertake cultural activities and maintain traditional connections to the land and waterways. A popular fishing platform is located beneath the Glenduart Cemetery. As a result of accessing the fishing site and pressure on the area from the car park previously located above the access point, the access point to the fishing site is eroding, causing damage to Aboriginal sites located above the access point [see recommendation three].

It is strongly recommended that access to the river in the Glenduart area be maintained. A single walking track to the river in this area should be formalised. The main access point is at 56 0235109 / 6024142 and is very steep. The embankment 20m upstream of current access is not as steep and may prove to be a better location for steps / ramp. These works are of high priority and need to be addressed immediately, however, it is recommended that the site be formally recorded by DEC [as per recommendation two] prior to construction work proceeding.

DEC advises that a Section 87 and 90 Permits [NSW NPW Act 1974] are required for such works.

RECOMMENDATION FIVE: Glenduart Riverside Reserve – stabilisation of riverbank.

It is recommended that bank stabilisation and revegetation occur along the Glenduart Riverside Reserve in order to protect known and potential Aboriginal sites on and in the embankment. It is further recommended that

public use of the river in this section be assessed in terms of potential damage to the embankment

DEC advises that a Section 87 and 90 Permits [NSW NPW Act 1974] may be required for such works. It is noted that the LALC may impose conditions on such works.

RECOMMENDATION SIX: Malabar Lagoon –site assessment and protection measures.

Undocumented Aboriginal sites exist on the banks of Malabar Lagoon and some are being damaged through wave action and water pressure flowing through the weir on the outgoing tide.

It is recommended that a full archaeological survey of Malabar Lagoon be undertaken, including the entrance to the lagoon on the south side of the weir. It is further recommended that monitoring and access arrangements be established in relation to the protection of these sites, if required.

RECOMMENDATION SEVEN: Malabar Lagoon – site protection measures.

In order to protect Aboriginal sites at the entrance to Malabar Lagoon, in the vicinity of the Moruya Weir, it is recommended that additional piping be placed under the road, west of the exiting piping, in order to disperse and direct water pressure away from the riverbank on the eastern side. Bank stabilisation measures and the revegetation of the riparian buffer should also be considered in the immediate vicinity of the site.

It is recommended that the site be formally recorded by DEC [as per recommendation six] prior to construction work proceeding.

DEC advises that a Section 87 and 90 Permits [NSW NPW Act 1974] are required for such works. It is noted that the LALC may impose conditions on such works.

RECOMMENDATION EIGHT: Ryans Creek –elderly and disabled access.

Access to a variety of natural resources, provides Aboriginal families with the opportunity to undertake cultural activities and maintain traditional connections to the land and waterways. Transmission of cultural knowledge is enhanced when family members from multiple generations meet together.

It is recommended that elderly and disabled access into Ryans Creek be considered through the construction of a 500m shared pathway linking the existing vehicle turning circle to the popular fishing place, located in the vicinity of the buoy.

It is further recommended that the Aboriginal community be involved in the future management of these lands and waterways.

RECOMMENDATION NINE: Rehabilitation of native bush resources – Moruya Riverside Park, Ryans Creek, Glenduart and Yarragee.

In accordance with Donaldson [2006], it is recommended that native bush resources in the Ryans Creek and the Moruya Riverside Park area be rehabilitated and promoted. It is further recommended that native bush resource be rehabilitated in the Glenduart and Yarragee areas.

It is recommended that this type of land management project be done in partnership with Aboriginal community groups, through Land Care, CDEP or TAFE for instance. Any such project should be done in full consultation with the LALCs and the broader Aboriginal community.

DEC advises that a Section 87 and 90 Permits [NSW NPW Act 1974] may be required for such works, particularly in the Glenduart area, where archaeological sites are recorded.

RECOMMENDATION TEN: Recreational facilities

As is traditional practise, food is most often eaten close to where it is caught. In well used fishing / gathering places, people will make a fire, potentially using surrounding wood, if there is no gas BBQ area provided.

It is recommended that gas BBQ facilities be installed at Yarragee and Ryans Creek. It is further recommended that toilet facilities be installed at Yarragee and Ryans Creek.

5.2 CULTURAL HERITAGE: RESPECT AND AWARENESS.

RECOMMENDATION ELEVEN: Recognition of place name origins.

Many familiar local place names originate from the pre contact era and hold Aboriginal cultural heritage value. For instance, in the 1830s the *Mullenderee* [= Mullinderry], *Moorooya* [= Moruya], *Duga* [= Dooga], *Gundaree* [= Gundary], *Mokondoora* [= Mogendoura] and *Kiyora* [= Kiora] were Aboriginal groups recorded as occupying the Moruya and Deua River area[77]. *Cobowra* is the Dhurga term for the location where the Moruya River is crossable by foot, whilst the term Moruya is also thought to be a description of this shallow crossing, but in a northern Aboriginal dialect.

It is recommended that the Aboriginal origins of place names, as relevant to the Moruya Deua River, be given formal recognition as a step towards the positive promotion of local Aboriginal cultural heritage. Any such project should be in full consultation with the LALCs and broader Aboriginal community.

RECOMMENDATION TWELVE: Repatriation of scarred tree from 'the boat shed' Park.

Scarred trees are caused by the removal of bark for use in the manufacturing of canoes, containers, shields or shelters. One such site was previously located on the northern banks of the Moruya River. The tree however was cut down and relocated to the Australian Museum, Park Street Sydney.

It is recommended that the site be repatriated to the local area and utilised as a cultural awareness tool. Any such process must be in full consultation with and be directed by the LALCs and broader Aboriginal community.

RECOMMENDATION THIRTEEN: Moruya Riverside Park – cultural awareness recognition and promotion.

The recognition of Aboriginal cultural heritage across the Moruya area is distinctly lacking. Positive promotion amongst the broad community of the Aboriginal heritage attributes in the local area, including the Moruya River is required

It is recommended that interpretive signage relating to the Aboriginal cultural values and uses of the Moruya River Estuary and immediate environment, both past and present, be erected in the Moruya Riverside Park. Any such project should be done in full consultation with the LALCs and the broader Aboriginal community.

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[77] Wesson 2000: 131 – 147.

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APPENDIX E

EXISTING LAND USE MAPPING FROM:
URBAN LEP 1999
RURAL LEP 1987

Compiled by : H Weber
Strategic Planning Unit

DISCLAIMER

This map is a G.I.S. copy of the gazetted Rural Local Environmental Plan 1987 (as amended). If zones or property boundaries are in question, reference must be made to the gazetted Rural Local Environmental Plan 1987 held by Council.

G.I.S. Duplicate of

Eurobodalla

RURAL LOCAL ENVIRONMENTAL PLAN 1987 (as amended)

First Gazetted 11.12.1987

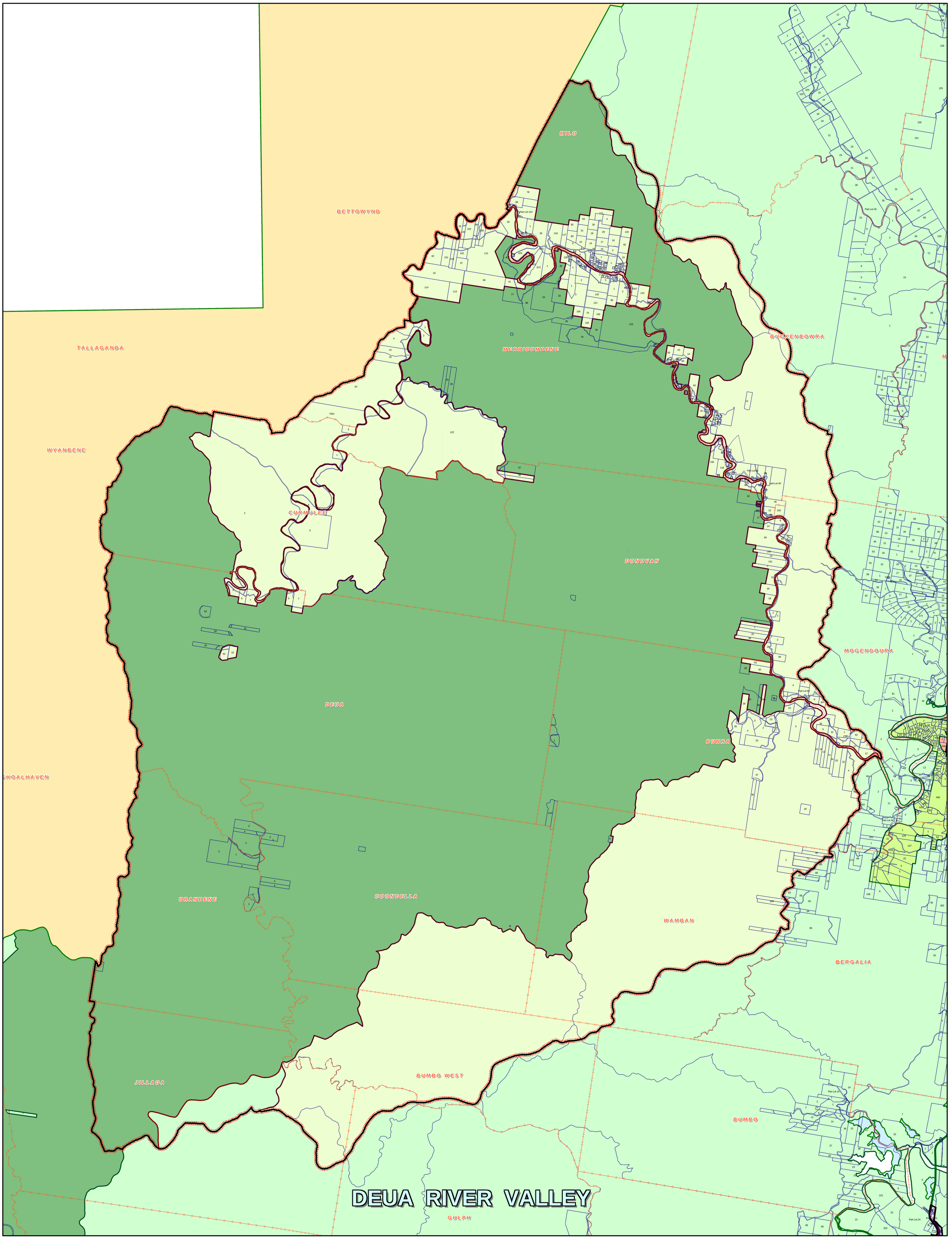
Council is NOT liable for the information shown on this map

LEGEND

- Rural 1a
- Rural 1a1
- Rural 1a Further Investigation
- Rural 1c
- Urban Expansion 10
- Public Open Space 6a
- Existing Arterial Road 5f
- Proposed Arterial Road 5c
- Environmental Protection - Wetlands 7a
- Environmental Protection - Coastal Land Protection 7f1
- Environmental Protection - Coastal Land Protection 7f2
- National Parks
- Urban LEP 1999 Boundary
- N.S.W. Coastal Zone

Sheet 5

Printed September 2006



G.I.S. Duplicate of

Eurobodalla

URBAN LOCAL ENVIRONMENTAL PLAN 1999 (as amended)

First gazetted 19 March 1999

with adjacent Rural LEP 1987 land

Parish boundary

Urban LEP 1999 boundary

DISCLAIMER:

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If zones or property boundaries are in question, reference must be made to the gazetted Plans held by Council.

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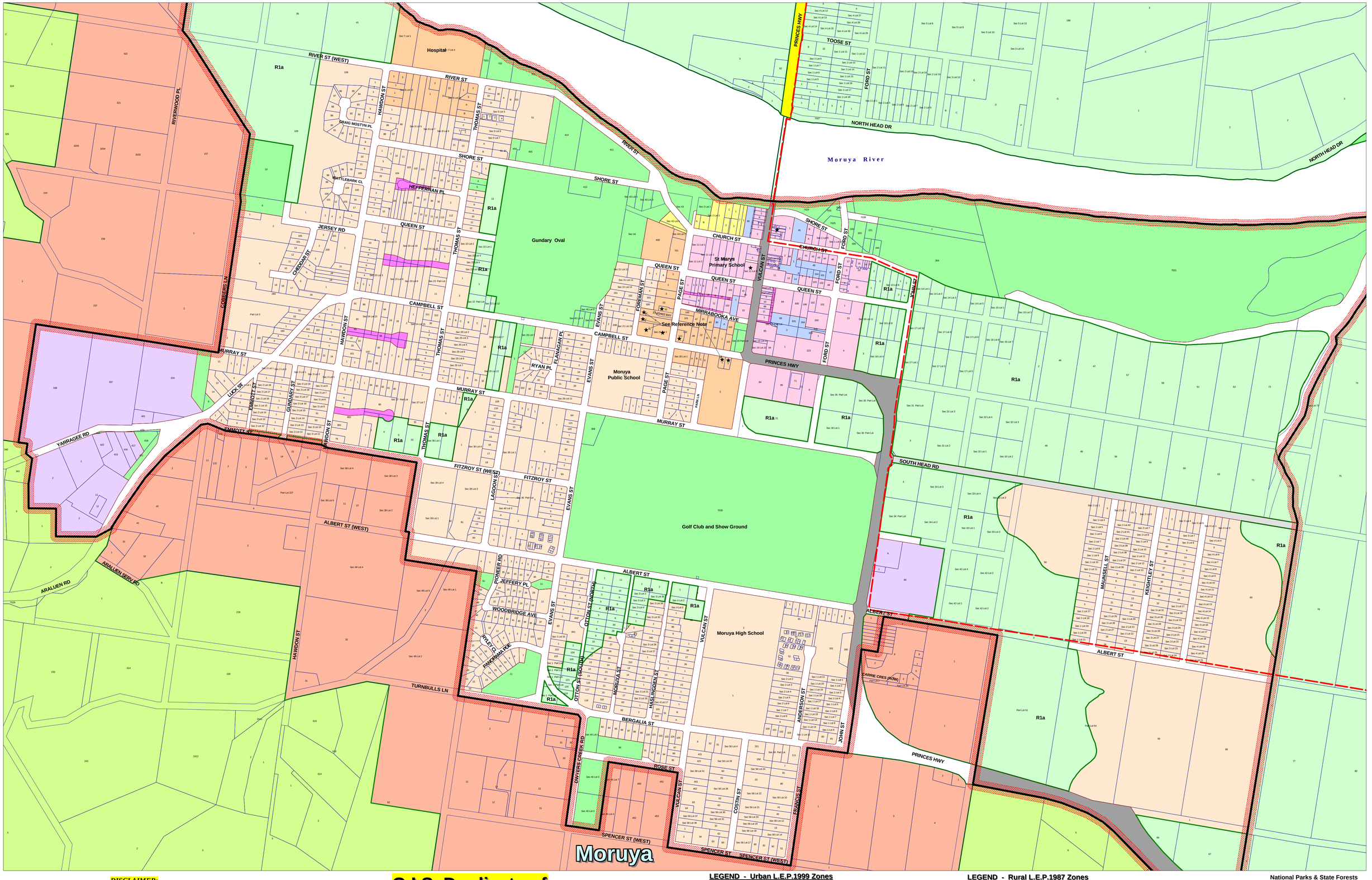
Printed September 2006

LEGEND - Rural L.E.P.1987 Zones

- 1a - Rural (Environmental Constraints and Agricultural)
- 1c - Rural (Small Holdings)
- 7a - Environmental Protection (Wetlands)
- 8 - National Parks and Nature Reserves
- Urban Expansion 10
- Uncoloured

ADDITIONAL RURAL ZONE

- 1a1 - Rural (Environmental Constraints Water Catchment Protection and Agricultural) — R1a1



Compiled by : H Weber
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Printed September 2006

G.I.S. Duplicate of

Eurobodalla

URBAN LOCAL ENVIRONMENTAL PLAN 1999 (as amended)

First gazetted 19 March 1999

with adjacent Rural LEP 1987 land

also displaying the Coastal Zone boundary, SEPP 71, National Parks and State Forest areas

LEGEND - Urban L.E.P.1999 Zones

Residential
- 2g - Residential - General
- 2t - Residential - Tourism
- 2ec - Residential - Environmental Constraints

Business
- 3a - Business

Industrial
- 4a - Industrial

Special Uses
- 5b - Arterial Roads
- 5b1 - Local Roads
- 5c - Main Roads
- 5d - Car Park

Open Space
- 6a1 - Public Open Space
- 6c1 - Private Recreation

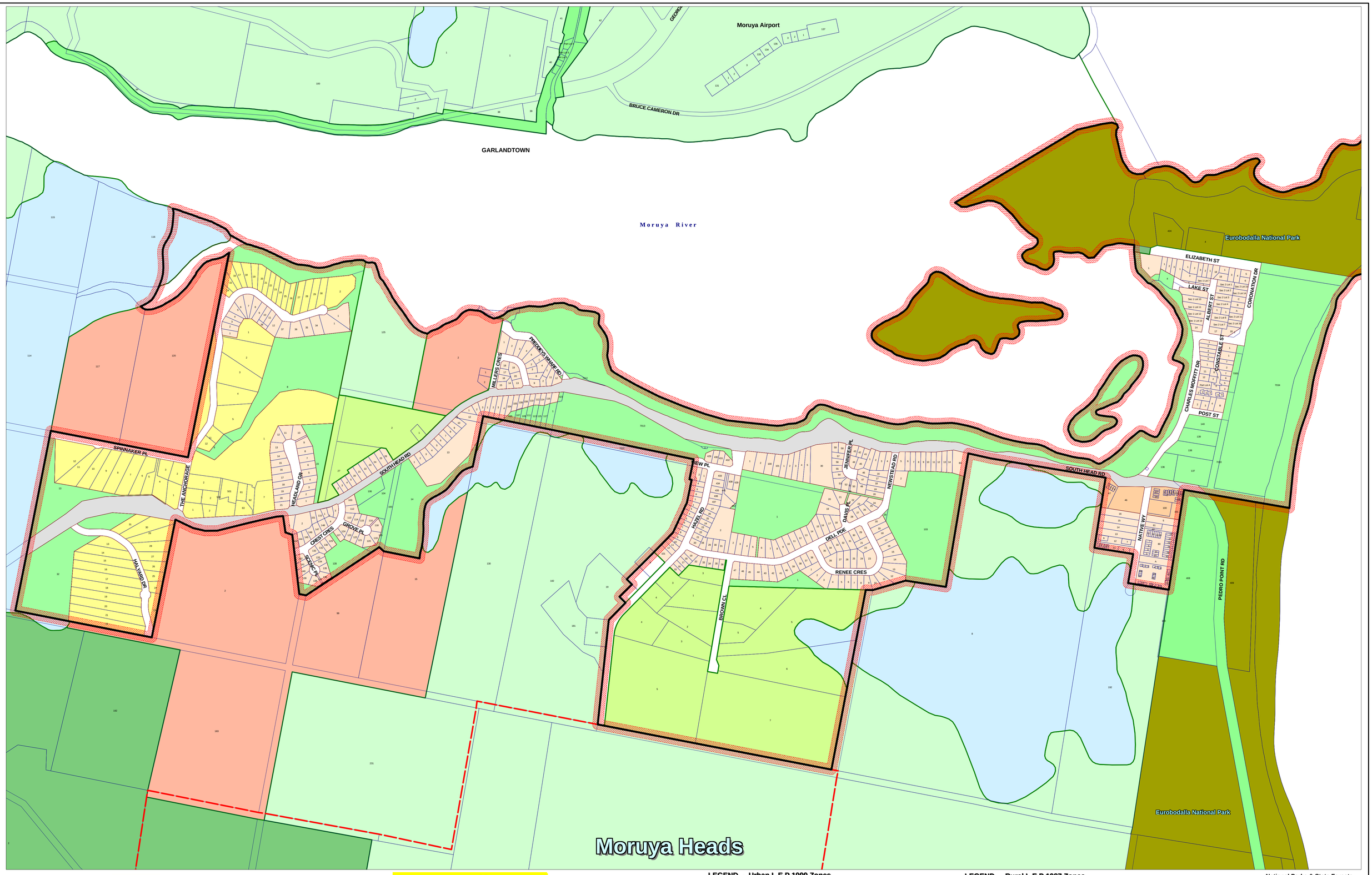
LEGEND - Rural L.E.P.1987 Zones

- 1a - Rural (Environmental Constraints and Agricultural) — R1a
- 1c - Rural (Small Holdings)
- 7a - Environmental Protection (Wetlands)
- 7f1 - Environmental Protection (Coastal Land Protection)
- Urban Expansion 10
- 5f - Existing Arterial Road
- 5c - Proposed Arterial Road

National Parks & State Forests
- National Park
- State Forest

Reference Note
★ Items of Environmental Heritage, refer to Part 4 of the written Instrument.

Urban LEP 1999 Boundary
Coastal Zone boundary



DISCLAIMER:

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URBAN LOCAL ENVIRONMENTAL PLAN 1999 (as amended)

First gazetted 19 March 1999

with adjacent Rural LEP 1987 land

also displaying the Coastal Zone boundary, SEPP 71, National Parks and State Forest areas

LEGEND - Urban L.E.P.1999 Zones

Residential
- 2g - Residential - General
- 2t - Residential - Tourism
- 2ec - Residential - Environmental Constraints

Business
- 3a - Business

Industrial
- 4a - Industrial

Special Uses
- 5b - Arterial Roads
- 5b1 - Local Roads
- 5c - Main Roads
- 5d - Car Park

Open Space
- 6a1 - Public Open Space
- 6c1 - Private Recreation

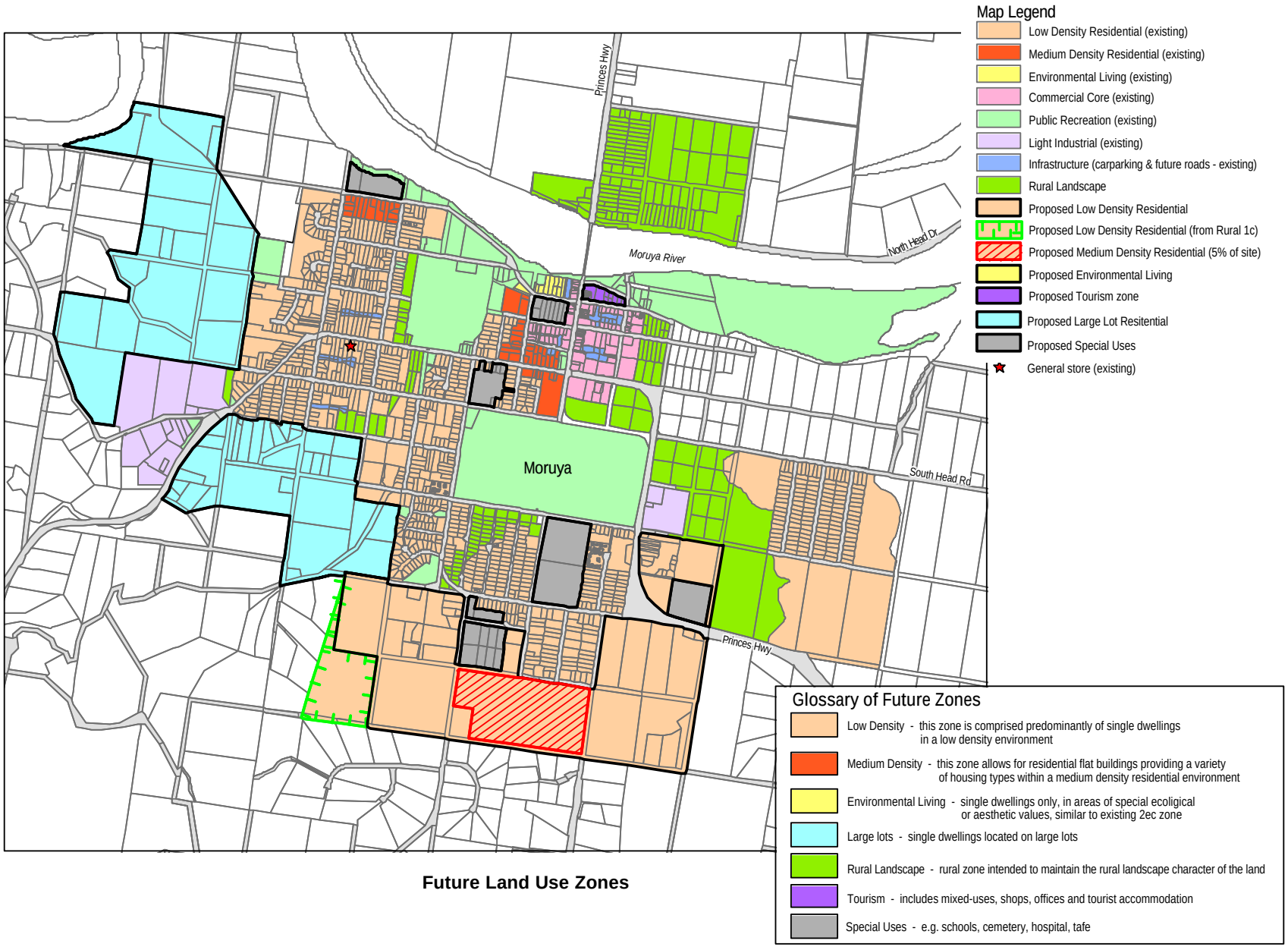
LEGEND - Rural L.E.P.1987 Zones
- 1a - Rural (Environmental Constraints and Agricultural)
- 1c - Rural (Small Holdings)
- 7a - Environmental Protection (Wetlands)
- 7f1 - Environmental Protection (Coastal Land Protection)
- Urban Expansion 10
- 5f - Existing Arterial Road
- 5c - Proposed Arterial Road
- Urban LEP 1999 Boundary
- Coastal Zone boundary

National Parks & State Forests
- National Park
- State Forest

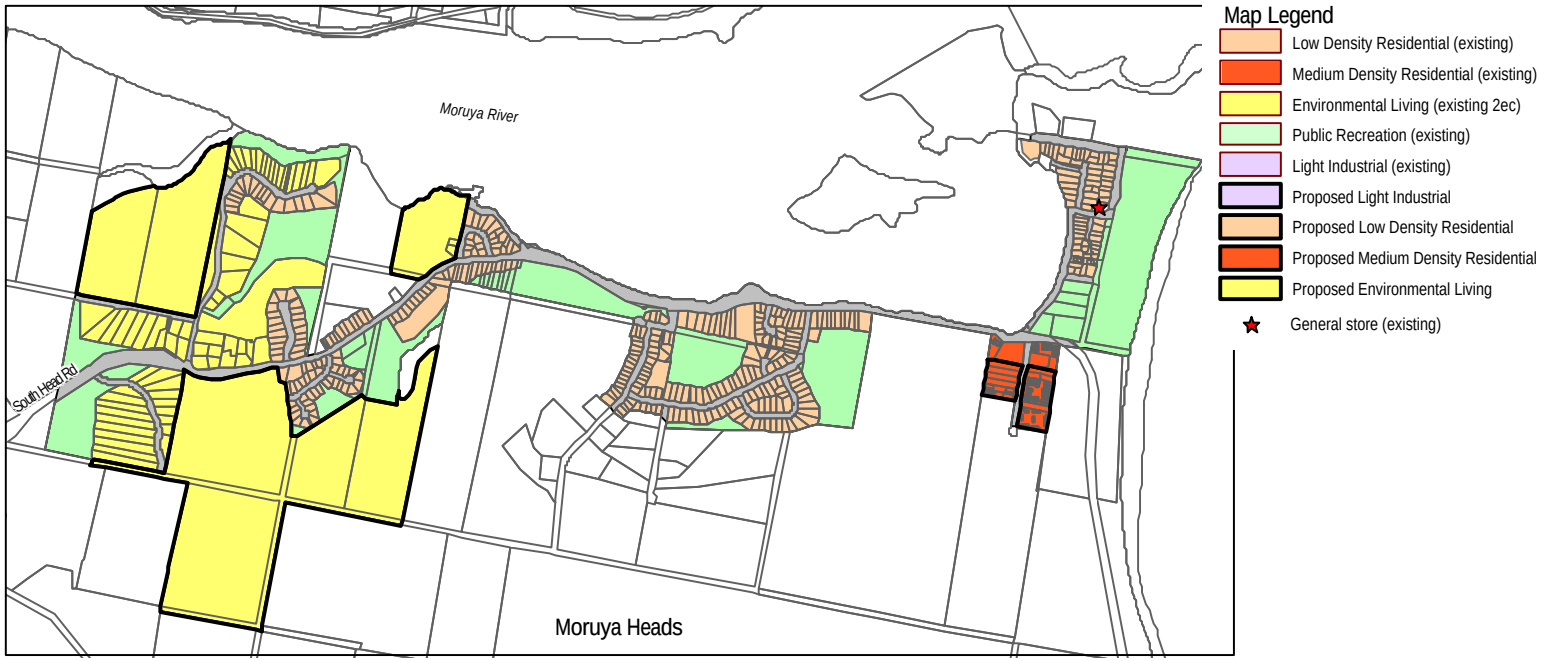
Sheet 11

APPENDIX F

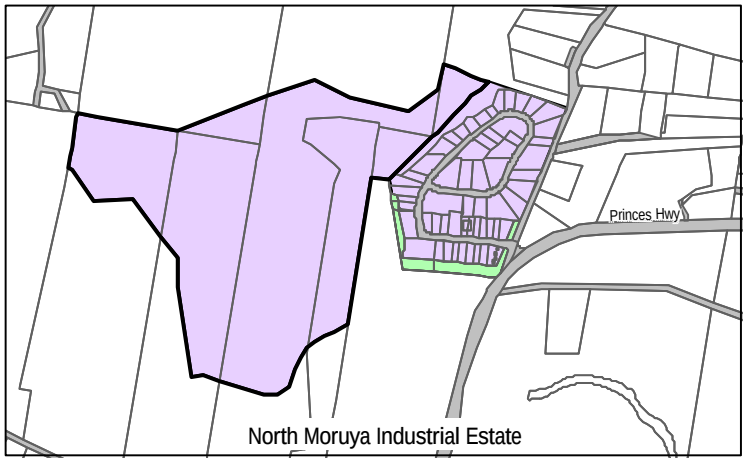
EXTRACTS FROM MORUYA STRUCTURE PLAN 2007:
FUTURE LAND USE ZONES
ENDANGERED ECOLOGICAL COMMUNITIES
ENVIRONMENTAL CONSTRAINTS
FLOOD MAPPING



Future Land Use Zones

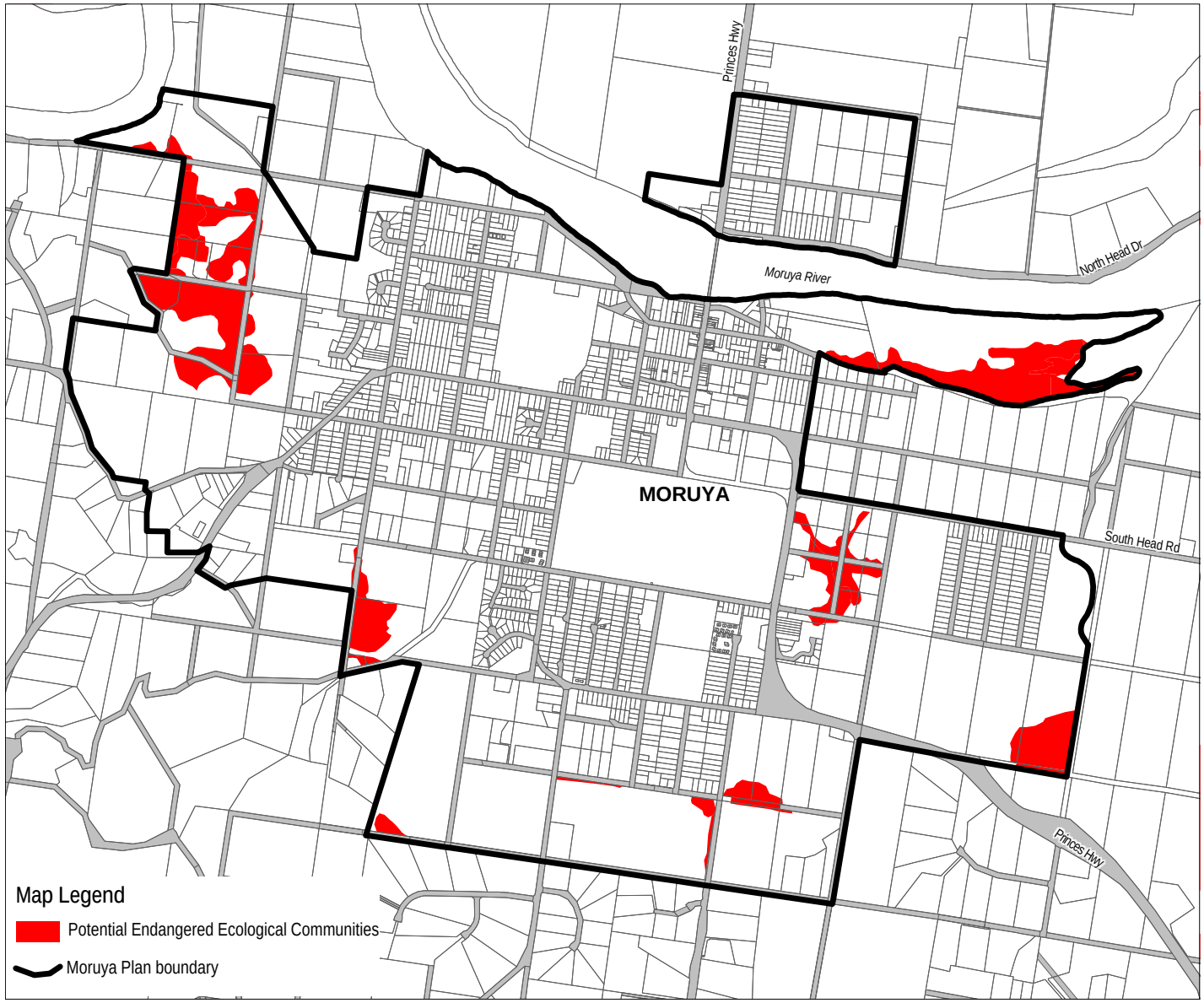


Future Land Use Zones

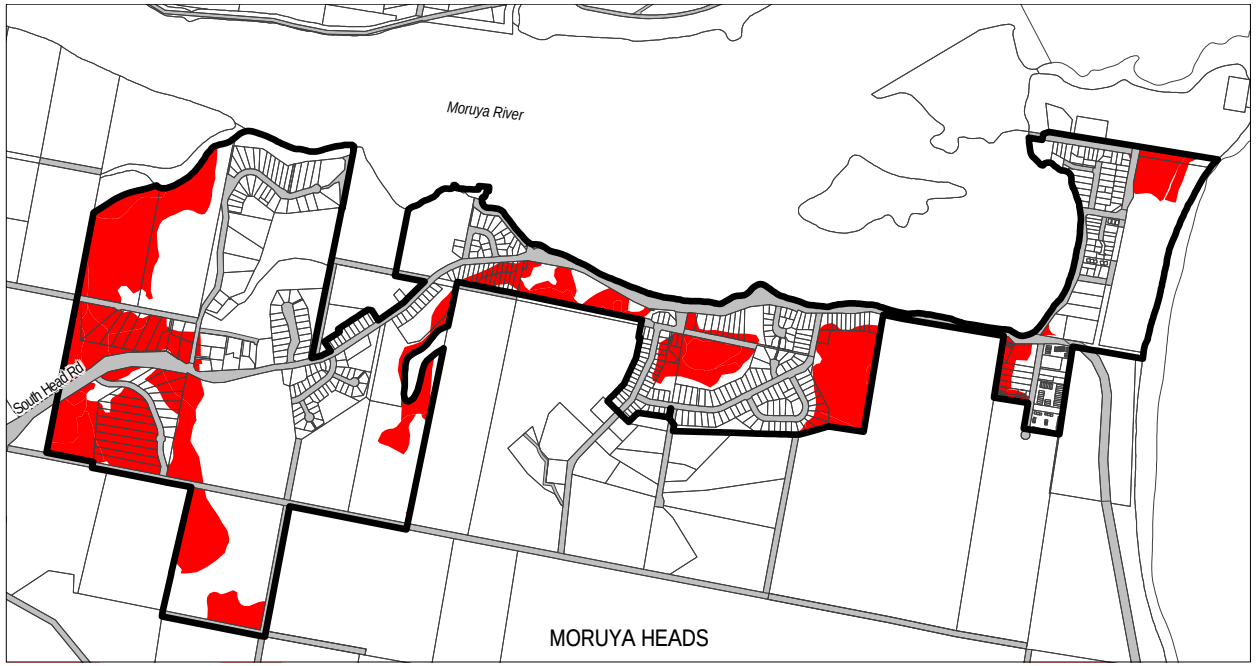


Glossary of Future Zones

- Low Density - this zone is comprised predominantly of single dwellings in a low density environment
- Medium Density - this zone allows for residential flat buildings providing a variety of housing types within a medium density residential environment
- Environmental Living - single dwellings only, in areas of special ecoligical or aesthetic values, similar to existing 2ec zone
- Light Industrial - provides a wide range of light industrial, warehouse and related land uses



Potential Endangered Ecological Communities

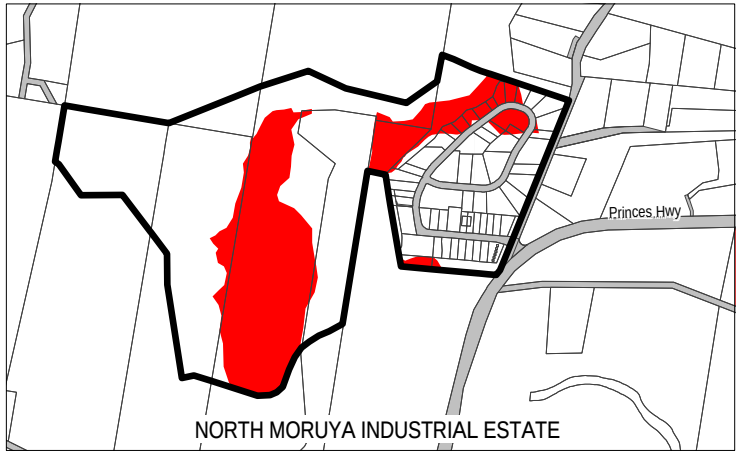


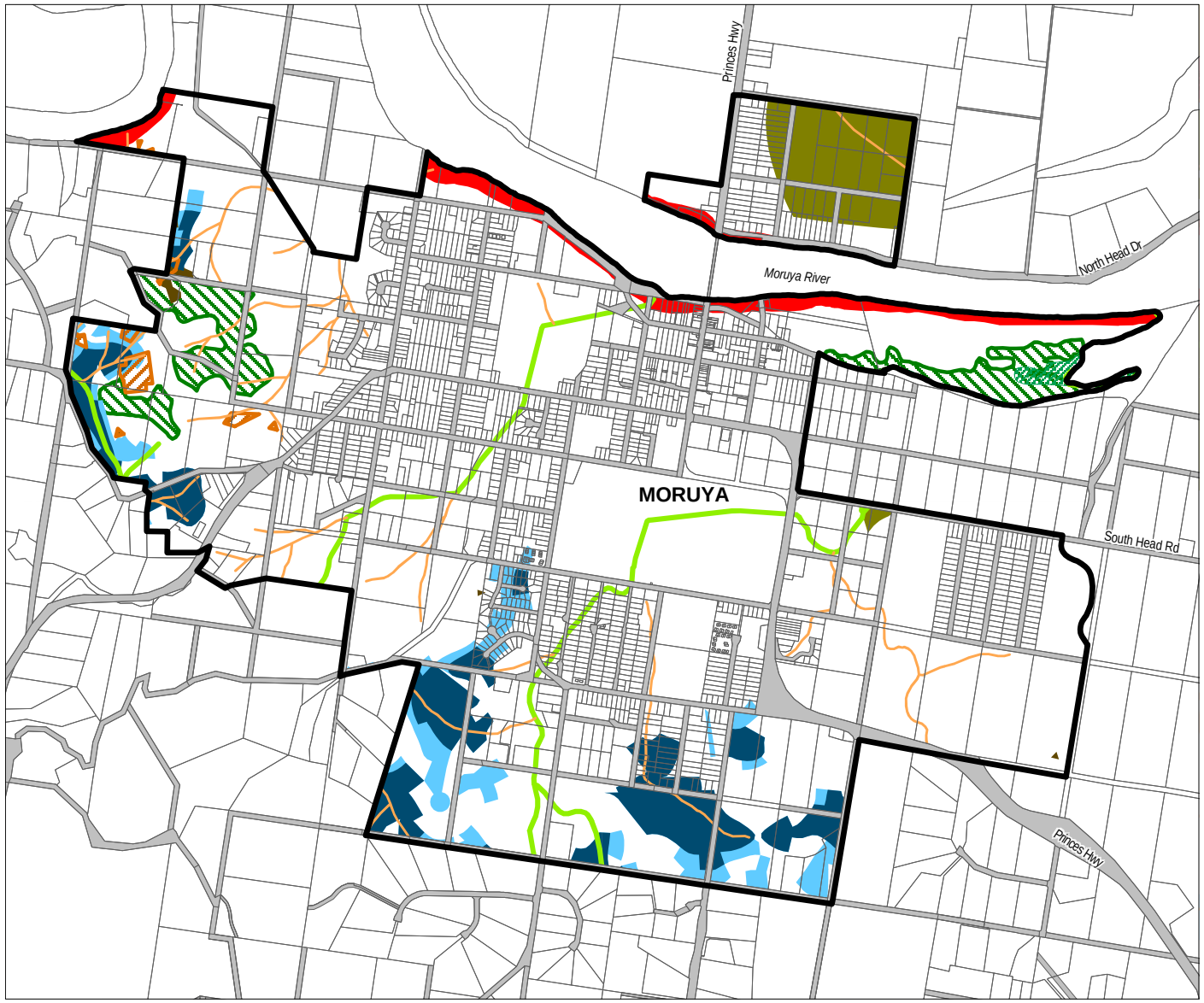
Map Legend

Potential Endangered Ecological Communities

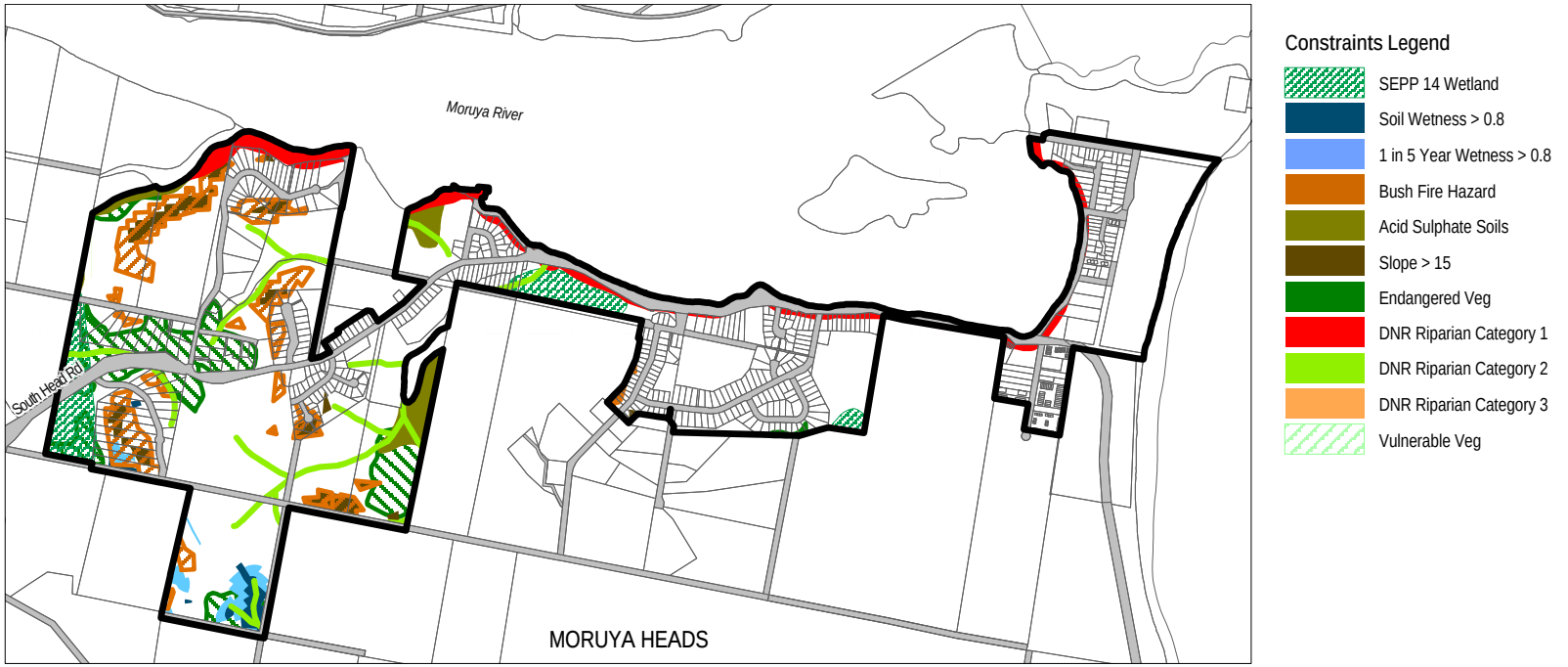
Moruya Plan boundary

Potential Endangered Ecological Communities

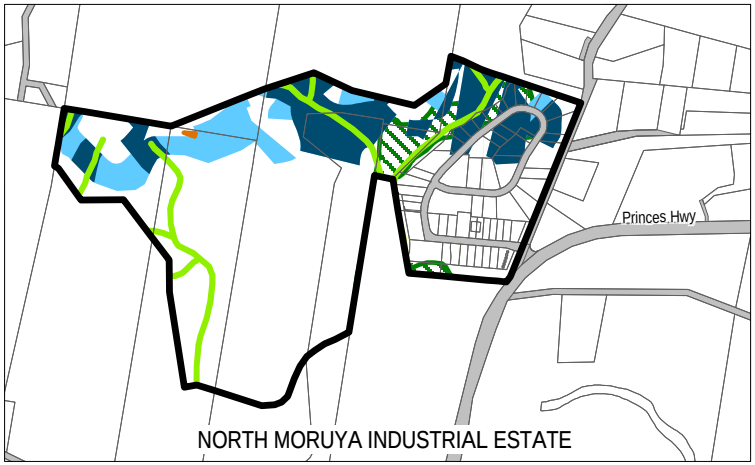


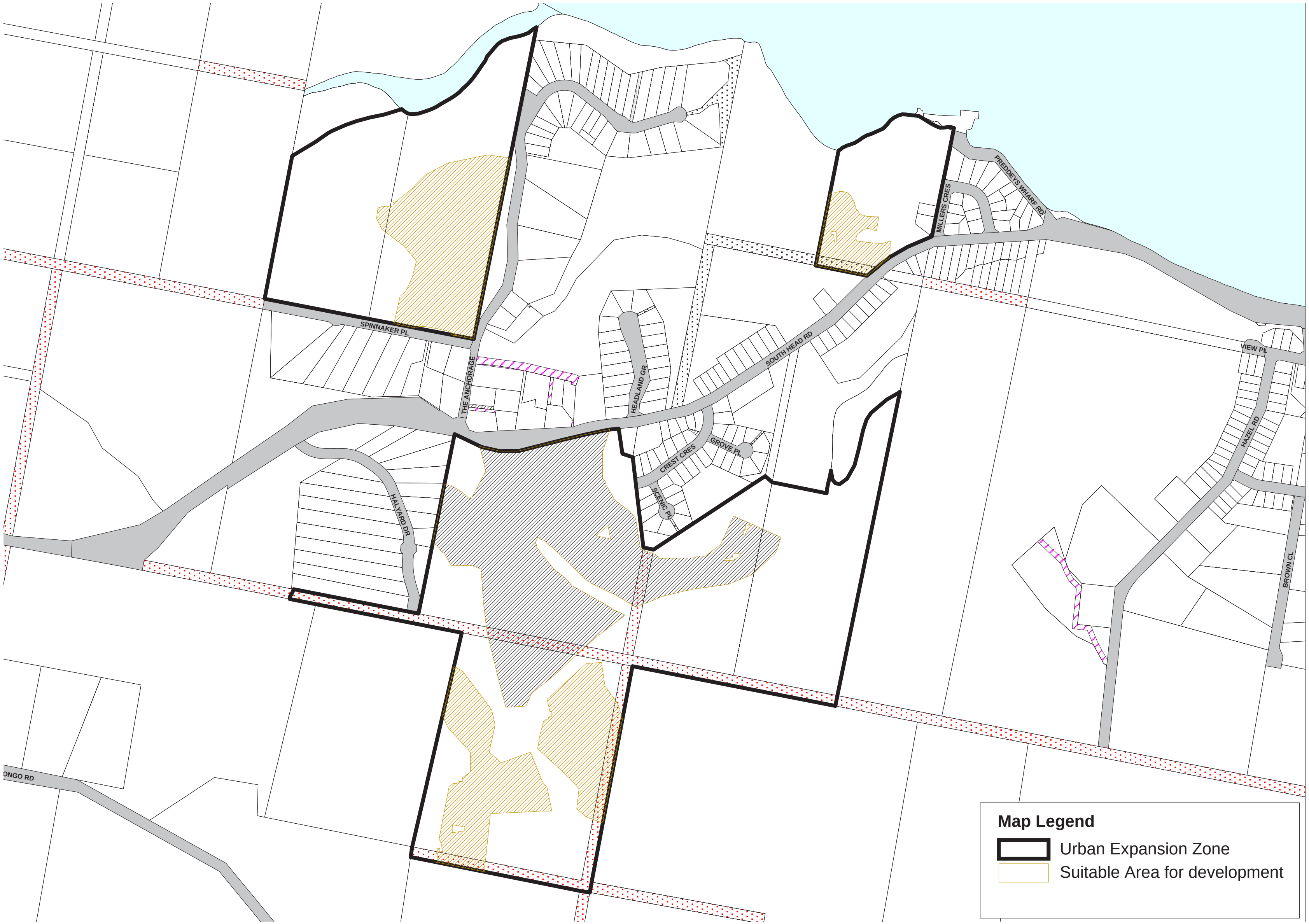


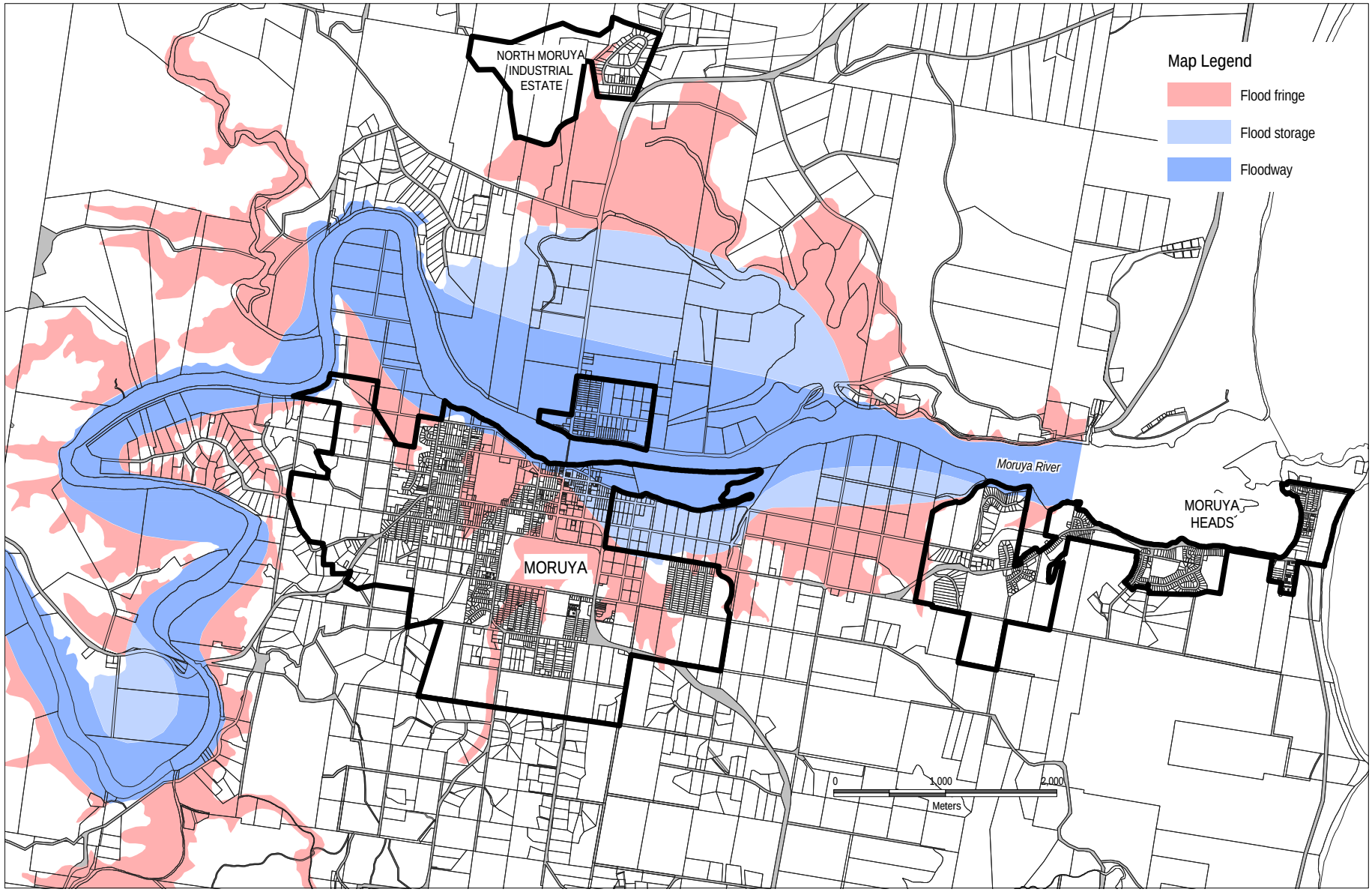
Environmental Management - Constraints



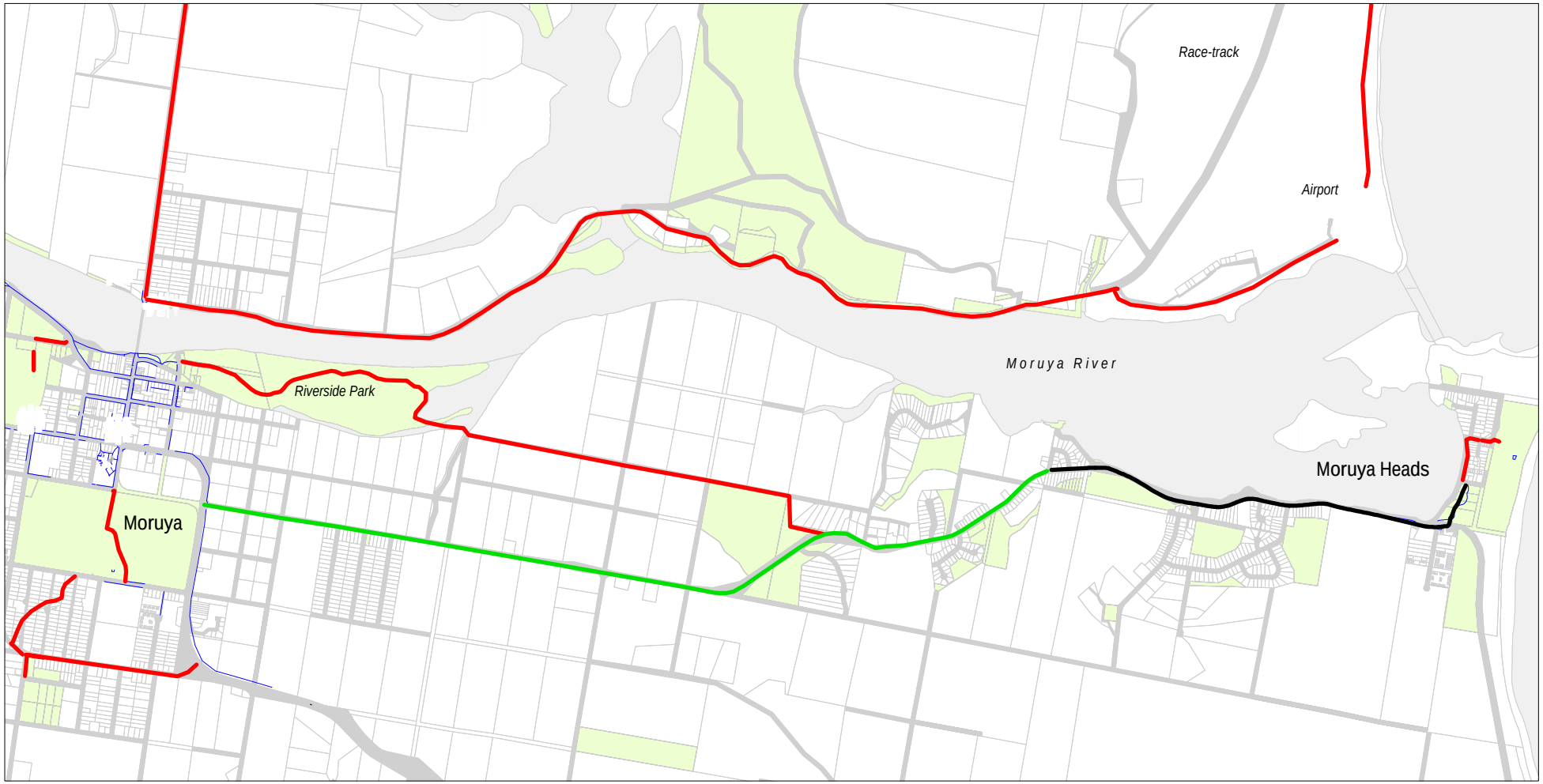
Environmental Management - Constraints




SPINNAKER PL
THE ANCHORAGE
HEADLAND GR
SOUTH HEAD RD
MILLERS CRES
PREDDEYS WHARF RD
VIEW PL
HAZEL RD
BROWN CL
CREST CRES
GROVE PL
SCENIC PL
HALYARD DR
ONGO RD
Map Legend
Urban Expansion Zone
Suitable Area for development



MORUYA RIVER FLOOD HYDRAULIC CATEGORY MAP



Map Legend

- Proposed cycleway - 20 year project
- Proposed cycleway - 5 year project
- Existing cycleway
- Existing footpaths

Existing and Proposed Cycleways

APPENDIX G
STATE LEGISLATION

Consolidated Acts

Marine Parks Act 1997

The *Marine Parks Act 1997* establishes a comprehensive system of marine parks throughout NSW. Marine parks are large marine protected areas that are designed to conserve all forms of marine plant and animal species (*biodiversity*) and provide for a multitude of uses. The Act also establishes the Marine Parks Authority, a Marine Parks Advisory Council and committees, and specifies the functions of the Authority and Council. The NSW Marine Parks Authority (*MPA*) is responsible for the declaration, management selection and zoning of marine parks.

The objectives of the Act are as follows:

(a) to conserve marine biological diversity and marine habitats by declaring and providing for the management of a comprehensive system of marine parks,

(b) to maintain ecological processes in marine parks,

(c) where consistent with the preceding objects:

   i. to provide for ecologically sustainable use of fish (*including commercial and recreational fishing*) and marine vegetation in marine parks, and

   ii. to provide opportunities for public appreciation, understanding and enjoyment of marine parks.

The Act specifies regulations relating to the zoning of marine parks, controls development and activities within marine parks, and specifies a requirements for an operational plan to be prepared for each marine park as soon as practicable after it has been declared.

Native Vegetation Conservation Act, 1997

The *Native Vegetation Conservation Act 1997* (*NVC Act*) came into effect on 1 January 1997. The *NVC Act* incorporates provisions relating to native vegetation conservation and management currently included in the *Soil Conservation Act*, the *Western Lands Act*, the *Forestry Act* and the *Crown Lands (Continued Tenures) Act*. These acts will continue to operate but will no longer incorporate controls on land clearing.

The purpose of the *NVC Act* is to provide a coordinated regional approach to native vegetation conservation in recognition of variability across NSW. The aims of the *NVC Act* are to:

- encourage and promote sustainable native vegetation management;
- protect remnant native vegetation of high conservation value;
- improve the condition of existing native vegetation;
- to streamline the administration of native vegetation management;
- to encourage landholder and community involvement in vegetation management;
- encourage revegetation of land with appropriate native vegetation; and
- prevent inappropriate native vegetation clearing.

The main features of the *NVC Act* are:

- Regional Vegetation Committees (*RVC*);

- Regional Vegetation Management Plans (*RVMP*);
- Property Agreements;
- Exemptions;
- Codes of Practice (*CoP*);
- Compliance; and,
- Native Vegetation Advisory Council.

Various features of the *NVC Act*, such as RVCs, RVMPs and property agreements, provide mechanisms to protect remnant native vegetation, improve the condition of existing native vegetation and encourage and promote sustainable native vegetation management.

The *NVC Act* also defines provisions for clearing within an estuary catchment. In areas with an approved RVMP, clearing allowed under the plan will not require development consent. Clearing that is consistent with an approved Code of Practice will also not require development consent. In areas of an estuary without an RVMP, or approved Code of Practice, native vegetation can be cleared if the clearing is consistent with the exemptions in the Act and other local government clearing restrictions do not apply.

A number of exemptions and exclusions occur, including:

- clearing less than 2 ha per year;
- National Parks, State Forests, SEPP designated areas;
- land under a conservation agreement; and,
- land zoned as urban area.

Where exemptions do not apply, clearing within an estuary catchment can only be carried out after an application has been made to DNR and development consent has been granted.

Native Vegetation Act 2003

The *Native Vegetation Act (NV Act) 2003* replaces the NVC Act 1997. The *NV Act* sets the legislative framework for protecting the health of land, rivers and wildlife while delivering investment security and increased flexibility for landholders. The new system is based on voluntary agreements between landholders and Catchment Management Authorities called Property Management Plans (*PMPs*) or Property Vegetation Plans (*PVPs*). The new Act sets a framework for:

- ending broadscale clearing unless it improves or maintains environmental outcomes;
- encouraging revegetation and rehabilitation of land with native vegetation; and
- rewarding farmers for good land management.

The NSW Parliament passed the *Native Vegetation Act 2003* but a supporting Regulation must be prepared and approved by the Minister before the Act can commence. The draft Regulation prepared in consultation with farming and environmental groups provides detail on how the Act

will work on the ground. At the writing of this report, the Regulation and Assessment Methodology were being revised in light of public comment received during the exhibition period. The gazettal of the Regulation and Assessment Methodology will allow the commencement of the *Native Vegetation Act 2003*.

Key improvements include:

- flexibility for landholders;
- no consent required for routine agricultural management activities;
- the introduction of financial incentives for landholders;
- an end to broadscale clearing by limiting the circumstances under which clearing may be approved;
- improving and streamlining the application process for the clearing of native vegetation;
- property vegetation plans that will provide certainty and flexibility for landholders allowing clearing for up to 15 years;
- clear definitions for different classes of native vegetation;
- involvement of local people in decision making; and,
- certainty for private native forestry.

National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act (NPW Act) 1974* is the principal legislation for protecting both Aboriginal and Non-Aboriginal cultural sites in the Moruya / Deua River Estuary. Under the Act, the Director-General of DEC is responsible for the care, control and management of all national parks, historic sites, nature reserves, reserves, Aboriginal areas and state game reserves. State conservation areas, karst conservation reserves and regional parks are also administered under the Act. The *National Parks and Wildlife Regulation 2002* governs various activities under the *NPW Act*, including:

- the regulation of the use of national parks and other areas administered by the DEC (*Part 2*);
- the preservation of public health in Kosciuszko National Park (*Part 3*);
- licenses and certificates (*Part 4*);
- the protection of fauna (*Part 5*);
- the exemption of Aboriginal people from the restrictions imposed by various sections of the Act on the hunting of certain animals and the gathering of certain plants (*Part 6*);
- boards of management and plans of management in relation to Aboriginal land (*Part 7*); and,
- advisory committees constituted under section 24 of the NPW Act (*Part 8*).

Threatened Species Conservation Act, 1995

The *Threatened Species Conservation Act 1995 (TSC Act)* came into effect on 1 January, 1996. The *TSC Act* aims to:

- conserve threatened species, populations, ecological communities and their habitats;
- promote their recovery; and,

§ manage the processes that threaten or endanger them.

The *TSC Act* replaces the *Endangered Fauna (Interim Protection) Act 1991*. The *TSC Act* covers plants as well as animals and includes categories for 'endangered', 'vulnerable', and 'presumed to be extinct'. This Act is relevant to the Moruya / Deua River Estuary, in that it must be taken into account where a development application (*DA*) is lodged with the consent authority under Part 4 of the *EP&A Act*, and where a proposed activity under Part 5 of the *EP&A Act* is likely to significantly affect the environment of threatened species, populations, ecological communities or their habitats.

This means that an appropriate study must be carried out to determine if any listings under the *TSC Act 1995* will be impacted by a proposed development or activity as defined in the Act.

In relation to agriculture, the *TSC Act* exempts 'routine agricultural activities' from Section 91 licensing but provides for certain routine agricultural activities to be prescribed by regulation as requiring a licence or a property management plan.

Four activities which may occur on agricultural land have initially been proposed for prescription and are:

§ Pesticide / herbicide application;

§ Dead timber collection or removal for sale including standing timber and fallen debris which may have an impact on threatened species;

§ Collection or removal of bushrock for sale which may have an impact on threatened species; and,

§ Activities affecting the distribution of water within a naturally occurring wetland which may have an impact on threatened species (*NPWS, 1997*).

Under Schedule 3 of the *TSC Act*, the following threatening processes were deemed relevant to the Moruya / Deua River Estuary catchment:

§ Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands;

§ Entanglement in or ingestion of anthropogenic debris in marine and estuarine environments;

§ Clearing of native vegetation; and,

§ Removal of dead wood and dead trees.

Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act* (*EP&A Act) 1979* is the key piece of environmental planning legislation in NSW. The EP&A Act establishes the three types of environmental planning instruments *(EPIs*):

§ local environmental plans;

§ regional environmental plans, and

§ state environmental planning policies.

The Act provides for local government to develop regional and local environmental plans which provide the planning framework tailored to local landscapes, objectives and issues.

The Act divides development into three broad categories:

- development that may be carried out without development consent;
- development that may be carried out only with development consent; and
- development that is prohibited.

The *EP&A Act* requires that activities deemed likely to have a potential significant impact on the environment require the preparation of an Environmental Impact Statement or an Environmental Assessment for major projects under the new Part 3A of the *EP&A Act.*

Coastal Protection Act 1979

The objectives of the *Coastal Protection Act 1979* are to provide for the protection of the coastal environment of the State for the benefit of both present and future generations. Under the Act, a public authority can not, without the concurrence of the Minister:

§ Carry out any development in the coastal zone, or

§ Grant any right or consent to a person
  – to use or occupy any part of the coastal zone or
  – to carry out any development in the coastal zone.

The Act provides for the preparation of Coastal Zone Management Plans for a council whose area, or part of whose area, is included within the coastal zone may, and must do so if directed by the Minister, prepare a Coastal Zone Management Plan in accordance with the Act. The Act also specifies those matters that must to be dealt with in the Plan, such as:

§ Protecting and preserving beach environments;

§ Provisions for emergency actions; and,

§ Continued and undiminishing public access to beaches, headlands and waterways, particularly where public access is threatened or affected by accretion.

NSW Fisheries Management Act, 1994

Government regulation of fishing in NSW began with the passing of the *Fisheries Act 1865.* A variety of acts and amendments were passed over the next 130 years to improve fisheries management in NSW.

The most recent legislation, the *Fisheries Management Act 1994* and *Fisheries Management Amendment Act 1997* were developed to conserve, develop and share the fisheries resources of the state for the benefits of present and future generations (*Fisheries NSW, 1998*).

The objectives of the Act are to:

- conserve fish stocks and protect key habitat;
- conserve threatened species, populations and ecological communities of fish and marine vegetation;
- promote ecologically sustainable development, including the conservation of biological diversity;
- promote viable commercial fishing and aquaculture industries;
- promote quality recreational fishing opportunities; and
- appropriately share fisheries resources between users of the resources.

The Department of Primary Industry (*DPI*) (*formerly named NSW Fisheries*) conserves fish habitats under Part 7 of the *Fisheries Management Act 1994* (*NSW Fisheries, 1998).* The main habitat related provisions in this part of the Act are:

- Habitat protection plans – allow for the preparation and gazettal of management plans for the protection of specific aquatic habitats.
- Aquatic reserves – allow for the creation and management of aquatic reserves.
- Dredging and reclamation – allow for the control and regulation of dredging and reclamation activities which may be harmful to fish and fish habitats. It establishes requirements to obtain a permit from, or to consult with, DPI (*Fisheries*).
- Protection of mangroves and certain other marine vegetation – allows for the regulation of damage to, or removal of, certain marine vegetation. At this stage, mangroves and seagrasses are the only forms of marine vegetation protected in this way. A permit is required to remove or damage marine vegetation.
- Protection of spawning of salmon, trout and certain other fish – allows for the protection of fish spawning areas.
- Noxious fish – allows for the declaration of undesirable fish as noxious fish. Once declared noxious these fish may be liable to be seized and destroyed.
- Release and importation of fish – allows for the control of the release, import, sale or possession of fish not originating from NSW waters. The purpose is to prevent the spread of disease and the introduction of undesirable species.
- Miscellaneous – provides for the free passage of fish past barriers such as dams and weirs. This facilitates the installation of fishways, and/or implementation of appropriate operation procedures for weirs.

Protection of the Environment Operations Act, 1997

The *Protection of the Environment Operations Act 1997* (*POEO Act*) came into effect on the 1st July 1999. It is administered by the NSW DEC.

The *POEO Act, 1997*, replaces the following Acts, which have subsequently been repealed:

- *Clean Waters Act, 1970;*
- *Pollution Control Act, 1970;*
- *Environmental Offences and Penalties Act, 1989;*

- *Clean Air Act, 1961*; and,
- *Noise Control Act, 1975.*

The *POEO Act* enables the Government to set out explicit protection of the environment policies (*PEPs*) and adopt more innovative approaches to reducing pollution. The *POEO Act* is designed to replace approvals required under these Acts, with an integrated licensing system. The most relevant provisions and requirements extracted from these Acts are discussed in the following sections.

The DEC is the appropriate regulatory authority for the activities specified in Schedule 1 of the *POEO Act* (*scheduled activities*). In most cases, local councils are the regulatory authorities for non-scheduled activities, except activities undertaken by a public authority which the DEC will regulate or where a public authority has been declared the appropriate regulatory authority. The DEC licenses scheduled activities.

In general, Eurobodalla Shire Council can regulate non-scheduled activities through notice and enforcement powers in their local government area. However, the DEC can issue a licence to regulate water pollution from a non-scheduled activity. If it does, the DEC becomes the regulator for all environmental impacts from the activity under the *POEO Act* instead of Eurobodalla Shire Council.

Clean-up notices, prevention notices and prohibition notices are the environment protection notices which are provided for under the legislation. The classification of offences as Tier 1, 2 or 3 continues under the *POEO Act.* The offences are similar to the previous offence regime. However, there is a duty to notify the appropriate regulatory authority (*broadly, the DEC or the local council*) of pollution incidents where material harm to the environment is caused or threatened.

Under the *POEO Act,* a load based licensing approach is required for point source discharges to any stream. The objective of this approach is to foster the protection of aquatic ecosystems in waterways where point source discharges occur. Under load based licensing, the focus has shifted from controlling the concentration of pollutants discharged, to controlling the total load of pollutants discharged. Notwithstanding, concentration limits will still be specified where the concentration of a pollutant is likely to cause harm to human health or the environment. The aim of the license is to establish long term environmental improvement for receiving waters.

The *POEO Act* also provides that mandatory audits may be required as a condition of a licence if the DEC reasonably suspects that the holder of the licence has on one or more occasions contravened the *POEO Act*, the regulations or the conditions of the licence, and the contravention has caused or is likely to cause harm to the environment.

Water Act 1912

The *Water Act 1912* provides the Department of Natural Resources (*DNR*) with powers to construct drains and raise rates. Section 21A of the Act makes it an offence to discharge substances such as refuse, sludge, noxious matter and liquid proceeding from factories,

manufacturing processes or businesses, into a river or lake. The Act is used primarily to regulate discharges in rural situations. Under the provisions of the Act, the installation of structures within streams for the impoundment of water must be licensed.

Rivers and Foreshores Improvement Act 1948

The *Rivers and Foreshores Improvement Act 1948*, aims to control excavations, the placement of fill and other works in or near rivers, estuaries and lakes. The Act is administered by the DNR. A Part 3A permit must be obtained from the DNR in the following circumstances:

- the excavation of material from, or within 40 metres of any river, estuary or lake;
- the construction of any structure, including erosion or sediment control works, in a river, estuary or lake; and,
- the placement of fill material in a river, estuary or lake.

Water Management Act 2000

The *Water Management Act 2000* provides for the sustainable and integrated management of water sources for the benefit of both present and future generations. The Act considers the following water management issues that relate to the Moruya / Deua River Estuary:

- the protection of geographical and other features of indigenous significance;
- maximisation of social and economic benefits to the community;
- responsive monitoring and improvements in understanding of ecological water requirements;
- drainage management to avoid or minimise land degradation including soil erosion, contamination, decline of native vegetation; and,
- the minimisation of impacts of drainage activities on other water users.

The *Water Management Act 2000 No. 92 - Proclamation* (*NSW Government Gazette No. 168, December 2000*) commenced most of the provisions of the Act on 1 January 2001, except those provisions relating to aspects of harvestable rights, access licences, approvals and the Water Investment Trust. For the time being, matters relating to licences and approvals will continue to be dealt with by the *Rivers and Foreshores Improvement Act 1948* and the *Water Act 1912*.

The *Water Management Act* provides for the preparation of water management plans, which contain much of the detail necessary for the operation of the Act. Water management plans address matters such as water sharing, water use, drainage and floodplain management and water source protection. Water management plans are created by the water management committee for a water management area or by the Minister for Natural Resources. Water management committees are appointed by the Minister, and each committee must develop a water management plan in accordance with terms of reference set by the Minister.

Crown Lands Act 1989

The term 'Crown land' refers only to land administered and managed under the provisions of the *Crown Lands Act 1989* and associated legislation. This includes the *Crown Land (Continued Tenures) Act 1989, Commons Management Act 1989, Western Lands Act 1901, Wentworth*

Irrigation Act 1890, Hay Irrigation Act 1902 and other Acts covering specific locations and Crown Land functions.

The *Crown Lands Act 1989* provides for the equitable sharing of Crown land resources in accordance with the principles of environmental protection, conservation and ecological sustainability, public use and enjoyment, as well as encouragement of multiple uses.

The Act contains the following principles for managing Crown land:

- environmental protection principles are observed in the management and administration of Crown land;
- natural resources of Crown land *(including water, soil, flora, fauna and scenic quality*) are conserved, wherever possible;
- public use and enjoyment of appropriate Crown land is to be encouraged;
- multiple use of Crown land is to be encouraged, where appropriate;
- Crown land should be used and managed so its resources are sustained in perpetuity, where appropriate; and
- Crown land is to be occupied, used, sold, leased, licensed or dealt with in the best interests of the State, consistent with the above principles.

As the bed and banks to the mean high water mark of the Moruya / Deua River Estuary, islands and much of its public foreshore land are Crown Land, this piece of legislation is very relevant to the management of the estuary.

APPENDIX H

ACID SULPHATE SOILS MAPPING

ASS Policy Planning Maps Legend

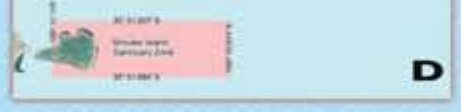
- Class 5
- Class 2
- Class 3
- Class 1
- Class 4

APPENDIX I

BATEMANS MARINE PARK
ZONING PLAN USER GUIDE

149°55'0"E 150°0'0"E 150°5'0"E 150°10'0"E 150°15'0"E 150°20'0"E 150°25'0"E 150°30'0"E

36°55'0"S 36°60'0"S 37°5'0"S 37°10'0"S 37°15'0"S 37°20'0"S



BATEMANS MARINE PARK

Zoning Plan User Guide

Tasman Sea
Terrestrial National Park
Recreational fishing haven

Zones

General Use Zone
Habitat Protection Zone
Habitat Protection Zone (Restricted)
Special Purpose Zone
Sanctuary Zone

APPENDIX J

SAMPLE AUDIT FOR BANK EROSION PROGRAM

1 OUTLINE SPECIFICATION

Task A. Extensive Survey:

A.1 Confirm or map the location of all areas which have currently or have had past rock bank protection.
A.2 Identify all breaches or makor failures in protection.
A.3 Identify all areas with erosion extending 4m or more landwards of the rear face of the rock as placed.
A.4 Identify all other areas where rock has failed so as to result in a failure of the protection layer (eg by slumping, subsidence, undercutting).
A.5 Prepare plans showing rock protection (A.1) and areas of damage (A.2, A.3, A.4).

Task B. Detailed Survey and Assessment:

B.1 For 16 sites, covering all major lengths of rock protection, survey 3 cross sections extending 20 m into the river and 10 m landwards of the 0 m AHD line.
B.2 For each cross section determine and indicate:
- rock toe position and elevation,
- rock crest position and elevation,
- typical, maximum and minimum rock size,
- presence or absence of a filter layer (rock of weight about 1/10 of primary armour weight),
- soil type and grain size (by inspection),
- presence/absence and extent of scour behind the rock,
- presence/absence and extent of scour at the rock toe,
- presence of any rock downslope from the toe.

B.3 For at least 3 sites, and more as warranted, evaluate slope stability for the rock and bank. Consider the soil to be saturated but tide at mean low water.
B.4 For each site, assess the potential for future scour of the soil behind the wall from land runoff and groundwater drainage.
B.5 For each site assess the risk of scour at the toe by tidal and flood currents.
B.6 For each site assess the risk of scour or leaching of the soil behind the wall by tidal and flood currents.

Task C. Recommendations:

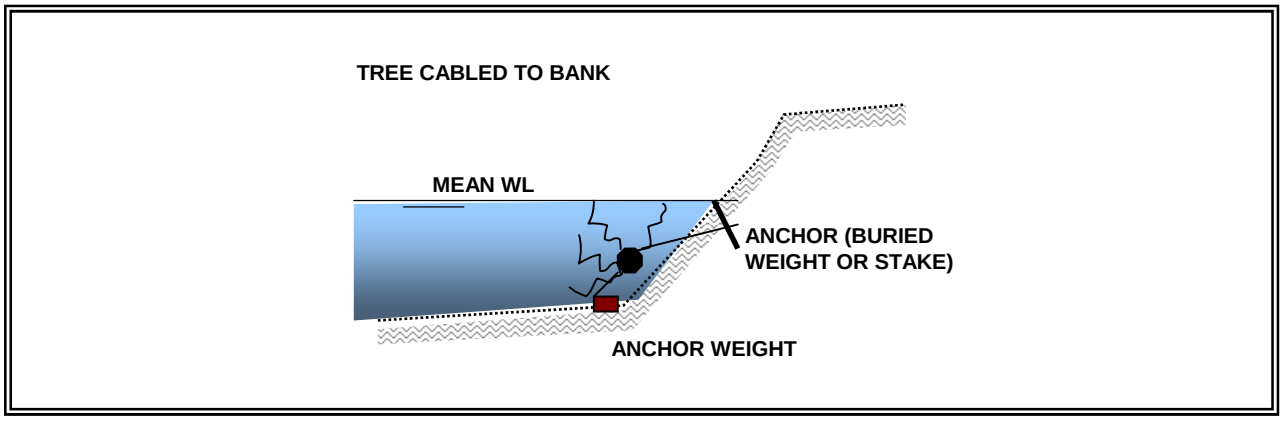
C.1 Develop proposals for remediation of the typical sites, briefly considering several options.
C.2 Recommend remediation procedures for the rock protection. Consider the extent of the protection and the need to tie in or extend that protection.
C.3 Estimate the cost of remediation, providing a breakdown by region and unit costs.

APPENDIX K

BANK AND FORESHORE REHABILITATION PLAN

BANK AND FORESHORE REHABILITATION OPTIONS

Brushing - Anchoring large organic debris or trees to the base of the bank



Organic debris is aligned along the toe of the bank and is held in place with an anchor weight on the existing river bed and anchor staked into the bank

- Debris such as 'rootballs' can be sourced from offsite
- Trim large root wads and branches and align trees along the toe in a head to tail fashion
- Tie trees to bank by means of a cable attached to a deadman anchor (concrete block) on the bed and an anchor or stake buried into the bank
- Short lengths of protection may lead to local scour – suggested minimum length is three channel widths

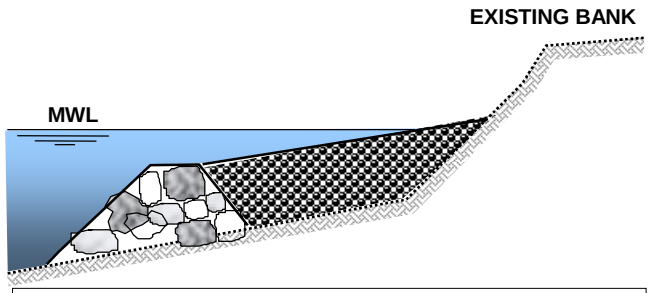
ADVANTAGES:

- helps to trap sediment and establish a natural vegetated bank
- diverse habitat value

DISADVANTAGES:

- applicable for straighter reaches

Gravel or cobble fillet behind a rock toe



ROCK SUPPORTED COBBLE FILLET

For sections of the riverbank which are affected by wave erosion at the water level, a gravel or cobble fillet can be installed, supported by a small rock toe, to prevent further wave attack of the bank. It is important that the cobble fillet extend to above the wave run-up level, otherwise the overall integrity of the option would be compromised.

- Create an artificial bench supported by a rock berm or and possibly vegetate to absorb wave energy.

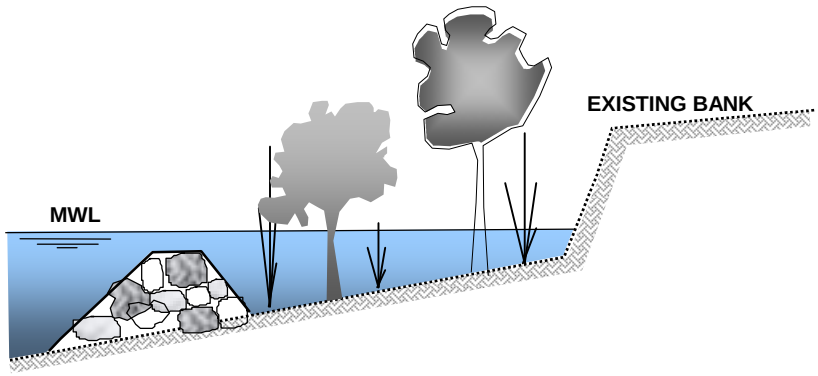
ADVANTAGES:

- simple but robust solution to mild wave erosion problem
- vegetation can be planted to provide habitat and further stabilisation, ie mangroves or phragmites
- create valuable intertidal habitat
- can improve access to water

DISADVANTAGES:

- requires shallow water at low tide
- appropriate only where banks are relatively low
- must be minimal toe scour potential

Mangrove Planting Behind Low Rock Wall



ROCK PROTECTED MANGROVE PLANTING

Mangroves can be planted in front of the eroding bank to provide protection against wave attack. This vegetation provides effective resistance against waves reaching the bank.

A low rock wall is required to offer protection from waves during establishment of the mangroves. Intertidal mangrove plantings could be carried out in combination with additional revegetation of the riverbank.

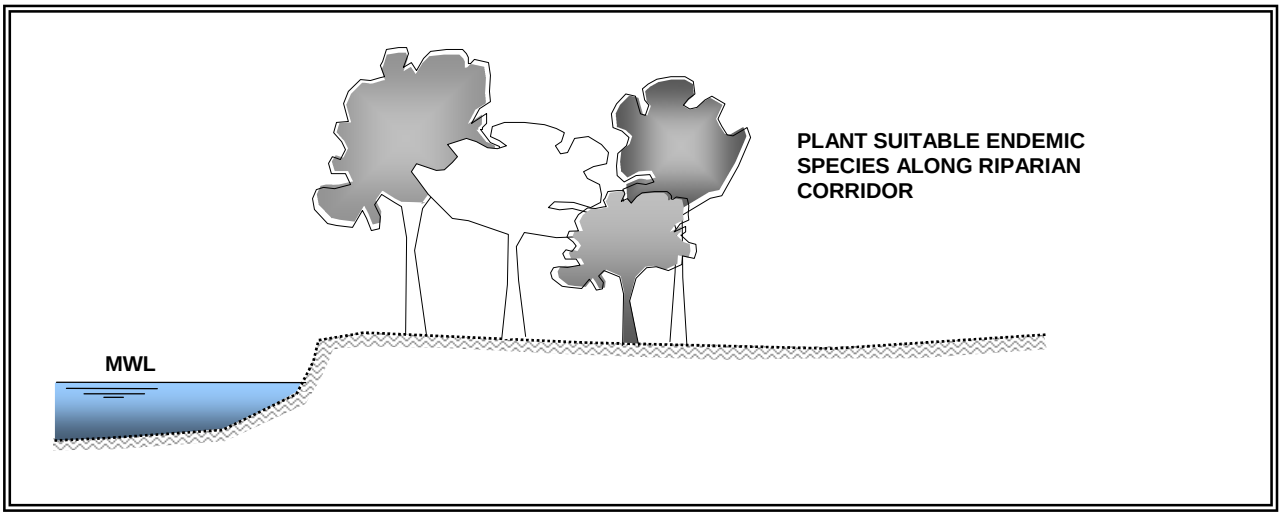
ADVANTAGES:

- § simple solution to wave erosion problem
- § create valuable intertidal habitat
- § aesthetically pleasing
- § can improve access to water

DISADVANTAGES:

- § appropriate only where banks are relatively low
- § flood velocities must not be too high (ie, up to 2 m/s)
- § not suitable in areas of pronounced river bed scour
- § may alter local flood behaviour

Revegetation of the riparian corridor



Riparian vegetation has significant potential to reduce bank erosion. The root system of riparian vegetation acts to bind together the bank soil structure, making it more resilient to scour, seepage and slumping. In addition to the structural benefits, planting riparian vegetation introduces significant habitat values, aesthetic values and a valuable buffer / filter strip between the land and the waterway. Such vegetated filter strips have been shown to reduced surface runoff pollutants (*ie, sediment and nutrients*) entering the waterway.

At suitable locations, appropriate tree species could be planted to improve the overall stability of the river bank along the riparian corridor.

ADVANTAGES:

- § aesthetic improvement
- § relatively inexpensive
- § provides increased protection through the following processes:
  - ⇒ leaves and branches of low-growing foliage help to dissipate flow at the surface of the soil, thereby reducing the erosive flow along the riverbank. This can ultimately result in sediment deposition around plants, eventually increasing further colonisation and diverting flow
  - ⇒ a shallow root mat (as provided by most grasses) can armour the soil surface, preventing disaggregation and subsequent loss of sediment
  - ⇒ deeper roots can reinforce soil as well, aiding in the prevention of deep-seated geotechnical failures

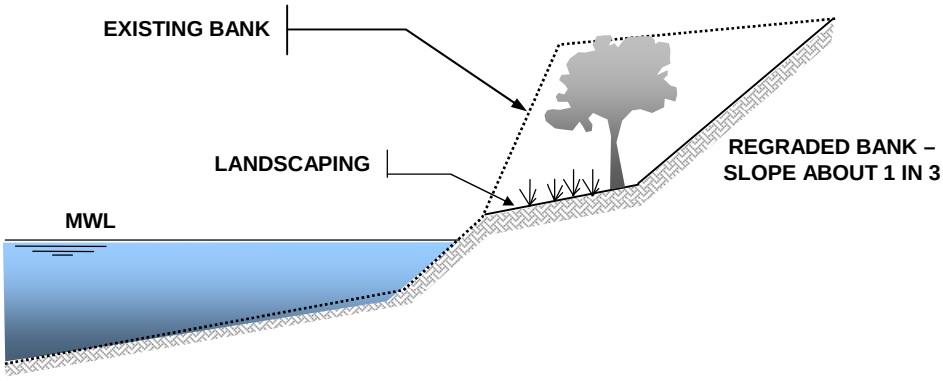
DISADVANTAGES:

- § Care needs to be taken with species selection to ensure appropriate native vegetation for any given situation
- § Will require maintenance for up to three years to ensure adequate establishment of vegetation
- § could be damaged by extreme event
- § not applicable to oversteepened banks
- § may require river bank regrading
- § could be damaged by storm events or bushfire
- § may obscure views of the waterway
- § may be difficult to establish and maintain due to obstruction of views
- § may alter local overbank flood behaviour and exacerbate flooding of surrounding areas

- ⇒ deep roots can also provide an effective path for drainage, thereby reducing the "drawdown" effect and slumping (as a result of falls in river water level)
- ⇒ extensive tree planting helps to control riverbank soil moisture, reducing the risk of excessive pore pressure in wet conditions and reducing the likelihood of soil shrinkage and cracking during extended dry conditions
- ⇒ many vegetative types are self maintaining, regrowing after damage and filling any gaps in the protection

§ surface runoff is intercepted and dissipated by vegetation, leading to potential deposition of sediment (soil building) and filtering of soil-bound pollutants (nutrients, pesticides, petrochemicals etc)

Bank regrading



BANK REGRADING (PLUS RE-VEGETATION)

Overly steep banks have a greater tendency to collapse, under the weight of surcharge loading, or through groundwater seepage. Regrading of an upper slope can also be adopted for banks experiencing toe scour, however, under such circumstances, the toe of the slope would need to be additionally protected (refer previous options).

- Vegetate bench for habitat or provide for recreation, eg walkway.
- Width to suit function of bench.
- Can incorporate planform features such as a small beach front for boating access.
- Cost depends on height of bank to be regraded.

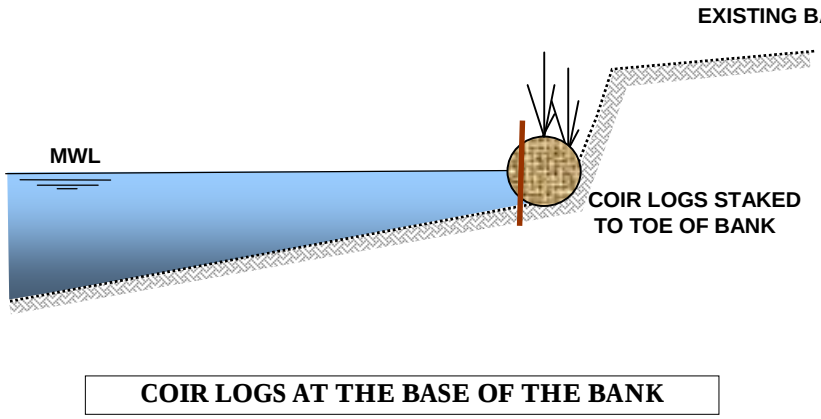
ADVANTAGES:

- relatively simple and inexpensive process
- reduces the slope of the bank, thereby decreasing its likelihood of failure.
- provides area for vegetation
- aesthetically attractive

DISADVANTAGES:

- initially damages habitat
- requires sufficient strip of riparian land

Installation of coir logs at the base of the bank



COIR LOGS AT THE BASE OF THE BANK

Coir logs are made from coconut fibre and are typically available in 3 metre lengths with a typical diameter of 300 mm. They are designed to biodegrade after about 4 years under normal estuary conditions. It is recommended that the coir logs be embedded into the base of the river bank to a depth of 50 to 100 mm.

The coir logs will gradually degrade as new vegetation that establishes along the river bank, and will form a "matting" that can retain sediment and provide a bed for aquatic plant growth. Over time, the natural processes of sediment deposition and vegetation growth will aid in biodegradation of the coconut fibres and the stabilisation of the eroded toe of the river bank. This may occur as a combination of some slumping of the eroded bank scarp and as deposition in the vicinity of the coir logs.

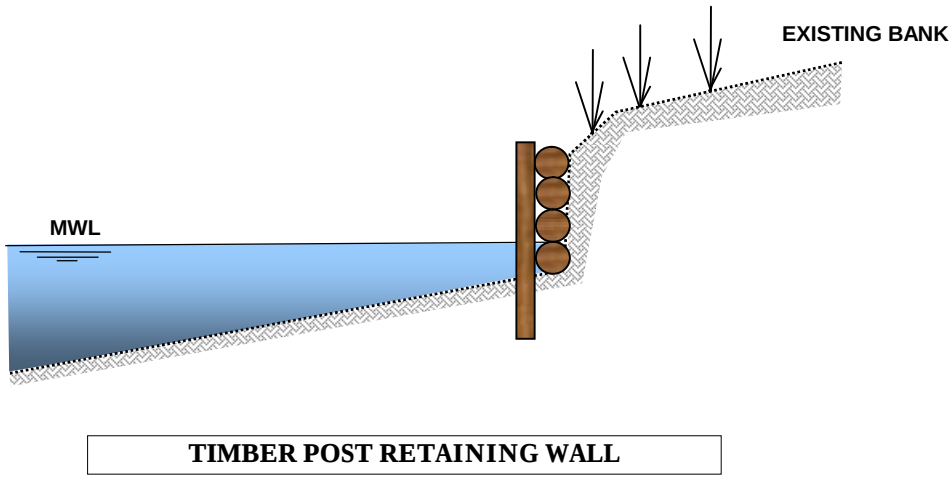
ADVANTAGES:

- relatively easy to install
- create valuable platform for new vegetation
- aesthetically pleasing once natural condition of the bank restored

DISADVANTAGES:

- most appropriate where banks are relatively low
- not typically suitable for areas of pronounced river bed scour

Timber post retaining wall



TIMBER POST RETAINING WALL

Timber post retaining wall has been installed previously at sections along the Moruya River foreshore, including upstream from the Moruya Hospital (*refer* **Figure 4**). An example is shown below in **Plate K**.

The upright posts are driven into the bed of the river near the base of the bank to provide structural support for the retaining wall. For the purpose of large scale bank stabilisation works, the timber logs should have a typical diameter of approximately 300 mm or more, to avoid future movement of posts and collapse of wall sections.

The works are best accompanied by minor regrading of the bank above the retaining wall (*if required*) and revegetation of the upper slope (*refer* **Plate K**).

ADVANTAGES:

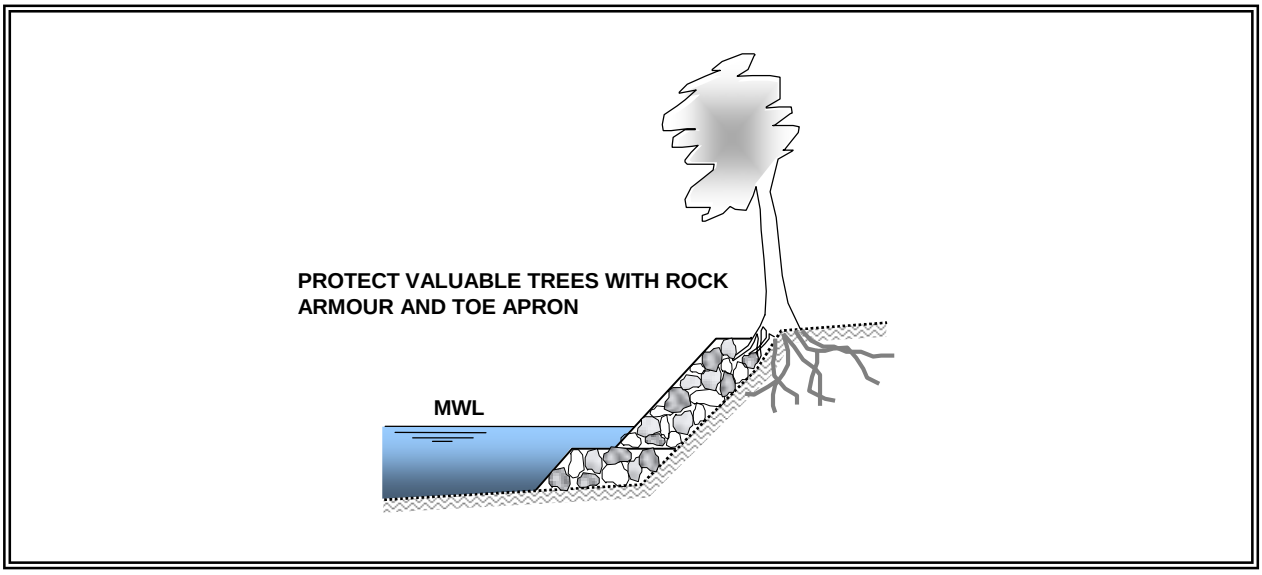
- § suitable for steep, tall banks
- § minimal encroachment into riparian zone
- § aesthetically pleasing once vegetated bank has developed

DISADVANTAGES:

- § heavy machinery may be required for installation
- § toe of wall may need protection from current scour
- § relatively expensive

Plate K: View of existing bank stabilisation measures on Moruya River

Localised rock protection for valuable trees



Protect valuable threatened trees with rock armour surrounding the exposed roots. The rock armour should include a toe apron to prevent undermining and should be cut into the bank at the sides to prevent outflanking.

ADVANTAGES:

- protects valuable trees
- can provide additional habitat value

DISADVANTAGES:

- hardens previously soft banks
- not a long-term solution (ie. high maintenance costs and risk of failure)
- if not properly designed hydraulically, may result in changes flow patterns and erosion problems elsewhere

TABLE K1: BANK AND FORESHORE REHABILITATION PLAN FOR MORUYA / DEUA RIVER ESTUARY

SITE	DESCRIPTION OF THE ISSUES AT THE SITE MECHANISMS OF BANK EROSION	PRIORITY RANKING	REHABILITATION OPTIONS	ESTIMATED COST		
				Option A	Option B	Option C
LOWER ESTUARY (Refer Figure 16)						
BFR-1	Damage to riparian vegetation resulting from unrestricted access by pedestrians and vehicles for camping activities. Reduction in vegetation has lead to increased exposure to wave attack, combined with trampling, to cause collapse of the bank. Located to the west of the North Head Camping Grounds. Length of site is approximately 500 metres.	HIGH	Option A: Revegate riparian strip with endemic species Prevent access to area by campers and recreational users by installing fencing around riparian zone Works to be done in conjunction with Strategy PCP-13 Option B: Bank regrading, revegetation and fencing	$95,000	$170,000	-
BFR-2	Lack of riparian vegetation at The Anchorage. Length of site is approximately 150 metres.	LOW	Option A: Work with landholders to identify and implement preferred rehabilitation option Revegetate riparian zone with endemic species of mangroves and phragmites Install temporary fencing around riparian zone Works to consider potential walkway/cycleway proposed as part of Strategy IR-7	$36,000	-	-
BFR-3	Natural erosion of unconsolidated sediments on the inside bend of the river, upstream from The Anchorage. Likely to have been exacerbated by reduction in riparian vegetation and stock damage. Length of erosion site is approximately 500 metres. Length of site lacking riparian vegetation is approximately 200 metres. Site incorporates a frontage to SEPP 14 wetlands at The Anchorage.	MEDIUM	Option A: Revegate riparian area immediately upstream from SEPP 14 Wetlands with endemic species Prevent stock access by installing fencing around revegetated area (seek permission from landholders) (refer also to Strategy IR-3) Option B: Plant mangroves behind a low rock wall (avoid access through SEPP 14 wetlands for rock placement) Revegetate riparian area and install fencing to prevent stock access Option C: Brushing - anchor large organic debris to base of eroded bank to protect from wave attack Revegetate riparian area and install fencing to prevent stock access Works to consider potential walkway/cycleway proposed as part of Strategy IR-7	$38,000	$163,000	$138,000
BFR-4	Lack of riparian vegetation along the top of an existing low level rock protection wall downstream from the entrance to Racecourse Creek. Length of site is approximately 1100 metres.	LOW	Option A: Work with landholders to identify and implement preferred rehabilitation option Revegetate riparian zone with endemic species Install temporary fencing around riparian zone Works to consider potential walkway/cycleway proposed as part of Strategy IR-7	$209,000	-	-
BFR-5	Erosion of the natural bank at the eastern side of the entrance to Malabar Lagoon threatens an identified site of Aboriginal significance (refer Strategy C-5 in Appendix C). Lack of riparian vegetation. Length of site is approximately 100 metres.	MEDIUM	Option A: Revegetate foreshore with endemic species Option B: Install a gravel or cobble fillet behind a rock toe Revegetate foreshore with endemic species	$19,000	$49,000	-
BFR-6	Erosion of the natural bank at the western side of the entrance to Malabar Lagoon. Likely the result of current scour on the outside bend in the river. Length of site is approximately 200 metres.	LOW	Option A: Plant mangroves behind a low rock wall Avoid access through existing riparian vegetation Option B: Install coir logs along the toe of the eroded bank Avoid damage to existing riparian vegetation	$50,000	$30,000	-
BFR-7	Erosion of cleared and heavily grazed land along the western shore of Malabar Lagoon. Length of the site is up to 1400 metres. Site borders significant areas of SEPP 14 wetlands.	MEDIUM	Option A: Work with landholders to identify and implement preferred rehabilitation option Revegetate riparian strip with endemic species Prevent stock access by installing fencing around revegetated area (refer also to Strategy IR-3)	$196,000	-	-
BFR-8	Erosion of cleared and heavily grazed land along the western shore of Malabar Lagoon Length of the site is up to 1600 metres	LOW	Option A: Work with landholders to identify and implement preferred rehabilitation option Revegetate riparian strip with endemic species Prevent stock access by installing fencing around revegetated area	$224,000	-	-

TABLE K1: BANK AND FORESHORE REHABILITATION PLAN FOR MORUYA / DEUA RIVER ESTUARY

SITE	DESCRIPTION OF THE ISSUES AT THE SITE MECHANISMS OF BANK EROSION	PRIORITY RANKING	REHABILITATION OPTIONS	ESTIMATED COST		
				Option A	Option B	Option C
UPPER ESTUARY (Refer Figure 17)						
BFR-9	Lack of riparian vegetation landward of existing rock wall and natural bank adjacent to grazed land upstream from the River Breeze Caravan Park. Length of site is approximately 1400 metres.	LOW	Option A: Work with landholders to identify and implement preferred rehabilitation option Revegetate riparian strip with endemic species Prevent stock access by installing fencing around revegetated area Works to consider potential walkway/cycleway between River Breeze Caravan Park and Glenduart Riverside Reserve (refer Strategy OGW 7)	$196,000	-	-
BFR-10	Erosion of high, steep natural river bank upstream from existing bank stabilisation measures. Bank collapse and tree falls are likely the result of undercutting of the bank toe by wave action at high tide level. Lack of riparian vegetation due to agricultural clearing and tree falls due to bank collapse. Length of site is approximately 450 metres.	MEDIUM	Option A: Revegetate the top of the bank with endemic species Option B: Install bank stabilisation measures similar to existing measures immediately downstream - timber post retaining wall Revegetate the top of the bank with endemic species Option C: Brushing - anchor large organic debris to base of eroded bank to protect from wave attack Revegetate the top of the bank with endemic species	$45,000	$495,000	$135,000
BFR-11	Lack of riparian vegetation along the natural river bank adjacent to grazed land. Length of site is approximately 700 metres.	LOW	Option A: Work with landholders to identify and implement preferred rehabilitation option Revegetate riparian strip with endemic species Prevent stock access by installing fencing around revegetated area	$105,000	-	-
BFR-12	Bank collapse and tree falls are likely the result of undercutting of the bank toe by current scour and wave action at high tide level. Riparian vegetation has been enhanced in this area through previous plantings and restriction of stock access, but is threatened by bank recession. Length of site is approximately 600 metres.	HIGH	Option A: Brushing - anchor large organic debris to base of eroded bank to protect from wave attack Option B: Install localised rock protection for large overhanging trees Option C: Plant mangroves behind a low rock wall Method of rock placement must avoid damage to existing vegetation	$120,000	$120,000	$150,000
BFR-13	Minor erosion of gradually sloping bank along exposed beaches on inside bend opposite Glenduart Reserve. Likely the results of current scour and undercutting from wave action. Lack of riparian vegetation in areas. Length of erosion site is approximately 200 metres. Length of site lacking riparian vegetation is approximately 100 metres.	LOW	Option A: Work with landholders to identify and implement preferred rehabilitation option Revegetate riparian strip with endemic species Prevent stock access by installing fencing around revegetated area Option B: Install coir logs along the toe of the eroded bank Revegetate riparian strip and install fencing to prevent stock access Option C: Install a gravel or cobble fillet behind a rock toe Revegetate riparian strip and install fencing to prevent stock access	$19,000	$49,000	$79,000
BFR-14	Erosion of steep natural river bank on the outside bend along the foreshore of Glenduart Reserve. Bank collapse and tree falls are likely the result of undercutting of the bank toe by current scour and wave action at high tide level. Existing riparian vegetation is threatened by bank recession and could be enhanced. Length of site is approximately 700 metres.	HIGH	Option A: Enhance riparian vegetation with endemic species Request the removal of small boats that are currently stored at the base of the bank Option B: Plant mangroves behind a low rock wall Enhance riparian vegetation with endemic species Option C: Install localised rock protection for large overhanging trees Enhance riparian vegetation with endemic species	$70,000	$245,000	$210,000

TABLE K1: BANK AND FORESHORE REHABILITATION PLAN FOR MORUYA / DEUA RIVER ESTUARY

SITE	DESCRIPTION OF THE ISSUES AT THE SITE MECHANISMS OF BANK EROSION	PRIORITY RANKING	REHABILITATION OPTIONS	ESTIMATED COST		
				Option A	Option B	Option C
BFR-15	Erosion of natural river bank on the outside bend upstream from Glenduart Reserve. Bank collapse and tree falls are likely the result of undercutting of the bank toe by wave action at high tide level. Lack of riparian vegetation due to agricultural clearing. Length of site is approximately 500 metres.	MEDIUM	Option A: Work with landholders to identify and implement preferred rehabilitation option Enhance riparian vegetation with endemic species Prevent stock access by installing new or repairing existing fencing around revegetated area Option B: Repair / replace existing stabilisation measures comprising timber post retaining wall Enhance riparian vegetation and install fencing to prevent stock access Option C: Brushing - anchor large organic debris to base of eroded bank to protect from wave attack Enhance riparian vegetation and install fencing to prevent stock access	$95,000	$595,000	$195,000
BFR-16	Lack of riparian vegetation along the natural river bank adjacent to grazed land. Site meets the eastern extent of SEPP 14 wetlands along Mogendoura Creek. Length of site is approximately 800 metres.	MEDIUM	Option A: Work with landholders to identify and implement preferred rehabilitation option Enhance riparian vegetation with endemic species Prevent stock access by installing fencing around revegetated area (refer also to Strategy IR-3)	$112,000	-	-
BFR-17	Severe erosion of steep natural river bank on outside bend opposite the confluence with Mogendoura Creek. Bank collapse is likely the result of undercutting of the bank toe by current scour and wave action at high tide level. Almost completely denuded of riparian vegetation due to agricultural clearing and tree falls due to bank collapse. Length of site is approximately 650 metres.	HIGH	Option A: Work with landholders to identify and implement preferred rehabilitation option Revegate riparian strip with endemic species Prevent stock access by installing fencing around revegetated area Option B: Bank regrading along a portion of the site Revegetate riparian strip and install fencing to prevent stock access Option C: Install coir logs along the toe of the eroded bank Revegetate riparian strip and install fencing to prevent stock access	$156,000	$226,000	$253,500
BFR-18	Lack of riparian vegetation along the natural river bank adjacent to grazed land. Site meets the eastern extent of SEPP 14 wetlands along Mogendoura Creek. Length of site is approximately 500 metres.	MEDIUM	Option A: Work with landholders to identify and implement preferred rehabilitation option Enhance riparian vegetation with endemic species Prevent stock access by installing fencing around revegetated area (refer also to Strategy IR-3)	$95,000	-	-
BFR-19	Lack of riparian vegetation along the natural river bank at the rear of private properties and along the foreshore of Yarragee Reserve. Length of site is approximately 1500 metres, including 900 metres along Yarragee Reserve.	LOW	Option A: Work with landholders to identify and implement preferred rehabilitation option Enhance riparian vegetation with endemic species Where required, prevent stock access by installing fencing around revegetated area	$210,000	-	-
BFR-20	Lack of riparian vegetation along the natural river bank downstream from unnamed creek. Length of site is approximately 150 metres.	LOW	Option A: Work with landholders to identify and implement preferred rehabilitation option Revegate riparian strip with endemic species If required, prevent stock access by installing fencing around revegetated area	$28,500	-	-
BFR-21	Lack of riparian vegetation along the natural river bank at Yarragee Reserve. Length of site is approximately 450 metres.	MEDIUM	Option A: Revegate riparian strip with endemic species If required, prevent access to the foreshore by installing fencing around revegetated area Works are to be in accordance with measures contained in the Plan of Management for Yarragee Reserve (2006)	$85,500	-	-
BFR-22	Lack of riparian vegetation along the natural river bank at the rear of private properties located opposite Yarragee Reserve. Length of site is approximately 1500 metres.	LOW	Option A: Work with landholders to identify and implement preferred rehabilitation option Enhance riparian vegetation with endemic species Prevent stock access by installing fencing around revegetated area	$210,000	-	-

* Cost estimates are based on Patterson Britton & Partner's experience and judgement as a firm of practising professional engineers familiar with the construction industry.
Cost estimates can NOT be guaranteed as we have no control over Contractor's prices, market forces and competitive bids from tenderers.
Cost estimates may exclude items which should be considered in a cost plan. Examples of such items are design fees, project management fees, authority approval fees, contractors risk and project contingencies *(e.g. to account for construction and site conditions, weather conditions, ground conditions and unknown services)*.
Construction cost estimates by Patterson Britton & Partners are not to be relied upon. If a reliable cost estimate is required, then an appropriately qualified Quantity Surveyor should be engaged.

APPENDIX L

SAMPLE ECOSYSTEM HEALTH REPORT CARD

Lake Illawarra Condition Report Card 2006

ECOSYSTEM HEALTH MONITORING PROGRAM

Estuary Information

Geomorphic type: wave-dominated barrier estuary
Entrance: Trained walls / Intermittent
Water area: 36.3 km^2 Volume: 76481ML
Catchment Area: 270 km^2
Average rainfall: 1190 mm 2006 rainfall: 790 mm
HRC (2002) Management classification:
Targeted Repair

Condition Index

Good Fair Poor No data

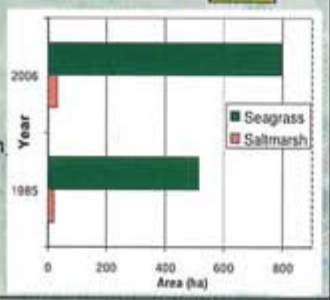
Trend Information *(where available)*
- improvement
- decline
- no change

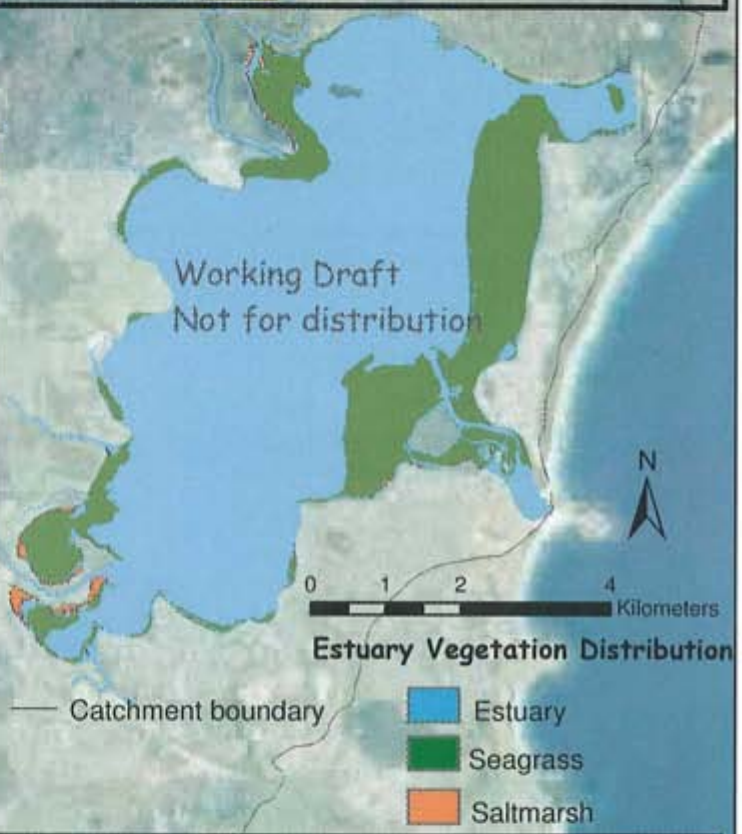
Data Quality
- good
- fair
- poor

Estuarine Vegetation Extent

Seagrass ▲ Mangroves n/a Saltmarsh ▲

Seagrass, mangroves & saltmarsh were mapped from historical aerial photography. Overall there has been an increase in estuarine vegetation with notable increases of seagrasses, while saltmarsh have increased slightly since 1985.[1]





Wetland Health

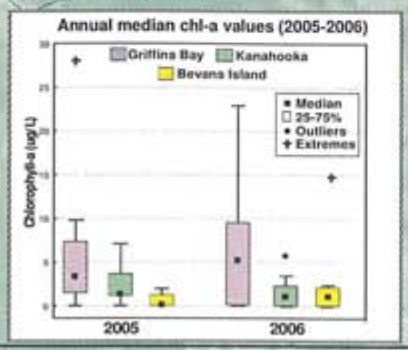
No wetland health assessments have been undertaken in Lake Illawarra.

Water Quality

Salinity, temperature, and pH data are not available for Lake Illawarra for 2006.

Chlorophyll-a

Chlorophyll-a data was collected monthly at three sites in Lake Illawarra in 2005 & 2006.[2]
Median values were less than 5ug/L, with the highest range of values recored at Griffins Bay. While median values were quite low there were high values, likely from large runoff events, causing high nutrient and sediment inputs into the lake.

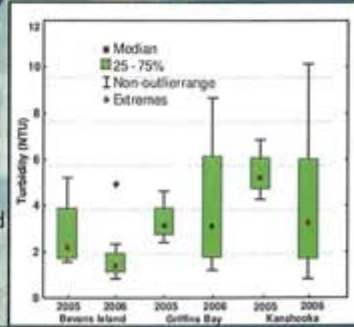


Seagrass Depth Limits

No seagrass depth limits (SDL) information is available for Lake Illawarra. SDL is the difference in elevation between the upper tidal limit of seagrass distribution and the lower light limited distribution.
The amount of light available to seagrasses is often considered the main determining factor controlling the depth to which seagrasses can grow. Light and hence seagrass growth can be affected by turbidity, phytoplankton, colored dissloved organic matter, and macroalgae and epiphytic microalgae that grow on seagrass.

Water clarity/ Turbidity

The Lake Illawarra Authority monitors turbidity monthly at 3 sites. Median values were less than 6 NTU, which are considered fair to good values.
A larger range of values were measured at Kanahooka and at Griffins Bay in 2006, compared to the well-flushed entrance site at Bevans Island.



Data Sources: [1] Data from Department of Environment and Climate Change [2] Data from Lake Illawarra Authority

APPENDIX M

TRIPLE BOTTOM LINE ASSESSMENT
FOR MANAGEMENT STRATEGIES

TBL Assessment

Scoring		
	0	No benefit
	1	Low (or indirect)
	2	Moderate
	3	High

Management Strategy:	PLANNING CONTROLS AND POLICIES													
	PCP-1	**PCP-2**	**PCP-3**	**PCP-4**	**PCP-5**	**PCP-6**	**PCP-7**	**PCP-8**	**PCP-9**	**PCP-10**	**PCP-11**	**PCP-12**	**PCP-13**	**PCP-14**
Environmental														
Benefit to:														
Water quality	2	3	2	3	3	3	1	3	1	1	2	2	1	0
Riparian zone biodiversity and connectivity	3	0	3	0	2	1	3	1	2	0	3	2	3	3
Reducing sediment load	2	1	2	3	3	3	2	3	2	0	2	2	3	1
Aquatic life and habitat (fish, seagrasses)	1	3	1	2	1	1	1	1	1	0	1	1	1	0
Environmental Sum	**8**	**7**	**8**	**8**	**9**	**8**	**7**	**8**	**6**	**1**	**8**	**7**	**8**	**4**
Environmental Scaling (x 1.2)	**9.6**	**8.4**	**9.6**	**9.6**	**10.8**	**9.6**	**8.4**	**9.6**	**7.2**	**1.2**	**9.6**	**8.4**	**9.6**	**4.8**
Social														
Benefit to:														
Estuary aesthetics	1	1	1	1	1	2	0	2	2	1	2	1	2	1
Recreational amenity	1	1	1	1	1	1	1	1	3	3	0	1	0	3
Community awareness / education	0	0	0	0	0	0	1	0	1	3	0	0	1	0
Resolving user conflicts	0	0	0	0	0	0	0	0	2	3	0	0	1	0
Cultural heritage	0	0	0	0	0	0	1	0	3	0	0	0	0	0
Social Sum	**2**	**2**	**2**	**2**	**2**	**3**	**3**	**3**	**11**	**10**	**2**	**2**	**4**	**4**
Economic														
Benefit to:														
Fishing (recreational and commercial)	1	2	1	1	1	1	0	1	0	1	1	1	0	1
Tourism	1	1	1	1	1	1	2	1	2	2	0	1	0	2
Agriculture and land productivity	1	1	1	1	1	0	1	0	0	0	0	0	0	0
Industrial growth	0	0	0	0	0	2	1	0	0	0	0	0	0	0
Economic Sum	**3**	**4**	**3**	**3**	**3**	**4**	**4**	**2**	**2**	**3**	**1**	**2**	**0**	**3**
TBL Total Score	**14.6**	**14.4**	**14.6**	**14.6**	**15.8**	**16.6**	**15.4**	**14.6**	**20.2**	**14.2**	**12.6**	**12.4**	**13.6**	**11.8**

TBL Assessment

Management Strategy:	ON-GROUND WORKS										
	OGW-1	OGW-2	OGW-3	OGW-4	OGW-5	OGW-6	OGW-7	OGW-8	OGW-9	OGW-10	OGW-11
Environmental											
Benefit to:											
Water quality	1	0	0	0	2	0	0	1	0	0	0
Riparian zone biodiversity and connectivity	2	0	2	1	0	0	1	2	0	1	0
Reducing sediment load	3	0	2	2	1	0	1	2	1	0	0
Aquatic life and habitat (fish, seagrasses)	0	0	0	0	3	0	0	0	0	0	0
Environmental Sum	**6**	**0**	**4**	**3**	**6**	**0**	**2**	**5**	**1**	**1**	**0**
Environmental Scaling (x 1.2)	**7.2**	**0**	**4.8**	**3.6**	**7.2**	**0**	**2.4**	**6**	**1.2**	**1.2**	**0**
Social											
Benefit to:											
Estuary aesthetics	2	2	1	2	1	1		1	0	2	0
Recreational amenity	2	3	3	3	0	3	3	3	3	2	3
Community awareness / education	0	1	1	0	0	1	1	0	0	0	0
Resolving user conflicts	2	2	0	2	0	3	1	0	2	1	1
Cultural heritage	0	2	2	0	0	0	1	0	0	0	3
Social Sum	**6**	**10**	**7**	**7**	**1**	**8**	**6**	**4**	**5**	**5**	**7**
Economic											
Benefit to:											
Fishing (recreational and commercial)	0	2	0	0	2	2	0	0	0	2	0
Tourism	1	3	2	2	2	2	3	1	3	1	3
Agriculture and land productivity	0	0	0	0	0	0	0	0	0	0	0
Industrial growth	0	0	0	0	0	0	0	0	0	0	0
Economic Sum	**1**	**5**	**2**	**2**	**4**	**4**	**3**	**1**	**3**	**3**	**3**
TBL Total Score	**14.2**	**15**	**13.8**	**12.6**	**12.2**	**12**	**11.4**	**11**	**9.2**	**9.2**	**10**

TBL Assessment

Management Strategy:	INVESTIGATION AND RESEARCH								
	IR-1	**IR-2**	**IR-3**	**IR-4**	**IR-5**	**IR-6**	**IR-7**	**IR-8**	**IR-9**
Environmental									
Benefit to:									
Water quality	1	1	2	1	2	2	0	0	1
Riparian zone biodiversity and connectivity	2	3	3	3	0	3	2	0	0
Reducing sediment load	2	2	3	1	3	3	0	0	0
Aquatic life and habitat (fish, seagrasses)	1	1	1	1	2	1	0	0	3
Environmental Sum	**6**	**7**	**9**	**6**	**7**	**9**	**2**	**0**	**4**
Environmental Scaling (x 1.2)	**7.2**	**8.4**	**10.8**	**7.2**	**8.4**	**10.8**	**2.4**	**0**	**4.8**
Social									
Benefit to:									
Estuary aesthetics	0	3	1	1	2	1	0	1	2
Recreational amenity	2	0	0	1	2	1	3	3	0
Community awareness / education	1	0	0	1	0	0	2	1	0
Resolving user conflicts	0	3	1	1	0	1	0	2	0
Cultural heritage	1	0	1	0	0	0	1	0	0
Social Sum	**4**	**6**	**3**	**4**	**4**	**3**	**6**	**7**	**2**
Economic									
Benefit to:									
Fishing (recreational and commercial)	0	0	0	1	0	0	1	1	2
Tourism	2	0	1	2	0	0	3	3	1
Agriculture and land productivity	1	0	0	1	1	1	0	0	0
Industrial growth	1	0	0	0	1	0	0	0	0
Economic Sum	**4**	**0**	**1**	**4**	**2**	**1**	**4**	**4**	**3**
TBL Total Score	**15.2**	**14.4**	**14.8**	**15.2**	**14.4**	**14.8**	**12.4**	**11**	**9.8**

TBL Assessment

Management Strategy:	EDUCATION AND COMMUNITY INVOLVEMENT					MONITORING						
	ECI-1	ECI-2	ECI-3	ECI-4	ECI-5	M-1	M-2	M-3	M-4	M-5	M-6	M-7
Environmental												
Benefit to:												
Water quality	3	2	2	1	1	1	3	2	2	3	2	0
Riparian zone biodiversity and connectivity	3	3	2	3	1	1	0	0	3	0	0	0
Reducing sediment load	2	2	1	3	0	1	0	0	2	0	0	0
Aquatic life and habitat (fish, seagrasses)	1	1	1	1	1	1	3	3	1	3	3	0
Environmental Sum	**9**	**8**	**6**	**8**	**3**	**4**	**6**	**5**	**8**	**6**	**5**	**0**
Environmental Scaling (x 1.2)	**10.8**	**9.6**	**7.2**	**9.6**	**3.6**	**4.8**	**7.2**	**6**	**9.6**	**7.2**	**6**	**0**
Social												
Benefit to:												
Estuary aesthetics	1	2	1	2	1	1	2	1	2	1	0	0
Recreational amenity	0	0	1	0	2	1	2	1	0	1	0	0
Community awareness / education	3	3	0	3	3	1	0	0	1	0	2	0
Resolving user conflicts	0	0	0	0	0	1	0	1	0	0	0	0
Cultural heritage	0	0	1	0	1	1	0	0	0	0	0	0
Social Sum	**4**	**5**	**3**	**5**	**7**	**5**	**4**	**3**	**3**	**2**	**2**	**0**
Economic												
Benefit to:												
Fishing (recreational and commercial)	0	0	1	0	1	1	2	3	0	2	3	3
Tourism	0	0	1	0	1	1	2	3	0	2	1	1
Agriculture and land productivity	0	0	1	3	1	1	0	0	0	0	0	0
Industrial growth	0	0	1	0	1	1	0	0	0	0	0	0
Economic Sum	**0**	**0**	**4**	**3**	**4**	**4**	**4**	**6**	**0**	**4**	**4**	**4**
TBL Total Score	**14.8**	**14.6**	**14.2**	**17.6**	**14.6**	**13.8**	**15.2**	**15**	**12.6**	**13.2**	**12**	**4**

TBL Assessment

Management Strategy:			CULTURAL ACTIVITIES				
	M-8	**M-9**	**C-1**	**C-2**	**C-3**	**C-4**	**C-5**
Environmental							
Benefit to:							
Water quality	0	1	0	1	0	1	0
Riparian zone biodiversity and connectivity	2	1	0	1	1	1	1
Reducing sediment load	3	3	0	0	0	0	2
Aquatic life and habitat (fish, seagrasses)	0	3	0	1	0	0	0
Environmental Sum	**5**	**8**	**0**	**3**	**1**	**2**	**3**
Environmental Scaling (x 1.2)	**6**	**9.6**	**0**	**3.6**	**1.2**	**2.4**	**3.6**
Social							
Benefit to:							
Estuary aesthetics	2	2	2	1	1	2	1
Recreational amenity	0	0	2	1	3	2	1
Community awareness / education	0	0	2	3	2	1	0
Resolving user conflicts	0	0	0	0	1	0	0
Cultural heritage	0	0	3	2	2	3	3
Social Sum	**2**	**2**	**9**	**7**	**9**	**8**	**5**
Economic							
Benefit to:							
Fishing (recreational and commercial)	0	0	0	0	0	1	0
Tourism	0	0	3	2	3	1	2
Agriculture and land productivity	0	0	0	0	0	0	0
Industrial growth	0	0	0	0	0	0	0
Economic Sum	**0**	**0**	**3**	**2**	**3**	**2**	**2**
TBL Total Score	**8**	**11.6**	**12**	**12.6**	**13.2**	**12.4**	**10.6**