

# Batemans Bay & Clyde River Estuary Management Study *FINAL REPORT*

Prepared For: Eurobodalla Shire Council

Prepared By: WBM Oceanics Australia

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	<b>Title:</b>	Batemans Bay and Clyde River Estuary Management Study
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	<b>Synopsis:</b>	<p>This document presents the Estuary Management Study (EMS) for Batemans Bay and the Clyde River. The EMS is a precursor to the Estuary Management Plan (EMP) and presents a social and planning basis for the EMP.</p> <p>The EMS considers current uses and values and provides a "vision statement" for the estuary. The EMS considers the current land tenure arrangements. The EMS provides a review of local, state and national planning policies that dictate the current management of the estuary (and broader catchment).</p> <p>The EMS concludes by providing strategies for addressing issues, and/or conflicts in use identified through community consultative process and from previous scientific study.</p>

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# 1 INTRODUCTION

This document presents the Estuary Management Study (EMS) for the Batemans Bay and Clyde Rivers. The EMS has been prepared by environmental consultants WBM Oceanics Australia and Peter Spurway and Associates, under the direction of the Batemans Bay and Clyde River Estuary Management Committee, Eurobodalla Shire Council and the Department of Infrastructure, Planning and Natural Resources, in accordance with the brief released by Eurobodalla Shire Council in March 2003.

The EMS is a precursor to the Estuary Management Plan (EMP). The EMS contains the majority of the background information, particularly in relation to planning arrangement, community values/uses, land tenure and usage and the regional significance of the estuary. Using this background information the EMS presents a “vision statement” for the estuary and broad strategies to address identified issues and conflicts in use that may prevent the achievement of the “vision statement”.

The EMS forms the basis for the EMP and is a “working document” that provides a program of strategic actions to assist government authorities and other stakeholder groups to sustain a healthy estuary through appropriate waterway, foreshore and catchment management (i.e. achieve the vision for the estuary). The EMP will present an integrated suite of management strategies, giving due consideration to the complex interactions between many estuarine processes and functions. The EMP will provide clear direction regarding responsibilities for actions and an indication of their likely cost and possible funding arrangements.

The EMP will be prepared in a manner that can be incorporated into Council’s and others planning frameworks. The creation of EMS/EMP will fulfil the requirements of the NSW Estuary Management Policy (1992) and the NSW Coastal Policy (1997). The Plan will be designed to be a dynamic document. That is, as the needs or conditions of the estuary change in the future, then the options and strategies being implemented as part of the Plan can be adjusted to suit. It is intended that progress in implementing the Plan would be reviewed annually, while the entire Plan would be reviewed and updated every 3 – 5 years.

It should be noted that a ‘Waterway Users Management Plan’ (WUMP) has been prepared separately, but in parallel, to the EMS by Peter Spurway and Associates to improve the consultative process for the WUMP. The recommendations of the WUMP will be incorporated into the EMP, which will be prepared after the EMS has been completed.

## 1.1 Study Area

The study area comprises the tidal waterway, foreshore and adjacent land of Batemans Bay and Clyde River including the entrance and major tributaries. Consideration has been given to the wider catchment areas insofar as they affect the issues to be addressed by the study. Figure 1-1 to Figure 1-3 present salient locality details of the study area.

The Clyde River is one of the larger rivers in NSW, covering an area of 30km<sup>2</sup> and drains a catchment of approximately 1800 km<sup>2</sup>. The catchment is mainly undeveloped and exists in a predominantly forested state, although some settlement exists along the foreshores of sections of the estuary in the lower catchment. A larger number of freshwater and estuarine SEPP 14 wetlands are

associated with the Clyde River many protecting significant areas of mangroves, seagrass and saltmarsh that fringe the river.

The entrance of the Clyde has a mobile and shifting sand bed, while the southern entrance is relatively stable, dominated by a training wall. Considerable sand movement occurs on the northern side of the entrance with an elevated sandy shoal, often exposed at low tide, appearing in the area south of Surfside.

Batemans Bay is the largest bay between Jervis Bay to the north and Twofold Bay at Eden to the south. The dominant habitats recorded within the Bay include rocky reefs and sandy unvegetated areas, although there are some areas of seagrass. The Bay itself supports an important recreational and commercial fishery, including the most productive oyster leases on the south coast.

The Clyde River is navigable up to the junction of Cockwhy Creek, some 38 km from the entrance. The tidal limit is located upstream of Shallow Crossing, a causeway 4 km upstream of the navigable limit. The Clyde River has several major tributaries in the tidal zone including Nelligen, Waterfall, Currowan, Cyne Mallowes Creeks and the Buckenbowra River.

Development in the catchment is concentrated at the entrance of the bay, with the major coastal town of Batemans Bay being located immediately south of the Clyde River entrance. The southern foreshore is more populated than the northern foreshore supporting considerable water orientated development including the CBD of Batemans Bay, marinas, the main fishing wharves and jetties.

**Figure 1-1 Locality Plan**

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## Figure 1-2 Locality Plan – Batemans Bay and Lower Clyde River Estuary

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**Figure 1-3 Locality Plan – Upper Clyde Estuary**

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## 1.2 Background

The Estuary Management Policy of the NSW Government is set out in the draft Estuary management Manual of October 1992. The policy outlines a structured management process leading to the implementation of a balanced long-term management plan for the ecologically sustainable use of each estuary and its catchment in which all values and uses have been considered.

The process of preparing the Estuary Management Plan commenced for Batemans Bay in 1996 with the formation of the Clyde River/Batemans Bay Estuary Management Committee. The preparation of the Estuary Management Study and Plan represent the final stages in this process.

The Committee has overseen the first two stages of the process, including:

- 1 **Data Compilation Study** - This study provided a desktop review of the scientific, social and economic information available for Batemans Bay and the Clyde River. Information compiled via this process formed a major platform for completion of subsequent stages.
- 2 **Estuary Processes Studies** - This study involved the preparation of a number of process studies designed to fill in identified knowledge/data gaps from the Data Compilation Study. The Estuary Processes Studies also expanded the knowledge base on both physical and ecological processes in the estuary. WBM Oceanics Australia prepared the Estuary Processes Study for Batemans Bay. The Estuary Processes Study was split into two main portions including the:
  - Ecological component, which was completed in 1999; and
  - Water quality and sedimentation component, which was completed in 2000.

## 1.3 Aim of Estuary Management Study

In accordance with the brief the EMS will build on from the previous studies to:

- Identify the place of the estuary in terms of broader planning issues;
- Identify 'essential features' or values of the estuary, be they physical, chemical, biological, aesthetic, social or economic;
- Document 'current uses' and conflicts of use in the estuary;
- Identify possible future land uses and assess threats and their impact on the 'essential features'; and
- Assess the need for nature conservation, remedial measures and other strategies.

The major aim of the project is to prepare a long-term management plan for the sustainable use of the Clyde River and Inner Batemans Bay in which all values and uses are considered and which outlines management strategies to assist in:

- Conservation of wildlife habitats (aquatic and terrestrial), ecosystems and biotic communities, both within and fringing the river and estuary;
- Conservation of the aesthetic values of the estuary and its wetlands;
- Prevention of further estuarine and foreshore degradation;

- Repair of damage to the estuarine and foreshore environments; and
- Provision of a set of guidelines under which sustainable use of resources, including commercial and recreational uses may be evaluated.

## 1.4 Site Inspections

Members of the study team undertook site inspections of Batemans Bay and surrounds over the week of 7th to 11th April 2003. Initially inspections included a drive through the upper reaches of the catchment, including the catchments of major tributaries such as Buckenbowra River, Nelligen and Cyne Mallowes Creeks. The condition of the river was also inspected by boat up as far as Nelligen Bridge in conjunction with members of the local public.

Further inspections were carried out in early May. This included a boat-based trip predominantly along the Clyde River up as far as Currowan Creek. This inspection was performed with NSW Fisheries. Another subsequent inspection was performed with a local community member of oyster farming areas in sections of Mundarlow and Rainfall Creeks and the Buckenbowra River. Further 4WD-based inspections were undertaken of specific sections of the upper catchment that included Bolaro and Buckenbowra State Forests, Mongo National Park and other rural and urban areas around Batemans Bay, which may be impacting on the health of the estuary.

## 2 DATA SOURCES

This section describes some of the information that has been utilised in the preparation of the Estuary Management Plan (and Waterway Users Management Plan).

### 2.1 Data Collation and Review

Additional information has been obtained from the Eurobodalla Shire Council (ESC) and other sources to assist in the preparation of the Estuary Management Study. The most significant additional data sets obtained has included:

- Updated Geographical Information System (GIS) data for the Batemans Bay and Clyde River study area from the (ESC); and
- Recent water quality data from ESC. The ESC had previously adopted a water quality monitoring program developed by WBM as part of the Estuary Processes Study. This additional water quality data has been reviewed.

Other additional information that has been obtained for review as part of this study includes:

- Vulnerability Assessment of Estuaries in Eurobodalla and Bega Valley Shires, draft November 2000;
- Securing Healthy Coastal Rivers, A Strategic Perspective, April 2000;
- Eurobodalla Shire Council Stormwater Campaign Reports, 2001/2002;
- Eurobodalla Waterways Infrastructure Strategy, June 2002;
- Batemans Bay Waterways Infrastructure Strategy, draft March 2002;
- South East Catchment Blue Print, 2003;
- Batemans Bay Marine Pumpout Facility Investigations, January 2001 and REF, 1999;
- Batemans Bay Coastline Hazard Management Plan, draft November 2001;
- Fishery Management Strategy, Estuary General Fishery, February 2003;
- Assessment of Seagrass Habitats in the Clyde, Tomaga and Moruya Rivers, September 2002;
- Assessment of the Effects of Possible Septic Tank Effluent Seepage near Nelligen on Benthic Estuarine Communities, October 2002;
- Cullendulla Creek Nature Reserve, Draft Plan of Management, April 2002;
- Stressed Rivers Assessment Report, NSW State Summary, 1998;
- Eurobodalla Shire Urban Stormwater Quality Management Plan, 2001;
- Discharges and nutrient, suspended solid and carbon loads from catchments with varied land cover on the south coast NSW, Australia, 2003; are
- Oysters - Independent Review of the Relationship between Healthy Oysters and Healthy Rivers, March 2003.

Full references of utilised information are included in Section 10.



### 3 ASSESSMENT OF EXISTING LAND TENURE AND USAGE

This section provides a summary of the tenure and development status of the catchment and river. Items considered includes current land use, areas of urban / rural / industrial development, land clearing patterns, open space dedications and State Forest / National Park areas. The status of foreshore land tenure and associated structures, riparian zone status, vegetation ecosystems and connectivity are also detailed.

#### 3.1 Catchment Land Uses

The following sections provide information on the main land uses and activities within the catchment of Batemans Bay and the Clyde River. The total Clyde River catchment has an area of 1,830 km<sup>2</sup>, with that portion of the catchment within Eurobodalla Shire measuring 880 km<sup>2</sup>. This figure includes the waterway areas of Batemans Bay out to the Tollgate Islands and the Clyde River to its tidal limit, which itself is approximately 45 km<sup>2</sup> or alternatively 4,500 hectares. The remaining 950 km<sup>2</sup> of catchment is located above the tidal limit in the Shoalhaven City Council Local Government Area.

Maps of land tenure and major rural land zonings are shown in Figure 3-1 to Figure 3-3. These maps refer to rural land zonings included in Table 3-1:

**Table 3-1 Land Zonings from Eurobodalla Rural LEP (1987)**

Zone	Description
<b>1(a)</b>	Rural (Environmental Constraints & Agriculture) Zone (includes some National Parks and State Forest lands)
<b>1(a) Further Invest</b>	Rural 1(a) land, under investigation for rezoning to Rural 1c
<b>1(a1)</b>	Rural (Environmental Constraints, Water Catchment Protection & Agricultural) Zone
<b>1(c)</b>	Rural Small Holdings Zone
<b>6(a)</b>	Public Open Space Zone
<b>7(a)</b>	Environment Protection (Wetland) Zone
<b>7(f1)</b>	Environmental Protection (Coastal Lands Protection) Zone
<b>7(f2)</b>	Environmental Protection (Coastal Lands Acquisition) Zone
<b>8</b>	National Parks and Nature Reserves Zone
<b>10</b>	Urban Expansion Zone

##### 3.1.1 Urban Development

There are numerous sites of urban development surrounding Batemans Bay. The coastal towns of Maloneys Beach, Long Beach and Surfside lie on the northern shore of the estuary. On the southern bank is the main commercial area of Batemans Bay. Further south are the almost continuous urban centres of Catalina, Batehaven, and Sunshine Bay, with further development at Denhams Beach and Surf Beach fronting the outer bay. These urban areas are all fully serviced with town water and sewerage facilities.

Urban Expansion 10 Zones under the Rural LEP cater for the area's strong urban growth. These are located at Long Beach and west of Batehaven. Other current growth areas are zoned residential under

the Eurobodalla Urban LEP, located at Long Beach and Sunshine Bay. A large area of land on the Kings Highway just west of the Princes Highway is under consideration for rezoning to Urban Expansion 10.

The township of Nelligen is located on the Clyde River on the Kings Highway approximately 6 km inland of the Princes Highway. Nelligen does not have town water and sewerage facilities.

### 3.1.2 Industrial Land

Batemans Bay contains two small areas of land zoned industrial.

The Cranbrook Road / Sharon Road / Kylie Crescent industrial area west comprises mainly bulky goods retail outlets and some light manufacturing activities. This area has a sensitive catchment comprising SEPP 14 wetland no. 212. Significant local risk to McLeods Creek from soil disturbance at the time of landclearing / land development occurred in the 1980's. Local stormwater management has since been a Council priority, with water quality controls installed on stormwater outlets.

The Hughes Street / Gregory Street / Russell Street area also east of the Princes Highway contains mainly bulky goods retailing. It lies in the catchment of the 'Batemans Bay Water Gardens' which contains a (non-SEPP 14) wetland comprising healthy she-oak forest. Once again a water quality control device has been installed by council at the outlet of the industrial catchment, to afford this wetland some protection from pollutants.

### 3.1.3 Rural Small Holdings

Since the late 1980's there has been a trend towards development for the purposes of rural small holdings or hobby farms in Eurobodalla Shire. Rural small holding development is permissible in the Rural 1c zone, with lot sizes typically of 2 hectares. Actual lot sizes depend on site constraints, servicing levels and relevant Development Control Plans.

Rural smallholding zones in the Clyde catchment fall in three areas as shown in Figure 3-3:

- along Nelligen Creek and on the outskirts of Nelligen village (545 hectares); and
- immediately north of Long Beach and Surfside (1038 hectares); and
- an elongated zone west of George Bass Drive from Batehaven to Surf Beach (1210 hectares).

At Nelligen, 17% of the 1c zone has been subdivided, with non-subdivided land having an estimated potential yield of 70 to 90 lots. For the Long Beach 1c zone, almost 400 lots have been subdivided, with the remainder of the zone having potential for about 190 further lots. The 1c zone from Batehaven to Surf Beach has a potential for a total 600 to 700 lots, with 330 lots having been subdivided to year 2000.

These rural smallholding zones cover about 3% of the area of the Clyde's catchment within Eurobodalla Shire.

### 3.1.4 Other Rural Uses

Removal of native vegetation for timber began in the Batemans Bay / Clyde River catchment in the early 1800's. Notably, clearing for agricultural purposes has concentrated on river flats along most of the Clyde's tributaries, and on the estuary itself in its upper reaches, where floodplain deposits provide opportunity for flatter landscapes.

The need for clearing for pasture is now considered to be generally in decline. A number of holdings are actively farmed for grazing in the Clyde River catchment. Other rural zoned land uses include Caravan Parks (both formal in the lower estuary and informal in the upper reaches of the Clyde estuary) and oyster processing at Budd Island and Lattas Point.

### 3.1.5 Recreational Open Space

The main recreational zone is the estuary itself. It is used for numerous activities including boating, swimming and fishing. Land-based open space including Council and Crown reserves as shown on Figure 3-1 and Figure 3-2 are located along the foreshores of Batemans Bay and the beach areas along the adjacent coastal zone. Further up the Clyde River there are scattered areas of public lands. Notably, the majority of river frontage land along the 'bends' and upstream to Shallow Crossing is in private ownership.

### 3.1.6 State Forests

The 81,628 hectares of State Forests (as shown in Table 3-2) within the Clyde River catchment represents about 44% of the catchment area. These areas naturally complement the conservation objectives on the surrounding National Parks. They are managed for a range of uses, principally timber production and are subject to harvesting for sawlogs and other timbers such as poles, fencing, firewood and pulpwood. It is estimated by State Forests that the forests within the Clyde River catchment annually contribute approximately 20,000 cubic metres of high value sawlogs. The forestry management approach is to provide this supply in perpetuity.

State Forests are zoned using a similar system to local government planning principles. The Forest Management Zones within the catchment and their relative proportions are:

- **Zone 1 Special Protection** - a harvesting exclusion area where management maximises protection of very high natural and cultural conservation values - 2%;
- **Zone 2 Special Management** - a harvesting exclusion area with specific management and protection of natural and cultural conservation values - 7%;
- **Zone 3A Harvesting Exclusions** - a harvesting exclusion area but other management and production activities are permitted - 5%;
- **Zone 3B Special Prescriptions** - a harvesting area with special prescriptions upon harvesting to conserve the value(s) identified upon it - 1%;
- **Zone 4 General Management** - management of native forests for timber production - 84%; and
- **Zone 7 Non Forestry Use** - management of cleared areas, usually for public infrastructure - 1%.

Further regulatory and prescriptive conditions apply which usually limit harvesting to approximately 62% of Zones 3B and 4. This means the potential harvesting area of forests in the Clyde catchment is about 50% of the State Forest area. On average, about 2% of State Forest is harvested annually for timber.

**Table 3-2 Summary of State Forest areas within the Clyde River Catchment**

State Forest Name	Area (hectares)
Bateman	1
Benandarah	2,770
Bolaro	1,786
Boyne	6,179
Buckenbowra	5,197
Clyde	3,604
Currowan	12,026
Flat Rock	4,888
Kioloa	175
Mogo	15,528
North Brooman	3,643
Shallow Crossing	3,877
South Brooman	5,941
Wandera	5,245
Yadboro	10,768
<b>Total</b>	<b>81,628</b>

### 3.1.7 National Park

Figure 3-1 and Figure 3-2 depict areas of National Park in the study area. Individual areas of National Park estate in the catchment are depicted below.

**Table 3-3 Summary of National Park area within the Clyde River Catchment**

National Park Name	Area (hectares)	Comments
Bimberamala	4,420	Pristine Bimberamala River catchment
Budawang	21,712	Mostly declared wilderness area
Clyde River	1,269	9 kilometres of estuary frontage
Deua	12	
Meroo	7	
Monga	16,670	Much is declared wilderness
Morton	36,041	Northern part of Clyde catchment
Murramarang	5,008	
<b>Total</b>	<b>85,139</b>	

The Clyde River National Park is situated on the northern bank of the Clyde River, extending from private land along the Kings Highway almost to Nelligen. It includes Big Island and Little Island.

About half of the Currowan Creek catchment falls within either Monga National Park, or Budawang National Park. In the Buckenbowra River catchment, Monga National Park lies along the western catchment boundary.

On a much smaller scale, the Cullendulla Creek Nature Reserve (126 hectares) is situated on wetlands at the western side of Cullendulla Creek and on the eastern side of the creek entrance at Square Head. Signs offering an insight into the area's significance have been installed along a raised mangrove walk.

The overall proportion of National Park in the Clyde River catchment is about 47%.

## 3.2 Land Clearing Status

Land use changes in the catchments of estuaries are a key pressure affecting aspects of their physical and biological environments.

The extent of landclearing in the Clyde catchment is represented in Table 3-4. This 1997 data shows the Clyde River catchment to be largely undisturbed, with forest comprising over 95% of the total catchment area. This reflects the extensive areas of state forest and national park within the catchment. Cleared rural lands comprise almost 4% of the total catchment area.

The mapping data from this assessment is reproduced as Figure 3-4 and Figure 3-5.

Ongoing changes in landuse are likely to be insignificant in terms of their proportional area, given the large areas of forested catchment involved. What is more critical is the location and nature of landclearing in relation to the estuary and its feeder creeks.

**Table 3-4 Proportion of each landuse in the Clyde Catchment**

Catchment Area	Year	% Forest Vegetation	% Rural Cleared	% Urban	% Waterbody
1740.73 km <sup>2</sup>	1997	95.21	3.78	0.10	0.91

Source: DLWC (unpub. data)

**Figure 3-1 Land Tenure Upper Estuary**

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### Figure 3-2 Land Tenure Lower Estuary

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### Figure 3-3 Major Rural Land Zonings

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**Figure 3-4 Areas of land cleared in Upper Catchment**

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**Figure 3-5 Areas of land cleared in Lower Catchment**

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### 3.3 Foreshore Land Tenure

#### 3.3.1 Categories of Riverfront Land

The tenure of waterfront land in the study area is depicted on Figure 3-1 (upper estuary) and Figure 3-2 (lower estuary). The trends from this figure show that:

- The Batemans Bay foreshore is dominantly public land, either Crown Reserve, National Park estate or Council Reserve.
- The freehold (“submerged”) land at north Batemans Bay is the sole area of private waterfront land / beach on the bay.
- Waterfront land fronting the Clyde River in the mid-estuary is a mix of State Forest, Crown Land (some of which is leased for shore-based oyster operations) and freehold.
- At Nelligen the properties on the eastern bank (Sproxtons Lane) front the river, most with foreshore facilities such as ramps or jetties. On the western bank in Nelligen, properties front Wharf Street and public access to the waterfront is available.
- Land fronting the Clyde estuary upstream of Nelligen is mainly freehold with some areas of State Forest.

On the Clyde’s major tributaries, river frontage land is dominantly freehold, with some minor exceptions.

- Waterfall Creek is surrounded by State Forest.
- On the Buckenbowra River, apart from two reaches that touch on State Forest and one small patch of Crown Reserve, the river cuts wholly through freehold land.
- Nelligen Creek runs through freehold land with two small exceptions where it touches on State Forest.
- Cyne Mallowes Creek, on its southern bank, fronts Crown Land and State Forest, with patches of freehold land and Council Reserve further upstream. The northern bank comprises mostly Crown Road Reserve, some of which is leased.

#### 3.3.2 Crown Land Leases

The Department of Lands manages the leasing of Crown Land. It has supplied details of current leases on land in the study area, in order to check for apparent inconsistencies with government policy. For this study, there is a particular focus on land fronting the estuary or its tributaries.

The following table details Licences (LI) or Permissive Occupancies (PO) that appear to allow for landuse that may be inconsistent with best practice estuary management principles. The reasons for the apparent inconsistency are stated. It should be emphasised that this table does not suggest that licence-holders are acting illegally; rather it depicts areas of Crown Land where it should be ensured that the current lease agreement is not compromising the health of the estuary.

**Table 3-5 Licenses and Permissive Occupancies Inconsistent with 'Best Practice'**

Topographic Map	Ref. No.	Status	Purpose	Inconsistency
Currowan	28	PO 1969/16	Grazing	Grazing in riparian zone Currowan Ck (part)
Nelligen	33	PO 1986/7	Grazing	Grazing in riparian zone Cyne Mallowses Ck
Nelligen	66	PO 1983/1	Vegetable Garden	Loss of riparian buffer to Clyde River (part)
Currowan	26	LI 193085	Grazing	Grazing in riparian zone Currowan Ck
Nelligen	38	LI 194550	Grazing	Grazing in riparian zone Clyde River
Nelligen	78	LI 199570	Grazing	Grazing in riparian zone Nelligen Creek (part)
Nelligen	93	LI 311074	Grazing	Grazing in riparian zone Clyde River (part) & along SEPP 14 wetland 223 (part)

If local estuary management issues were detected, a program of riparian zone fencing would be appropriate. This is particularly the case where, as noted in the table, some areas have only a small part of the Crown Land fronting the estuary.

We note inconsistencies between Council's database of Crown leases and data supplied by the Department of Lands. In particular, the leased land noted above along Cyne Mallowses Creek (Ref No 33) is listed by the Department as Crown Reserve. If parts of this 30 metre-wide strip were indeed leased for grazing, similar comments to the above would apply.

## 3.4 Riparian Vegetation

### 3.4.1 Changes in Extent

Riparian vegetation is the vegetation on the edge of the estuary and its tributary creeks. Riparian vegetation is a key component in the maintenance of aquatic ecosystems as it provides shelter, food sources, shade and habitat for a range of aquatic and riparian fauna. It assists with bank stability and provides a buffer against human activities in the catchment. Riparian vegetation also plays a role in the aesthetics of an area, particularly for views from the water.

The then Department of Land and Water Conservation (DLWC) has mapped the extent of riparian vegetation for all south coast estuaries. For the Clyde, the mapping utilised 1997 aerial photography.

This mapping provides a good estimate of the proportions of each estuary foreshore (within 30m and 100m of banks) covered by 'dense' or 'sparse' riparian vegetation. These two widths were selected in recognition that different fauna groups have varying riparian vegetation width requirements. For example, the 100 m riparian vegetation zone width is a better indicator of the value of riparian vegetation as a wildlife corridor, especially for birdlife, than the 30 m width. By contrast, the 30 m riparian width represents the riparian vegetation that is likely to influence in-stream communities.

Table 3-6 shows the proportion of 30 m and 100 m riparian zones for the estuary.

**Table 3-6 Riparian Zone Condition Assessment 1997**

Vegetation Cover	Riparian Zone Width	
	30 metres	100 metres
<b>Dense</b>	73%	68%
<b>Sparse</b>	25%	30%
<b>Absent</b>	2%	2%

Source: DLWC unpub. 1998

The high proportion of dense riparian vegetation along the estuary is notable. Also of note is the very slight difference between the 30 metre and 100 metre zones. That is, where riparian vegetation exists, it is of significant width. Clearly riparian vegetation is a significant asset along much of the estuary.

## 3.5 Vegetation Ecosystems

### 3.5.1 Vulnerable Ecosystems

Regional vegetation maps of south-eastern New South Wales were prepared as part of the Comprehensive Regional Assessments (CRAs) of forests in New South Wales between 1997 and 2000. Eurobodalla Shire was mapped under the Southern CRA regional process.

An extension of this process designated 'vulnerable' ecosystems for private lands in the Eurobodalla Shire (EcoGIS 2001). Vulnerable ecosystems result from human and natural processes. They may have been subject to over-clearing or they may be regionally rare, or locally common but restricted geographically. A list of 13 vulnerable ecosystems (based on adequacy of reservation) and the urgency / type of management response required (based on ecosystem functionality and level of pressure) are identified by EcoGIS.

The highly vulnerable ecosystems in the Eurobodalla Shire are those principally associated with coastal wetlands, including the wetlands themselves and the fringing Swamp Oak and Bangalay forests. The vulnerable forest ecosystems are associated mostly with the coastal lowlands, floodplains and rivers, often in the most sought after rural lands of the Shire for farming and rural lifestyle settlement. Of the vulnerable forest types, Forest Redgum (54) is most notable with vast stands along the Buckenbowra River, and small remnant patches around Cockwhy Creek and Cullendulla Creek. A small copse is noted on Budd Island adjacent to oyster leases. Council has applied to list this ecosystem as a Threatened Community under the Threatened Species Act, 1997.

All vulnerable ecosystems in private lands of the Eurobodalla and their major issues - listed as 'landscape protection objectives' - are summarised in Table 3-7. Legislative controls relate to freehold lands only.

**Table 3-7 All Vulnerable Ecosystems in Eurobodalla Shire**

Legend Number	Ecosystem Description	Landscape Protection Objectives	Possible Legislative Controls
27	Ecotonal Coastal Swamp Oak-Bangalay Swamp Forest	Limit further fragmentation of existing habitat. Maintain and expand linkages to surrounding vegetation. Control Weeds	Council Zoning Controls. Vegetation Management Plan with NPWS, DLWC
54	Coastal Forest Red Gum Shrub / Grass Forest	Limit further fragmentation and isolation of patches Restoration of key vegetation corridors and remnant patches with a native grassy understorey	Secure patches under threat. May be listed as a threatened community under the 1997 Threatened Species Act
189	Coastal Alluvial Valley Floor Wetlands	Limit nutrient and sediment inflows	Mostly Already protected under SEPP 14. Protect remaining wetlands under separate Council policy
24	Coastal Swamp Oak- Swamp Melaleuca Wet Heath Swamp Forest	Maintain low pollution and stormwater inflows	Significant wetlands - International Wetland Treaty
25	South Coast Swamp Oak Forest Complex	Control Weeds	Council Zoning Controls
51	Araluen Yellow Box-Maidens Blue Gum Acacia Herb-Grass Dry Forest	Control Weeds, limit further fragmentation of habitat	Joint Vegetation Management Plan with Tallaganda Shire Council
53	Riparian River Oak Acacia Shrub-Grass-Herb Forest	Maintain corridor connectivity and linkage to surrounding vegetation matrix Control riparian weeds	Council Zoning Controls Link to Catchment Management Board plan - riparian vegetation
28	Coastal Bangalay-Blady Grass Shrub-Grass Dry Forest	Limit expansion or coastal urban settlements. Maintain connectivity to surrounding vegetation	Council Zoning Controls
4849	Coastal Lowlands Riparian Herb-Twiners-Grass Forest - various eucalypts	Maintain corridor connectivity and linkage to surrounding vegetation matrix Control riparian weeds	Council Zoning Controls Link to Catchment Management Board plan - riparian vegetation
185	Mangrove Estuarine Low Forest	Maintain low pollution and stormwater inflows	Land Use - joint planning and management with Catchment Management Board and NSW Fisheries
197	Coastal Littoral Rainforest	Control Weeds, Maintain connection to Native Vegetation matrix	Already protected under SEPP 26
203	Dignams Creek Blue Box-Sydney Blue Gum Moist Shrub Forest	Control Weeds, Maintain connection to Native Vegetation matrix	Land Use - joint planning and management with Catchment Management Board
167	Coastal Lowland Sub Tropical/Littoral Rainforest	Control Weeds, Maintain connection to Native Vegetation matrix	Council Zoning Controls

It is noted that occurrences of Ecosystems 24, 25, 27, 53, 54, 185 189 and 197 are already protected on National parks and State forests.

Around the estuary's foreshores there are a number of intact patches of vulnerable vegetation, particularly in the middle section of the Clyde River. Their locations are depicted in Figure 3-6 and Figure 3-7 and comprise:

- **FOREST ECOSYSTEM 24: Coastal Wet Heath Swamp Forest - *Casuarina glauca* / *Melaleuca ericifolia*.** This coastal forest type is restricted to acid sulphate soils above semi saline flats, along the edges and low-lying tributaries of coastal lagoons. It features in wetland fringes at Maloneys Beach, Long Beach, Cullendulla, and Surfside / North Batemans Bay.

- **FOREST ECOSYSTEM 25: South Coast Swamp Forest complex- *Casuarina glauca*.** South Coast Swamp Forest complex occurs in less wet situations to vegetation type 24, in the upper reaches of major river estuaries and tributaries. It is found on wetland fringes at Maloneys Beach, Cullendulla and near Wray Street, North Batemans Bay.
- **FOREST ECOSYSTEM 27: Ecotonal Coastal Swamp Forest - *Casuarina glauca* / *E. botryoides*.** Ecotonal Coastal Swamp Forest is a medium forest up to 20 metres tall, dominated by *Casuarina glauca*, with *E. botryoides*. The tall shrub layer is a variable mixture of *Banksia integrifolia* and *Acacia longifolia*. It is found at Surfside and also along Waterfall Creek.
- **FOREST ECOSYSTEM 48/49: Coastal Lowlands Riparian Herb/Grass Forest / Southern Hinterland Shrub/Herb/Grass Riparian Forest.** Forest ecosystems 48 and 49 are mapped jointly as they are similar in species, differing mainly in location. Coastal Lowlands Riparian Herb/Grass Forest is found on alluvium in sheltered riparian valleys. Southern Hinterland Shrub/Herb/Grass Riparian Forest occurs at low lying elevations in open sheltered slopes and gullies, on either granites or Ordovician sediments. They are forests to 30 metres dominated by *Eucalyptus elata* (River Peppermint), *Angophora floribunda* (Rough-barked Angophora) and *Acacia mearnsii* (Black Wattle). Their ecosystem type is unusual in the study area, being found mainly in the Tuross River catchment. They occur in the non-tidal reaches of Nelligen Creek and Waterfall Creek, with small patches remaining in the Buckenbowra Valley.
- **FOREST ECOSYSTEM 53: Riparian Acacia Shrub/Grass/Herb Forest – *Casuarina cunninghamiana*.** Riparian Acacia Shrub/Grass/Herb Forest is a tall riparian forest up to 30 metres tall, dominated by *Casuarina cunninghamiana*. It occurs in a linear strip along the upper reaches of the Buckenbowra River.
- **FOREST ECOSYSTEM 54: Coastal Shrub/Grass Forest - *E. tereticornis*.** Open to medium tall forest, dominated by *Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus globoides* (White Stringy Bark) and *Angophora floribunda* (Rough-barked Apple). This ecosystem has suffered a huge depletion of its former extent. Three very significant patches of total area 212 hectares within the Buckenbowra River catchment represents about 30% of remaining ecosystem 54 in the shire.
- **FOREST ECOSYSTEM 185: Mangrove Estuarine Low Forest.** Low estuarine forest dominated by *Aegiceras corniculatus* (River Mangrove) and *Avicennia marina* (Grey Mangrove). Mangrove Estuarine Low Forest is located along the Clyde River in many locations but is mapped only where it exceeds a 2-hectare patch. Significant locations are at McLeods Creek and Pelican Inlet, at the Buckenbowra River confluence with the Clyde, and along both Sheep Station and Cyne Mallows Creeks.
- **NON-FOREST ECOSYSTEM 189: Coastal Alluvial Valley Floor Wetlands.** Coastal alluvial valley floor wetlands are lagoons and closed parts of former estuaries adjoining coastal lakes and estuaries. Small areas occur on the Buckenbowra River.
- **FOREST ECOSYSTEM 197: Coastal Littoral Rainforest.** Littoral rainforest is particularly rare in NSW and is protected under SEPP 26. A small patch of this ecosystem occurs at Square Head.

### 3.5.2 SEPP 14 Wetlands

The Clyde River's lower catchment area contains wetlands of State and National significance. The location of all 54 wetlands around the estuary designated under State Environmental Planning Policy No. 14 (SEPP 14) is depicted on Figure 3-8. Note that comparison of Figure 3-8 with Figure 3-7 shows the vulnerable ecosystem mapping for the Eurobodalla picks up most estuarine wetlands fringing areas. These wetlands possess high biodiversity values and are afforded a high level of statutory protection under SEPP 14.

The Estuary Management Plan needs to be consistent with the objectives of SEPP 14 and apply best management practices to recognise the values and the inherent vulnerability of all wetlands in the study area.

## 3.6 Vegetation Connectivity

Connectivity of forest types refers to linkages within and between habitats, particularly on rural lands. It is important that locally important habitat linkages (corridors) are protected from inappropriate land use so that regional biodiversity is not compromised. Natural barriers to dispersal of (non-flying) forest dependant animals near the coast include major rivers such as the Clyde, and on a smaller scale lagoons and wetlands. Hence, the habitat corridor for forest dependant fauna is often narrow due to natural landform features. These features, combined with fragmentation caused by roads, electricity easements and clearing, have impacted on the ability of animals to disperse.

The identification of regional habitat linkages is a wide-scale issue than has been addressed by Council and NPWS (NPWS, 2001). This study found that the Eurobodalla Shire contains large, continuous areas of forested habitat, as depicted on Figure 3-4 and Figure 3-5. Furthermore, patterns of landscape habitat connectivity are strongly evident as the area supports a relatively high percentage of native vegetation cover.

Connective habitats of bioregional significance in or adjoining the Clyde River study area are reported between the Clyde River extending west to the Durras Lake catchment (Murrumbidgee National Park and Boyne / Benandarah State Forest).

In relation to areas under current rural 1c development pressures, primary habitat corridors are noted in NPWS, 2001 along both sides of Nelligen Creek for some 5km upstream of its confluence with the Clyde River, and extending from Square Head to north of Long Beach. Council is currently preparing maps of likely fauna habitat corridors; consequently this information can not be presented at this stage.

Riparian vegetation along the Clyde River foreshore has excellent continuity to adjacent forest vegetation. There are no areas of riparian vegetation that are isolated from broader forests. This is a positive aspect for linkage of habitats and biodiversity management.



**Figure 3-6 Vulnerable Ecosystem in Upper Estuary**

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**Figure 3-7 Vulnerable Ecosystems in Lower Estuary**

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**Figure 3-8 SEPP 14 Wetland Areas**

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### 3.7 Foreshore Structures

Crown Land licences, issued by the Department of Lands, are used as an indicator on the extent of reclamation and foreshore development in the study area. This is a robust indicator of current foreshore pressures. The numbers of licensed waterway structures and reclamations as at 1999 is shown in Table 3-8.

**Table 3-8 Licensed waterway structures and reclamations in 1999**

Estuary	Jetty	Wharf	Ramp	Boatshed	Reclamation	Other	Total	% change since 1995
Clyde	36	3	12	12	18	48	129	+26

Source: DLWC (Crown Land Information Database) within 1999 State of the Rivers and Estuaries Report - Far South Coast DLWC Unpub. Note that 'Other' licences consist of wet areas, pontoons, oyster depuration sites, landings / platforms.

DLWC reported that the Clyde River had the second largest number of licensed structures of all south coast estuaries (Clyde River to the Victorian border), comprising mostly 'others' (37%), jetties (28%) and boat ramps and boatsheds both 9%.

The Department of Lands has supplied the current (2003) status of Crown Leases and Permissive Occupancies for this study. Collation of this data into the same format as the above table shows some discrepancies, however the following issues are relevant:

- Oyster depuration sites and work areas account for 29 Special Leases, focussed on the Budd Island / Lattas Point area.
- Sproxtons Lane at Nelligen is the only locality where privately held urban-sized allotments have titles to MHWL fronting the river. In relation to this area, which concentrates foreshore structures such as jetties, pontoons and slipways in a highly-visible location, it is noted that:
  - A total of ten licenses for private foreshore structures are located at Sproxtons Lane. These comprise jetties (10), slipways (5), ramps (3), and pontoons (2).
  - An additional three leases in this area (comprising two jetties and two slipways) have been terminated
  - Unauthorised structures appear to exist.
  - The authorised structures at Sproxtons Lane fall within Department of Lands guidelines (i.e. structure length less than 15 metres, do not impede public foreshore access, no impact on seagrasses), and their presence is considered a compatible use of this part of the river.
  - Incursion into mangroves by a few of these structures has occurred but impacts are negligible when considered on an estuary scale. Retention of these structures can be accommodated without having a significant bearing on estuarine ecology or health.
  - Ongoing protection from bank erosion in a few localities at Sproxtons Lane appears to be unauthorised and degrades the visual amenity of the locality.

In general the existing level of foreshore structures is having a minimal effect on the estuary and its values. The biggest issue appears to be the visual impact of unauthorised bank protection works on the eastern bank between Sheep Station Creek and Nelligen.

## 4 ASSESSMENT OF EXISTING USAGE IMPACTS

The impacts of existing uses of the estuary have been determined from interpretation of existing scientific investigations and monitoring studies of the estuary. The impacts of potential future uses are discussed in Section 5.0.

### 4.1 Relevant Investigations

In order to gain an initial appreciation of the actual water quality/environmental impacts of existing and future land uses within the area, we have reviewed the:

- Clyde River Catchment Stressed Rivers Assessment (DLWC, 1999a);
- Vulnerability Assessment of Estuaries in Eurobodalla and Bega Valley Shires (DLWC, 2000);
- Recent water quality data collected by the Eurobodalla Shire Council;
- Sewer overflow data; and
- Recent estuarine health assessment reports.

These information sources are discussed below.

#### 4.1.1 Clyde River Catchment Stressed Rivers Assessment

As part of the NSW Water Reform package declared in 1997, all major river systems in NSW underwent an assessment to determine what degree of anthropogenic stress is being imposed on them. In addition to conservation value, two types of stress were assessed: hydrological stress, which related to the proportion of water being extracted from the system; and environmental stress. Environmental stress was determined from a desktop assessment of the various environmental parameters (including riparian vegetation, tidal restrictions, artificial entrance openings, landuse, fish passage, acid sulfate soils, algal blooms, water quality, geomorphology and major dams) and an expert review panel assessment.

For the Clyde River, the catchment was divided into a number of sub-catchments and assigned a management classification as detailed in Table 4-1.

**Table 4-1 Management classifications for Rivers**

<b>Hydrologic Stress</b>	<b>Low Environmental Stress</b>	<b>Medium Environmental Stress</b>	<b>High Environmental Stress</b>
<b>High proportion of water extracted</b>	<b>Category U1</b> Immediate indications are that water extraction is causing a problem. However, more detailed evaluation should be undertaken to confirm. It is also likely that conflict between users may be occurring during critical periods	<b>Category S3</b> Water extraction is likely to be contributing to environmental stress	<b>Category S1</b> Water extraction is likely to be contributing to environmental stress
<b>Medium proportion of water extracted</b>	<b>Category U2</b> There is no indication of a problem and therefore such rivers would be a low priority for management action	<b>Category S4</b> Water extraction may be contributing to environmental stress	<b>Category S2</b> Water extraction may be contributing to environmental stress
<b>Low proportion of water extracted</b>	<b>Category U4</b> There is no indication of a problem and therefore such rivers would be a low priority for management action	<b>Category U3</b> Environmental stress is likely to be due to factors other than water extraction, and as stress is not high, these rivers would be a lower priority for management action	<b>Category S5</b> While environmental stress is likely to be due to factors other than water extraction, the high level of environmental stress means it is important to ensure extraction is not exacerbating the problem

In this table is should be noted that:

- **Dark Shading** indicates categories with high combined stress rating;
- **Lighter shading** indicates categories with medium combined stress rating; and
- **Absence of shading** indicates categories with low combined stress rating.

For current conditions, the Clyde River catchment stress classifications were defined as shown in Table 4-2.

The high conservation rating provided indicates that the sub-catchment has special conservation values, which is likely to relate to the presence of high value species or wetlands, high biodiversity or the pristine or near pristine condition of the rivers. It is noted that some catchments were not resolved due to lack of data, but will be classified as soon as the data becomes available.

The subcatchments assessed have low proportions of water extracted and low proportions of environmental stress indicating that on a state wide basis these rivers have a low overall priority for the development of River Management Plans to address these issues.

**Table 4-2 Classifications for Clyde River**

Subcatchment	Present Management Classification	Environmental Stress	High Conservation Value
Upper Clyde River	U4	Low	Yes
Holland Creek	Unresolved	Low	No
Pigeon House Creek	U2	Low	No
Boyne Creek	Unresolved	Low	No
Yadboro River	Unresolved	Low	No
Bimberamala River	Unresolved	Low	No
Mid Clyde River	U4	Low	Yes
Cyne Mallows Creek	Unresolved	Low	No
Currowan Creek	Unresolved	Low	No
Cockwhy Creek	U4	Low	No
Buckenbowra River	U4	Low	Yes
Nelligen Creek	Unresolved	Medium	Yes
Batemans Bay/Clyde	Unresolved	Medium	Yes

Some maps from this study showing the assessed levels of environmental stress, conservation value and management classification have been included in Appendix D.

From discussions with the Bega Office of Department of Infrastructure, Planning and Natural Resources (McPhee, D., pers. comm., 2004), embargoes on new licences for freshwater extraction from the Clyde were put in place July 2003. The embargo was put in place to protect the high conservation values of the Clyde River.

#### 4.1.2 Vulnerability Assessment of Estuaries in Eurobodalla and Bega Valley Shires

The then Department of Land and Water Conservation has prepared a vulnerability assessment of estuaries in the Eurobodalla and Bega Valley Shires as an adjunct to the Department's Stressed Rivers Assessment (discussed above).

In this study, the DLWC determined the vulnerability of the subject estuaries to particular stressors (namely man-based factors). The vulnerability (or sometimes referred to by others as sustainability) is the capacity of an estuary to sustain catchment land use change without adverse effect. The following approach was adopted for this vulnerability assessment:

- Review the basic functioning of estuarine ecosystems and their biological productivity;
- Quantify, and where required, calibrate the principal geomorphic and hydrologic factors controlling productivity;
- Rank the vulnerability of the estuaries to excessive productivity caused by catchment development using a matrix of these geomorphic and hydrologic factors; and
- Correlate observations of individual estuary responses to catchment development with the vulnerability ranking.

Vulnerability was initially determined assuming fully forested catchments to determine if there are natural factors that make some receiving waters more productive and therefore more susceptible than others to the impacts of development through cultural eutrophication. Current catchment land uses were then modelled to determine the degree of change in the controlling factors and to correlate predictions with field observations of estuary condition as indicated by the presence of macroalgal blooms.

The factors chosen to assess vulnerability were estuary depth, freshwater dilution capacity, tidal flushing period, trapping efficiency and catchment loads (per unit area).

The assessment indicated that the Clyde River showed moderately low rankings (on a scale of very high, high, moderately high, medium, moderately low and low) for vulnerability under a fully forested catchment condition and also with the current levels of land use.

From the overall assessment, DLWC determined that the most naturally robust systems appear to be deep, relatively youthful barrier estuaries that are permanently tidal, have a small catchment area (and hence low runoff quantity relative to estuary volume) and experience only a low nutrient loading. Conversely, shallow intermittently open lakes, lagoons and creeks with larger catchment runoff to estuary volume ratios and higher nutrient loading quickly reflect the poorer quality catchment runoff and, if entrance breakout does not occur, trap all the catchment runoff and associated material with subsequent increases in biological productivity.

#### **4.1.3 Review of Eurobodalla Shire Council Water Quality Data**

In relation to the estuary, a useful indicator of the impacts of existing usage is to review available water quality data and compare these data against generally accepted guidelines. This method can be used to identify any uses which may be causing significant impacts. Available sources of water quality data includes that published in previous investigations and that obtained from the Eurobodalla Shire Council (ESC).

The Batemans Bay and Clyde River Estuary Processes Study (EPS) included a chapter on hydrodynamics and water quality. The water quality data reviewed/used as part of this study included both physical and chemical parameters. This study found that all physical water quality parameter recorded were within acceptable limits as contained in the ANZECC (1992) guidelines. The physical water quality data was collected by the Manly Hydraulics Laboratory between 1996 and 1998 and the spatial extent of the data set extended from near the mouth of the Clyde River to near the tidal limit. The chemical water quality data was obtained by the ESC at six sites in the lower estuary between 1993 and 1998. The nutrient data collected by the ESC was noted to be of questionable accuracy, which only left faecal coliform counts, pH and salinity records available for use. These parameters were noted to comply with the ANZECC guidelines for the protection of human consumers of fish and other aquatic organisms (e.g. oysters).

The EPS included a recommendation that ESC implement a revised water quality-monitoring program that included physical, chemical and biological parameters at several regions within the tidal reaches of estuary. ESC has subsequently implemented this recommendation. ESC has collaborated with other southeast shires in developing a water quality-monitoring program for the south-east region and has compiled a database of water quality information.



Within the Batemans Bay and Clyde River estuary, the program is regularly monitoring approximately 20 sites for a wide range of water quality parameters (physical, chemical and biological). These sites exist in the major tributaries, e.g. Buckenbowra River and along the length of the Clyde River as far as Shallow Crossing. Shoalhaven City Council monitors the freshwater portions of the Clyde River. The program is also responsible for monitoring water quality within a number of small coastal lakes and creeks (ICOLLS) around Batemans Bay.

Available water quality data from this monitoring program has been obtained and used for the purposes of the Estuary Management Plan. A review of this data was undertaken to determine the current status of water quality in the estuary in comparison to published guideline information (Section 4.1.4 provides information on the correlation of water quality data to rainfall within the catchment). Table 4-3 includes water quality data for the Clyde River. Figure 4-1 shows the locations of ESC's monitoring locations correlating to those shown in Table 4-3.

This data has been collected on an approximate monthly cycle from July 2000 to October 2001 (providing approximately 12 records) in the Clyde River and from February 2002 to February 2003 in the Buckenbowra River (again providing approximately 12 records). The table includes a description of the water quality parameter/indicator being considered, eg pH or total nitrogen, along with a 20<sup>th</sup>, 80<sup>th</sup> percentile or 50<sup>th</sup> percentile value (i.e. mean) for that parameter. Also included is the number of samples used to calculate the statistical value (as represented by "No. of samples"), and the number of samples for which no data was available (as represented by "No. of blank results").

It should be noted that some data sets contained "LOR" values (i.e. lowest observable reading) which indicates that the sample when analysed in a laboratory was found to have a concentration less than the lowest value that the analytical equipment was capable of testing for. To ensure that these values were represented in the statistical analyses the LOR value provided by ESC was converted to a real value, for example if a value of <0.07 was provided, this value was converted to 0.07.

The results in Table 4-3 indicate that the water quality of the Clyde River is generally within the acceptable limits of the EPA's (now DEC's) Interim Water Quality Objectives for Batemans Bay, apart from some slightly elevated turbidity values in the lower Clyde between Nelligen and the Princes Highway Bridge.

However, when compared to the ANZECC (2000) guideline values, the following exceedences are noted.

- Total Nitrogen (TN) values for the lower Buckenbowra exceed guideline trigger values at some sites in the upper Clyde between Currowan Creek and Nelligen;
- Oxidised nitrogen (NO<sub>x</sub>) and ammonium (NH<sub>4</sub>) levels in the Clyde River and Buckenbowra River are higher than guideline trigger values;
- Chlorophyll-a values were seen to exceed guideline values in the stretch of river between Big Island and the confluence of the Clyde River with Currowan Creek. The higher chlorophyll-a levels may be a result of the reduced tidal flushing in this section of the river and higher nutrient levels (such as the increased TN concentrations observed) which may have stimulated increased algal growth; and
- Other relevant notes about the data have been included after Table 4-3.

It should be noted that the ANZECC guideline values are “default trigger values” for slightly disturbed ecosystems. These guidelines are generic and are not site specific to Batemans Bay, hence the exceedences noted by the water quality monitoring, may in fact be due to natural variation in the system, particularly given the largely pristine nature of the catchment. These trends can only be born out by the:

- Collection of further baseline water quality data (note only approximately 12 records have been provided); and/or
- Establishment of site specific guideline criteria either from recorded data for Batemans Bay or from other similar estuaries in the region (i.e. a reference location).

Other estuarine health data collected to date (as described in Section 4.1.6 and 4.1.7) do not indicate any adverse effects.

Section 4.1.4 includes recommendations for future water quality monitoring within the Clyde River.

#### *4.1.3.1 Summary of Water Quality Data*

Overall the collected water quality data for Batemans Bay and the Clyde River is of high quality and representative of a near pristine estuary. The water quality in the Clyde River is considered suitable for its intended range of end uses which includes:

- Aquatic ecosystems;
- Visual amenity;
- Secondary contact recreation;
- Primary contact recreation;
- Livestock water supply;
- Irrigation water supply;
- Homestead water supply;
- Drinking water - Disinfection only; or
- Drinking water - Clarification and disinfection;
- Drinking water – Groundwater;
- Aquatic foods (cooked); and
- Industrial water supplies.

Table 4-3 Eurobodalla Shire Council Water Quality Data for the Clyde River

Parameter	Statistic	Units	Monitoring Location									Guideline	
			BR300	BR301	CL202	CL206	CL207	CL208	CL209	CL210	CL211	ANZECC (2000) <sup>5</sup>	EPA <sup>6</sup>
Chlorophyll a	80th perc. trigger value	ug/L	1.80	2.30	5.10	2.90	4.80	4.58	5.70	4.52	3.22	4	1 - 10
	No. of samples	-	12	10	13	13	13	13	12	12	12		
	No. of blanks results	-	0	2	0	0	0	0	0	0	0		
Total Phosphorus (TP)	80th perc. trigger value	mg/L	0.01	0.01	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.03	0.01 - 0.1
	No. of samples	-	12	10	13	13	13	13	12	12	12		
	No. of blank results	-	0	2	0	0	0	0	0	0	0		
Filterable Reactive Phosphorus (FRP) <sup>1</sup>	80th perc. trigger value	mg/L	0.010	0.014	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.005	
	No. of samples	-	12	9	12	13	12	12	11	11	11		
	No. of blanks results	-	0	3	1	0	1	1	1	1	1		
Total Nitrogen (TN)	80th perc. trigger value	mg/L	0.18	0.35	0.21	0.18	0.25	0.36	0.36	0.30	0.24	0.3	0.1 - 0.75
	No. of samples	-	12	10	13	13	13	13	12	12	12		
	No. of blank results	-	0	2	0	0	0	0	0	0	0		
Nitrite/Nitrate (NOx) <sup>2</sup>	80th perc. trigger value	mg/L	0.029	0.019	0.026	0.030	0.030	0.032	0.058	0.072	0.088	0.015	
	No. of samples	-	12	10	13	13	13	13	12	12	12		
	No. of blanks results	-	0	2	0	0	0	0	0	0	0		
Ammonium (NH <sub>4</sub> <sup>+</sup> )	80th perc. trigger value	mg/L	0.016	0.015	0.046	0.050	0.030	0.036	0.020	0.020	0.020	0.015	
	No. of samples	-	12	10	13	13	13	13	12	12	12		
	No. of blank results	-	0	2	0	0	0	0	0	0	0		
Dissolved Oxygen (DO)	20th perc. trigger value	mg/L	8.0	6.9	6.5	6.9	6.1	6.3	6.5	6.7	7.1		>6
	80th perc. trigger value	mg/L	8.6	9.1	8.3	8.8	8.0	8.0	7.8	8.0	8.5		
	No. of samples	-	9	6	12	11	12	12	10	10	10		
pH <sup>3</sup>	No. of blanks results	-	3	6	1	2	1	1	2	2	2		
	20th perc. trigger value	-	6.8	6.9	7.8	7.9	7.7	7.4	7.4	7.0	6.8	7	
	80th perc. trigger value	-	7.4	7.5	8.0	8.1	7.8	7.7	7.6	7.5	7.1	8.5	
Turbidity <sup>4</sup>	No. of samples	-	9	8	12	11	12	12	10	10	10		
	No. of blank results	-	3	4	1	2	1	1	2	2	2		
	80th perc. trigger value	NTU	7.0	2.0	6.2	6.2	4.0	5.6	1.6	3.8	2.4	0.5-10	<5
Faecal Coliforms	No. of samples	-	9	6	10	10	10	10	8	9	9		
	No. of blanks results	-	3	6	3	3	3	3	3	3	3		
	Median	MPN/100mL	14	11	2	2	2	2	2	8	7	<14	<14
	No. of samples	-	12	9	13	13	13	13	12	12	12		
	No. of blank results	-	0	3	0	0	0	0	0	0	0		

<sup>1</sup> Filterable Reactive Phosphorus values significantly affected by LOR values which were above ANZECC 2000 criteria

<sup>2</sup> Nitrite/Nitrate values appear to be significantly affected by large readings throughout on 31/7/2001, 18/9/2001 & 8/2/2001 which were possibly related to rainfall events

<sup>3</sup> pH exceedences in Buckenbowra and upper Clyde River are due to predominance of fresh water in these locations which reduces pH values, ANZECC (2000) guidelines included are for saline estuaries

<sup>4</sup> Result for site BR300 affected by LOR values provided by ESC (7 out of the 9 values provided were recorded as <7 NTU which were converted to values of 7 for this statistical analysis)

<sup>5</sup> Default trigger values for physical and chemical stressors in southeast Australia for slightly disturbed open estuarine systems (ANZECC, 2000).

<sup>6</sup> NSW Department of Environment and Conservation - Interim Water Quality Objectives for Batemans Bay and Jervis Bay

**Figure 4-1 Eurobodalla Shire Council Water Quality Monitoring Locations**

I:\B14590\BRH\Drawings\water\_qual.wor

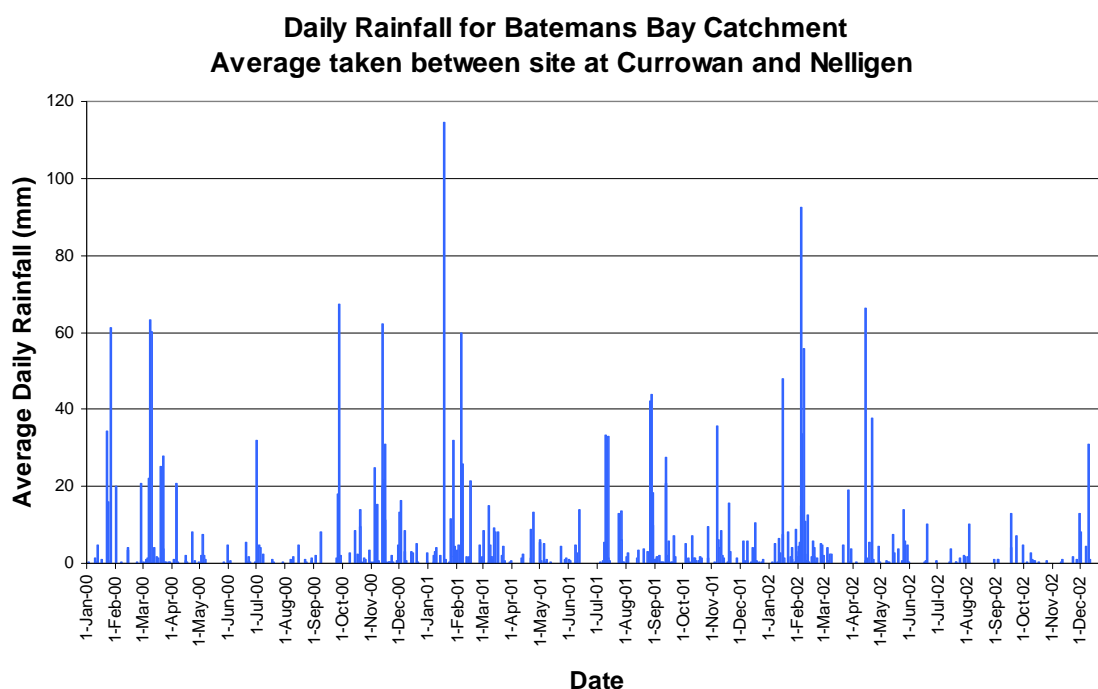
#### 4.1.4 Correlation of Water Quality Data with Rainfall

Water quality in the Clyde River is affected by rainfall in the catchment. Rainfall in the Clyde River catchment over the period of start 2000 to end 2002 has been average to dry (the Batemans Bay region has a long term average rainfall of approximately 900mm per year), with the following yearly total rainfalls being recorded:

- 2000 - 948 mm;
- 2001 - 963 mm; and
- 2002 - 713 mm.

These rainfall totals were prepared by averaging recorded rainfall data from Currowan and Nelligen. It is acknowledged that the Clyde River catchment is very large and the inclusion of additional upstream rainfall records may provide slightly different values to the totals provided above. The period of 2000 to 2002 was selected as this covers the period when water quality data was collected (refer to section 4.1.3).

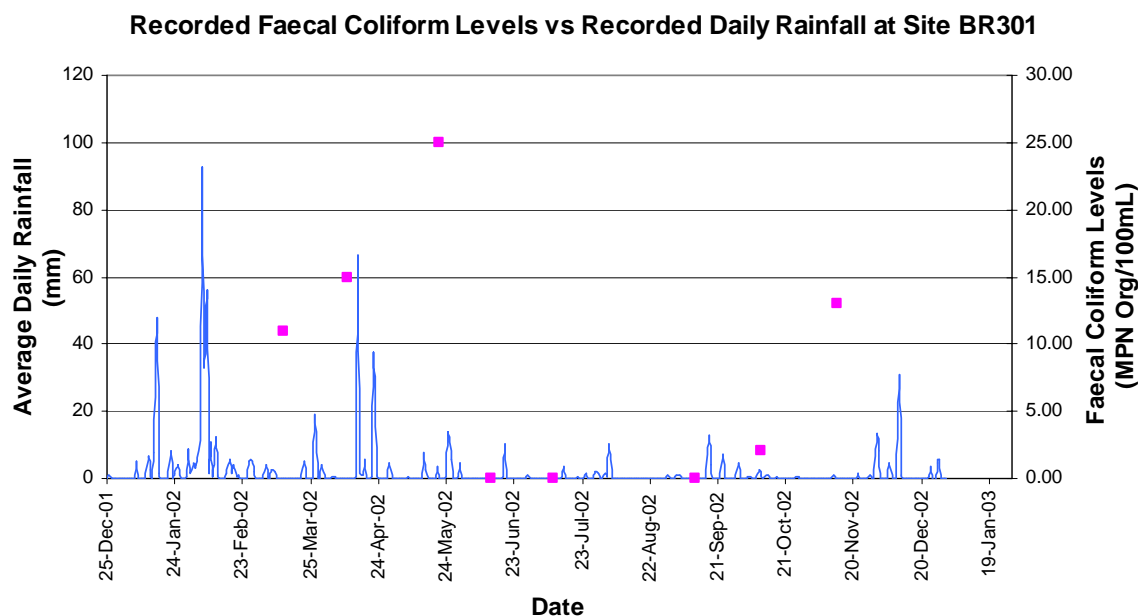
Figure 4-2 shows the temporal variability of this rainfall. It can be seen that there were periods of high daily rainfall (in excess of up to 100mm/day) and it can also be seen that the highest rainfall periods were received over the summer months, which is typical for this region.



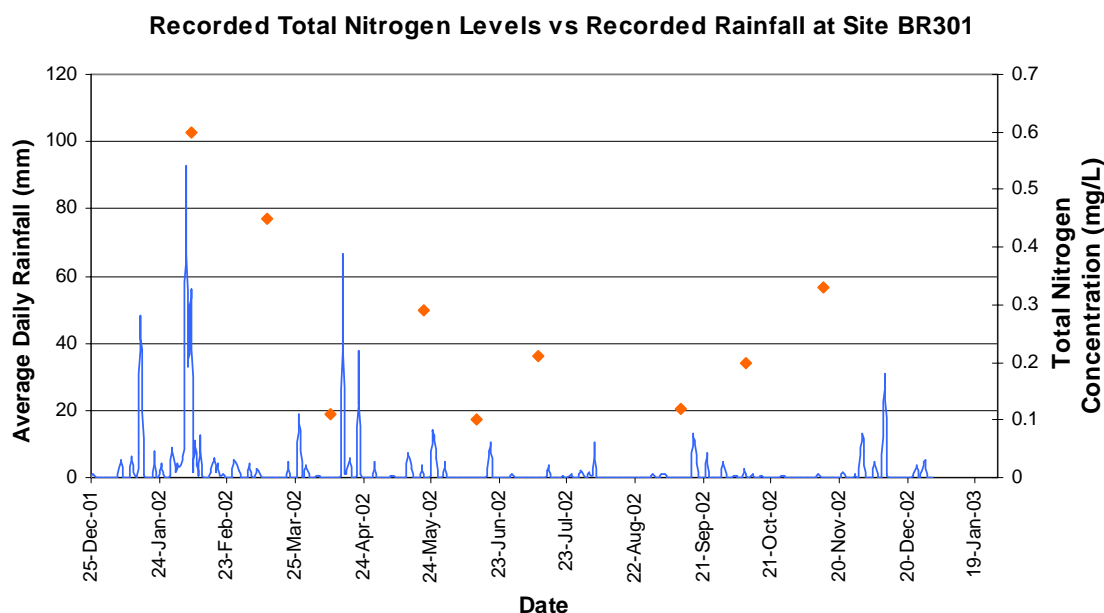
**Figure 4-2 Average daily rainfall in Clyde River catchment, 1/1/2000 to 31/12/2002**

The larger rainfall events, and rainfall events which occur when the catchment is wet (i.e. back to back rain events) are likely to generate significant runoff. This runoff can, depending on its characteristics (i.e. peak flow rate, duration etc) and condition/use of the catchment, collect varying quantities of water pollutants and transfer these directly to the receiving waters, i.e. Clyde River and

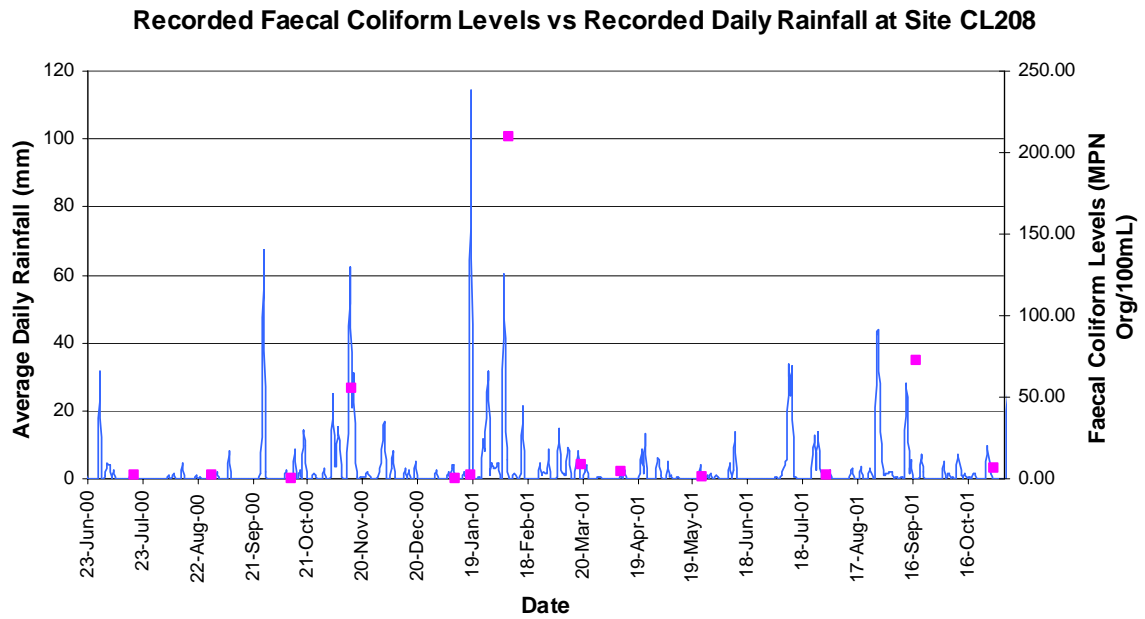
its tributaries. Table 4-3 shows that some of the 80<sup>th</sup> percentile values exceed recommended guideline values for those water quality parameters, such as Total Nitrogen (TN) levels at sites BR301, CL208 and CL209. These exceedances may be related to rainfall received in the catchment washing pollutants into the Clyde River at or near these locations. To examine the likely degree of correlation between the noted exceedances and recorded rainfall Figure 4-3 to Figure 4-8 presents graphs showing these potential relationships for faecal coliforms levels and total nitrogen levels.



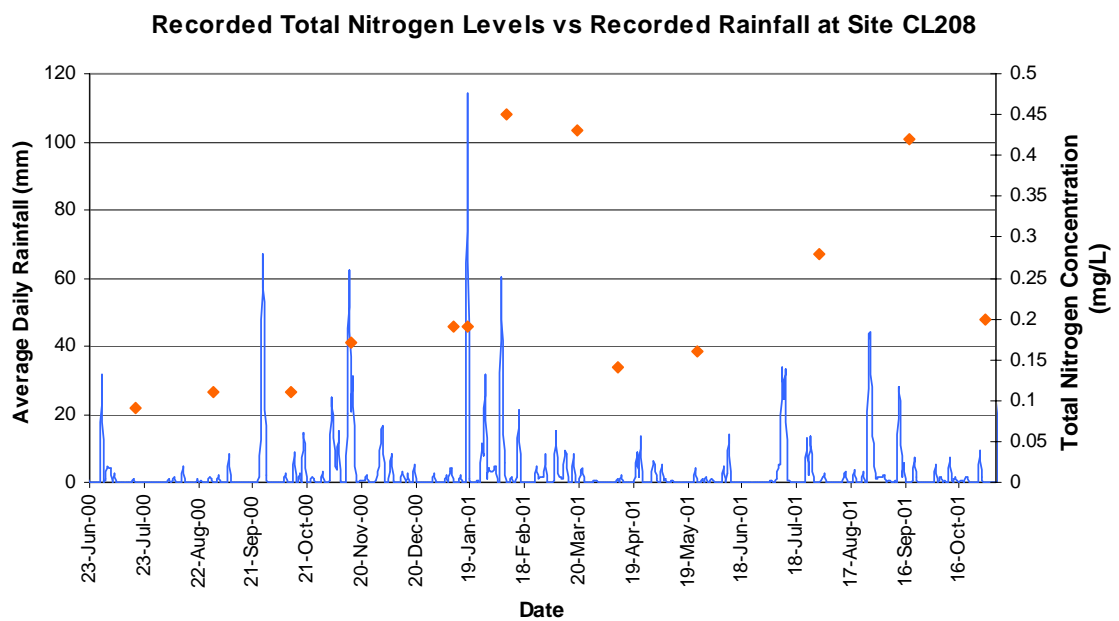
**Figure 4-3 Faecal Coliform Levels vs Recorded Rainfall at BR301**



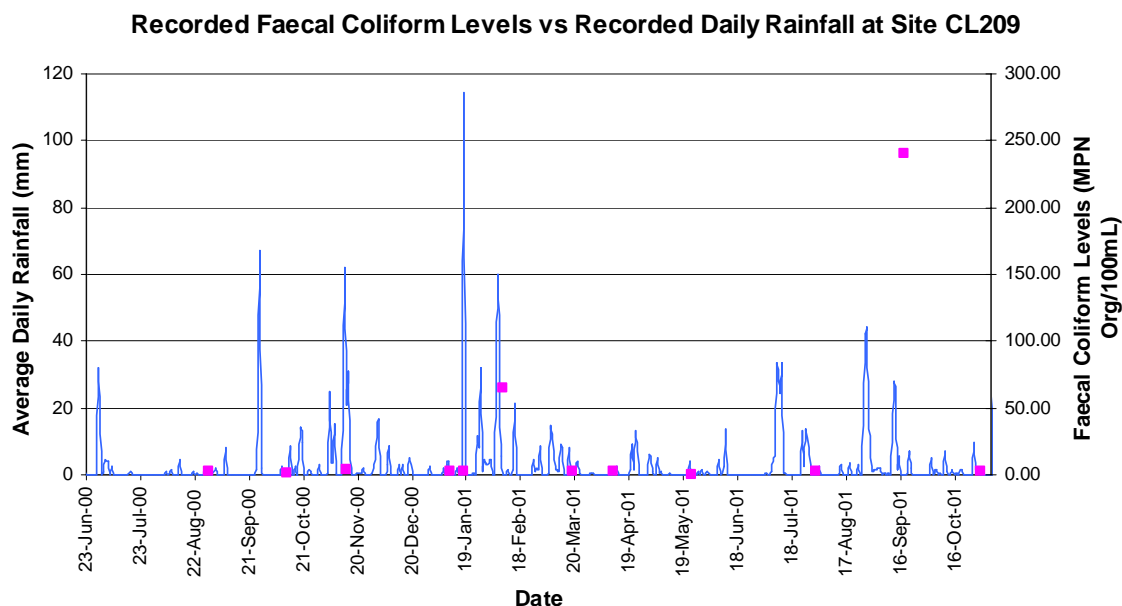
**Figure 4-4 Total Nitrogen Levels vs Recorded Rainfall at BR301**



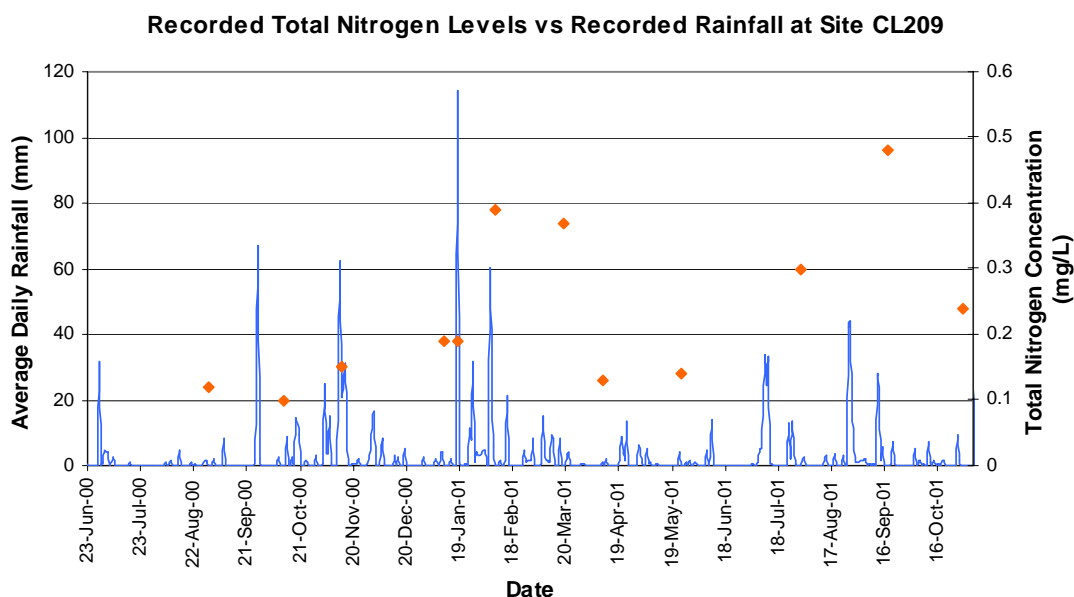
**Figure 4-5 Faecal Coliform Levels vs Recorded Rainfall at CL208**



**Figure 4-6 Total Nitrogen Levels vs Recorded Rainfall at CL208**



**Figure 4-7 Faecal Coliform Levels vs Recorded Rainfall at CL209**



**Figure 4-8 Total Nitrogen Levels vs Recorded Rainfall at CL209**

The graphs comparing faecal coliform levels and rainfall do not appear to show a strong response to rainfall at site BR301, whereas sites CL208 and CL209 appear to show a better correlation to the recorded rainfall data. The apparent lack of correlation around February to May 2002 at site BR301 may be a result of the low flushing observed during this monitoring location (i.e. pollutants contained in runoff from earlier rainfall events may linger in the water column for longer periods of time) thereby being recorded in later monitoring events. More reasonable faecal coliform results are observed from June to September 2002 when low catchment rainfall is correlated to low faecal coliform readings.



The graphs comparing total nitrogen levels and rainfall do appear to have some correlation at all sites. This is most obvious for the large rainfall event in January 2002 at site BR301 which appears to have caused elevated nutrient levels in the Buckenbowra in the January and February sampling events. Total nitrogen levels appear to return to natural background levels after this time. Similarly the higher summer rains over the summer of 2001 is likely to have been the cause of the higher TN concentrations recorded in the Clyde River at this time. Concentrations appear to return to background levels after this time, apart from another high result which was received in September of that year which does not appear to be related to any particularly large rainfall events in the catchment.

In summary, it is likely that some of the higher (than background) observed nutrient concentrations, which have contributed to the observed exceedances of guideline values at these locations, are correlated with high rainfall within the catchment. The water quality sampling regime currently employed on the Clyde River, is a monthly sampling scheme, which will (by chance) record both dry and wet weather water quality events. The water quality monitoring program should ensure that sufficient dry weather (i.e. without significant rain in the catchment for at least two weeks before sampling) and wet weather (i.e. a few days after heavy rains when this water is being washed down the river) water quality records have been obtained for the Clyde. This data will enable the development of site-specific water quality objectives for the Clyde River. It is recommended that a minimum of 24 months of dry weather monthly water quality records be obtained at all sites (ANZECC, 2000). In addition to this several targeted wet weather sampling events should be performed to capture the effects of varying quantities of catchment runoff, i.e. sampling after a major event when the catchment is dry, sampling after rain events when the catchment is wet, etc.

Once sufficient information has been obtained for the main branch of the Clyde River, further water quality investigations may be warranted in the tributaries of the Clyde River, such as Nelligen, Cyne Malloves Creeks, etc to:

- Establish background water quality levels in these tributaries; and
- Assist in the identification of hot spots, which may actively be contributing pollutants to the river.

To do this both dry and wet weather water quality sampling would be required at several consistent places along the length of the tributary, to the mid point of the Clyde River (tide at time of sampling should be noted). Wet weather event sampling will also be required to identify any potentially polluting activities, which may only occur during periods of catchment runoff, e.g. poorly managed farm land, overflow from septic tanks etc.

Depending on potential for human/environmental harm, identified hotspots may need to be addressed immediately via Council or other relevant government departments, or included in revisions of the Estuary Management Study and Plan for future action.

#### **4.1.5 Water Quality Modelling of Existing Use Impacts**

In order to quantify the potential water quality/environmental impacts of existing and future (refer Section 5.0) land uses within the study area, the AQUALM (pollutant export) and MIKE11 (receiving water) models developed as part of the Estuary Processes Study (WBM, 2000) were applied.

The models have been updated to include the latest available information on both:

- Ambient water quality (to assist in calibration of model) as discussed in the Section 4.1.3; and
- Pollutant export coefficients.

Pollutant export coefficients for the Batemans Bay area have been obtained from a PhD thesis (Spooner *et al*, 2003) conducted through the University of Canberra. This thesis measured nutrient and suspended solids export coefficients for the catchments of Corunna and Nangudga Lakes, south of Narooma. The new research has produced locally specific pollutant export coefficients for cleared grazing land and native forest. This information represents the closest and most recent source of information for use in the AQUALM model and is included in Table 4-4. The pollutant export coefficients previously used in the AQUALM model as part of the Estuary Processes Study are also included in Table 4-4.

**Table 4-4 Pollutant Export Coefficients used in AQUALM**

Source	Land Use	TN (kg/km <sup>2</sup> )	TP (kg/km <sup>2</sup> )	TSS (kg/km <sup>2</sup> )
Spooner <i>et al</i> (2003)	Native Vegetation	0.006R <sup>1.80</sup>	0.0001R <sup>1.84</sup>	6.01R <sup>0.97</sup>
Spooner <i>et al</i> (2003)	Grassland	0.444R <sup>0.81</sup>	0.02R <sup>0.94</sup>	10.83R <sup>1.08</sup>
Estuary Processes Study	Native Vegetation	0.3R <sup>1.25</sup>	0.03R <sup>0.1</sup>	20R <sup>1.5</sup>

Note: R is the designation for runoff in ML/km<sup>2</sup> or mm

It can be seen from Table 4-4 that the pollutant export coefficients provided by Spooner *et al* (2003), for native vegetation are significantly lower than those used in the Estuary Processes Study for some parameters.

The designation of “grassland” refers to cleared lands dominated by temperate grasses and legumes and predominantly supports cattle grazing. The designation of “native vegetation” refers to tree coverage predominantly by Eucalyptus forest (Spooner *et al*, 2003).

#### 4.1.5.1 Pollutant Export Modelling

Catchment pollutant and receiving water quality assessments were performed with the catchment assumed to be in its existing (i.e. current) condition. This required the catchment to be broken down into its various land use components. This was achieved by interrogation of Eurobodalla Shire Council’s land use mapping (maintained on their digital GIS database) which was last updated in 1997/98. The interrogation of this mapping provided a breakdown of the areas of land which were cleared (assumed to be “grassland” for the purposes of pollutant export modelling) or had forest coverage (assumed to be “native vegetation” for the purposes of pollutant export modelling). The designation of grassland provided by Spooner *et al* (2003), approaches a “rural” landuse as these lands were subject to cattle grazing.

Due to the very limited areas of urbanised catchment that exists within the Batemans Bay catchment (refer to Table 3-4) these areas have been excluded for the purposes of pollutant export modelling. The model boundary exists at the Princes Highway Bridge and most of the urbanised areas of Batemans Bay drains to the east of the Princes Highway Bridge and hence cannot be accounted for in the AQUALM model.

The AQUALM model was updated with the most recent landuse areas and associated pollutant export coefficients. This model was then run for several years to generate a daily pollutant export time series for use in the MIKE-11 hydrodynamic/advection and dispersion model (i.e. HD/AD model).

#### 4.1.5.2 Hydrodynamic and Advection/Dispersion Modelling (HD/AD model)

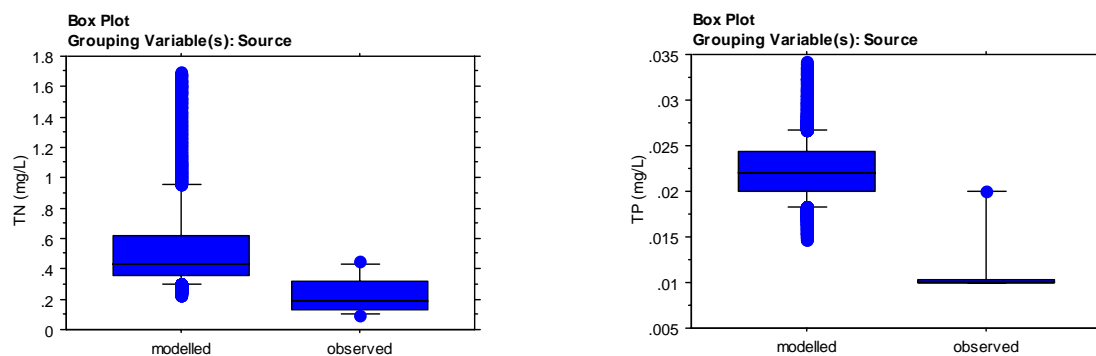
A calibrated and validated HD/AD MIKE-11 model was prepared for Batemans Bay and the Clyde River as part of the Estuary Processes Study (relevant details of the previous model setup and calibration etc are included in the Estuary Processes Study). The AD/HD model was prepared for use as a planning tool that may be used in the assessment of impacts of the existing and possible future development scenarios. For the existing situation, assessments were conducted for the following key pollutants:

- Total Nitrogen (TN); and
- Total Phosphorus (TP).

It was considered that establishing the model for these pollutants should be sufficient to determine the relative impacts of potential land use changes within the catchment. It should be noted that the AD/HD model treats pollutants as conservative unless a decay rate is specified. A more advanced non-conservative water quality model has not been set up in MIKE-11 at this stage, as further work (outside the scope of this study) would be required to establish this model before it could be reliably used.

The HD/AD model was updated with flow and concentration time series data (for TN and TP) from the AQUALM model and run for several months with recorded tide data at the “forcing” ocean boundary of the model.

Time series of pollutants levels over time were obtained from the model for several locations throughout the estuary, where ambient water quality data was available (i.e. ESC monitoring locations). Pollutant concentrations at these locations were then compared to observed data and it was found that pollutant concentrations were significantly lower than the observed data for TN and TP. Hence, the pollutant export coefficients provided by Spooner *et al* (2003) were factored up to closer represent those used in the Estuary Processes Study (which had previously provided a reasonable calibration) and the models rerun. This set of pollutant export coefficients provided a more favourable comparison to observed data, sufficient for the purposes of performing a comparative analysis. The reasons for the discrepancy in the pollutant export coefficients provided by Spooner *et al* (2003) are unknown and may relate to differences in the catchment geology or soils.



**Figure 4-9 Comparison Plots for Nutrients at CL208**

The box and whisker plots provided above show the concentrations of TN and TP at the monitoring location CL208 (refer to Figure 4-1) which is located at the connection point of Nelligen Creek to the Clyde River. These graphs show from the top of the graph window down, all outliers greater than the 90<sup>th</sup> percentile value (represented as dots, the 90<sup>th</sup> percentile value (represented by the short horizontal bar), the 75<sup>th</sup> percentile value (represented by the long horizontal bar at the top of the blue area), the median value which is the horizontal bar in the middle of the blue area, the 25<sup>th</sup> percentile value (represented by the long horizontal bar at the bottom of the blue area), the 10<sup>th</sup> percentile value (represented by the short horizontal bar) and all outliers below this value represented as dots.

For nitrogen, the plots indicate that the median value of the modelled data set is approximately 0.2 mg/L above that of the observed data set. This difference is considered acceptable given that nitrogen was modelled as a conservative substance whereby there is no in-stream processing, eg settling, denitrification which will reduce pollutant concentrations.

For phosphorus, the plots indicate that the median value of the modelled data set is approximately 0.015 mg/L above that of the observed data set. This difference is considered acceptable again given that phosphorus was modelled as a conservative substance whereby there is no in-stream processing, eg settling etc which would reduce pollutant concentrations.

The re-established AQUALM and MIKE-11 AD/HD models have been used in assessments of future usage impacts detailed in Section 5.0.

#### 4.1.6 Pollution Risk

The potential for water quality pollution of waterways in the Clyde River estuary is in part related to tidal flushing patterns of that waterway (where flushing refers to water exchange with a “clean” water source). It is also a function of the ability of catchment-based pollutants to reach particular waterways. This is influenced by a number of factors including:

- Level of pollution control placed on man-made activities and/or developments (e.g. dirt roads, housing developments, grazing, agriculture etc);
- Presence and quality of riparian vegetation on tributaries and their associated feeder streams;

- Presence of other water quality control measures, such as natural or man-made wetlands or other buffering areas to waterways; and
- Geology and soils present in the catchment and the degree of prior catchment disturbance.

As part of the Estuary Processes Study (WBM, 2000), flushing assessments were conducted in the estuary. Models were calibrated and validated to available data on salinity levels. Figure 4-10 illustrates the results of downstream area flushing assessments, while Figure 4-11 illustrates whole of estuary flushing assessments.

Using these modelled flushing times as a guide, locations with flushing times less than approximately 15 days have been assumed to have a low to very low risk for potential water quality pollution, while those parts of the estuary with flushing times of between 15 to 30 days have been considered a moderate risk for water quality pollution, while those locations with flushing times in excess of 30 days have been considered a higher risk for water quality pollution.

It is noted that the higher risk locations typically occur upstream of Cyne Mallowes Creek and in the upper reaches of some tributaries. However, flushing times only represent part of the pollutant risk equation, as described above, the ability of catchment-based pollutants to reach the waterways is also a key determinant in the pollutant risk of a waterway.

In summary, those catchments in the estuary which contribute runoff to the upper Clyde River (above approximately Cyne Mallowes Creek) or to the upper reaches of tributaries of the Clyde River (such as Nelligen Creek etc) which have a low flushing capacity, are at most risk of becoming polluted (i.e. having excessive pollutant concentrations) and potentially developing water quality problems (such as algal blooms). Any land-use changes that may result in land-clearing or more intensified use of the land for such things as cattle grazing etc or other developments (e.g. road construction and maintenance, housing etc) within these catchments should have the strictest pollutant generation controls placed on them.

The review of water quality data of the estuary from Eurobodalla Shire Council (described earlier) indicated that at present there are no locations within the Clyde River (to its tidal limit) or within the Buckenbowra River that currently display poor water quality. However, no water quality data are available for other tributaries of the Clyde River.

#### **4.1.7 Assessments of Seagrass Habitats in Clyde River**

As part of the Estuary Processes Study for the Clyde, Tomaga and Moruya Rivers, Eurobodalla Shire commissioned The Ecology Lab (TEL, 2002) to investigate the state and health of seagrasses in the Clyde, Tomaga and Moruya Rivers.

Several aspects of the seagrass habitats were examined in the mouth, mid and upper reaches of estuary based on the salinity gradient present. These assessments found that the seagrass communities in the Clyde River appeared to be generally healthy and no critical areas were identified for specific monitoring. The study was considered to form a baseline of data on which future studies could build on and document changes in seagrass beds and their condition (which will be reflection of the overall condition of the estuary).

**Figure 4-10 Lower Estuary Flushing Times**

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**Figure 4-11 Whole Estuary Flushing Times**

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#### 4.1.8 Effects of Possible Septic Discharges from Nelligen

The Estuary Management Committee/Eurobodalla Shire Council commissioned The Ecology Lab (TEL, 2002a) to conduct an investigation into the distribution and abundance of animals living in soft sediments at selected locations in the Moruya and Clyde Rivers as an indicator of estuarine health. The study was commissioned due to concerns regarding the possible effects of seepage of effluent from septic systems at Nelligen.

The study was conducted by comparing benthic communities at locations upstream and downstream of Nelligen. The study was unable to identify any significant differences (and hence likely impacts) on the benthic estuarine communities as a result of potential septic discharges.

The results of this study will form a baseline of data onto which future studies will build and over time will become a useful tool for identifying changes in estuarine health and condition of the estuary.

## 4.2 Summary of Existing Usage Impacts

From the review of water quality data and other relevant studies, it is apparent that the estuary is in very good condition. The effects of the current levels of usage on the estuary do not appear to be causing any identifiable issues at this stage. However, future usage may affect the health of the estuary if not managed appropriately (as discussed in Section 5.0). One management tool available to the Eurobodalla Shire Council in this regard is to adopt more stringent water quality objectives (WQO's), which the estuary presently complies with, to further safeguard the estuary as detailed below.

### 4.2.1 Water Quality Objectives (WQO)

The Department of Environment and Conservation's Interim Water Quality Objectives for the Clyde River and Jervis Bay are presently based on ANZECC (1992) guidelines. The review of presently available water quality data indicated that the estuary was generally in compliance with the ANZECC (2000) guidelines.

It is a recommendation of this Estuary Management Study that consideration is given to adopting the ANZECC (2000) guidelines as the current Interim Water Quality Objectives for Batemans Bay and the Clyde River.

Adopting the more stringent ANZECC (2000) guidelines in combination with continued water quality monitoring may allow earlier detection of any significant changes in water quality which otherwise may have gone unnoticed. It is further recommended that over time that site specific WQO's are developed for Batemans Bay and the Clyde River, using recorded water quality data, based on the methodologies included in the ANZECC guidelines (2000).



## 5 ASSESSMENT OF FUTURE USAGE AND IMPACTS

This section provides an analysis of likely future land use changes as a result of development and its associated potential impacts on estuarine ecosystem health and human usage.

The first step in this process has been to define the potential future usages of the estuary as based on what is currently allowable under Council Planning Policies, such as the Rural and Urban Environmental Plans.

### 5.1 Future Usage – Development Potential

#### 5.1.1 Rural 1c Development Potential

Council's Strategic Planning staff have analysed the development potential of Rural 1c (Smallholdings) zonings based on absolute constraints of the landscape as follows:

- Slope > 25%;
- Extreme Bushfire Hazard;
- Soil wetness;
- Natural Drainage Lines – 20m buffer on each side;
- SEPP 14 wetlands & 100m buffer around wetland;
- Vulnerable ecosystems;
- Fauna habitat corridors;
- Riparian vegetation; and
- Acid sulphate soils.

Where any one of these absolute constraints exists, the land is deemed not capable of supporting rural smallholding development. When considering lot yields, a 2ha “footprint” must be contained entirely within unconstrained land. Three main areas for future 1c development have been identified by Council at Nelligen, North Batemans Bay and Long Beach and are shown in Figure 3-3.

##### 5.1.1.1 Nelligen 1c Area

In the Nelligen 1c area, there exist (in year 2003) 65 smallholding lots of median size 5 hectares and minimum size 2 hectares. The analysis found that 30 to 32 additional lots could potentially be subdivided from the residual lot layout, considering land constraints and servicing / lot layout requirements. There is little difference on potential lot numbers based on a lot size of 2ha and 5ha. This is logical as steep slopes and bushfire hazard limit opportunities for subdivision in this area. Drainage from this 1c area is predominantly to tidal sections of Nelligen Creek.

##### 5.1.1.2 North Batemans Bay 1c Area

In the North Batemans Bay 1c area, there exist (in year 2003) 89 smallholding lots of median size 2.15 hectares and minimum size 2 hectares. The analysis found that 38 additional lots could

potentially be subdivided from the residual lot layout, considering land constraints and servicing / lot layout requirements. Drainage from the North Batemans Bay 1c area drains via wetlands (SEPP Wetlands 214 and 215) and small coastal creeks (Cullendulla and Surfside Creeks) to Batemans Bay.

#### *5.1.1.3 Long Beach 1c Area*

In the Long Beach 1c area, there exist (in year 2003) 254 smallholding lots of median size 1.1 hectares and minimum size 1 hectare. The analysis found that 83 to 94 additional lots could potentially be subdivided from the residual lot layout, considering land constraints and servicing / lot layout requirements. The majority of this 1c area flows to the Cullendulla Creek wetlands, while some southern areas of the zone fall towards the Long Beach Reed Pond (SEPP Wetland 216). The 1c zone in the east drains to SEPP Wetland 217 at Maloneys Beach.

### **5.1.2 Urban Development Potential**

#### *5.1.2.1 Long Beach Urban 10 Zone*

This major area of urban expansion is located at Long Beach, comprising some 350 future urban allotments. The area is expected to be a major growth area of Batemans Bay over the next 30 years. This area drains to SEPP Wetland 217 at Maloneys Beach.

#### *5.1.2.2 North Batemans Bay Urban Zone*

Two areas at North Batemans Bay are under discussion for potential urban development.

The first is 90 hectares of land along the Kings Highway which is currently under investigation for rezoning from 1c to Urban. This land forms the south-western limits of the North Batemans Bay 1c zone. Its catchment streams discharge via the Palana Street wetland (SEPP Wetland 214) to Surfside Creek.

The second is the 3.75 hectare Country Comfort Motel site which is being examined for medium density urban development. The majority of this site drains towards the Lincoln Downs lagoon.

## **5.2 Future Development – Impact Assessment and Management**

### **5.2.1 Nelligen 1c Area**

Rural subdivision in this area must reflect the relative vulnerability of the receiving waters i.e. Nelligen Creek. The Estuary Processes Study (WBM, 2000) highlighted the potentially deleterious impacts of significant land use changes in the upper reaches of the Clyde River and many of its tributaries such as Nelligen Creek. Hence, the potential impacts of intensifying rural development in this area have been subject to water quality modelling in order to assess its relative impacts.

#### *5.2.1.1 Pollutant Export Modelling*

The Clyde River at the junction with Nelligen Creek has flushing times of the order of 19 to 24 days under purely tidal conditions (WBM, 2000). The creek itself has limited opportunity for tidal

flushing. This places it in a high risk category, where increases in nutrient loads may present significant water quality problems to the local waterway.

To assess the likely impacts of development at Nelligen, a worst-case developed scenario has been run in the AQUALM and MIKE-11 AD/HD models (refer to section 4.0).

It has been assumed that all the area available for 1c development has been used for this style of development. This area (approximately 640 ha) post development has been assumed to have been mostly cleared for the purposes of building erection and associated services (Figure 3-3 shows the extent of 1c lands around Nelligen). As such the pollutant export from the area has been assumed to resemble that of “grassland” (which is in fact land subject to light agricultural/rural pursuits such as grazing). Runoff from the development area has been assumed to enter Nelligen Creek at its approximate tidal limit without any pre-treatment.

The existing case AQUALM model was reconfigured to represent the changed land use at Nelligen and rerun. Output from the AQUALM model was used as input to the MIKE-11 AD/HD model and this also was rerun to generate time series of pollutant concentrations for all locations along the river.

Statistical comparisons of the existing and developed scenarios indicate that there is an average 42% increase in TN and 37% increase in TP in the mid reaches of Nelligen Creek (over the modelling period). This increase could be considered a worst-case result as it was assumed that:

- The entire Nelligen 1c had been developed;
- Stormwater entered the creek at the upstream limit of Nelligen Creek (in the AD/HD model) where flushing times are lowest;
- There were no stormwater quality improvement measures put in place; and
- Pollutants were conservative, i.e. there was no in-stream processing of pollutants over time, eg settling, denitrification etc which would reduce pollutant concentrations.

The obviously unacceptable increases in pollutant loads associated with land use change would be significantly reduced by the implementation of strategies to:

- Minimise the risk of nutrient discharge to the waterway and feeder streams, such as regular monitoring and maintenance of septic systems, education programs for residents etc; and
- Maintain and improve riparian buffers to the creek and feeder streams;

In practice, these measures should be implemented for individual subdivision proposals. As a guide, we suggest the following minimum riparian buffers in this area in recognition of its high relative risk:

- To Nelligen Creek - 100 metres from either creek bank or 20 metres from edge of floodplain, whichever is the larger;
- To permanent tributary streams – 40 metres from top of either bank; and
- To intermittent tributary streams – 20 metres from top of either bank.

It is expected that these measures will have a significant impact on reducing nutrient impacts (and other water quality pollutants) within Nelligen Creek. Another important consideration will be to

minimise vegetation loss/alteration in creeks and other flow areas during construction/operation to preserve hydrologic flow regimes.

### 5.2.2 North Batemans Bay 1c Area

This area falls within the catchment of Batemans Bay rather than the Clyde River itself. As such, environmental threats relate to local issues with creeks and wetlands rather than the estuary, which is well flushed and mixed at these sites (hence no pollutant export and water quality modelling has been undertaken).

Part of the area between Clyde Road and the Kings Highway drains via the Palana Street wetland (SEPP Wetland 214) to Surfside Creek. The Creek Management Plan for this creek identifies that new development within the catchment should have stringent erosion and sediment control programs enforced during the construction phase. During the planning and detailed design phase, various measures should be promoted and/or enforced to ensure that pollutant exports to Surfside Creek do not worsen as a result of the development.

The remainder of this 1c area northeast of Clyde Road drains beneath the highway in three sub-catchment creeks, ultimately entering the Cullendulla wetlands (SEPP Wetland 215). The regional and state significance of these wetlands is outlined in Section 7.0. Nutrients and organic matter can enter these creeks during rain events in the catchment. The nutrients may either be in a dissolved form (these are not visible to the eye, but come from a variety of sources such as animal faeces, sewage or fertilisers etc) or in a particulate form, bound to small clay or silt particles which can be collected and moved by runoff. Both sources would be likely to discharge to the Cullendulla wetlands.

Catchment management practices should be imposed to manage the amounts of pollutants entering this creek and wetland system. Sediment and erosion control measures at the time of subdivision and eventual building work should be standard practice in these higher risk areas. The maintenance of buffers to creeks will also assist to support good water quality.

As a guide, we suggest the following minimum riparian buffers in this area:

- To permanent streams – 40 metres from top of either bank; and
- To intermittent streams – 20 metres from top of either bank.

### 5.2.3 Long Beach Urban 10 Zone

For the Long Beach Urban 10 Zone (which is also within the catchment of the Clyde River), similar catchment management comments to those made for the North Batemans Bay 1c Area (as detailed above) should apply. As well as riparian buffers to creeks as above, there should be a 100 metre buffer around SEPP 14 wetlands, in order to manage the quality of local runoff and filter diffuse pollutants entering these sensitive waterbodies.

All new developments within this area should have stringent erosion and sediment control programs enforced during the construction phase. During the planning and detailed design phase, various measures should be promoted and/or enforced to ensure that pollutant exports to Wetland 217 do not

increase as a result of the development. The types of controls are detailed in the Eurobodalla USQMP.

Future sewage pumping stations will by necessity be located at the lower parts of this area, near the wetland boundary. They should be designed with adequate storage to allow for potential overflows, in recognition of the sensitivity of receiving waters.

#### 5.2.4 North Batemans Urban Zone

Development of the parcel of land along the Kings Highway would have to carefully consider the impacts of urban runoff on SEPP wetland 214 and the Surfside Creek systems. If not carefully managed, these impacts could include:

- Increased volumes of discharge under urban conditions would lead to more frequent demands to artificially open Surfside Creek. It has been identified that odour from the creek worsens temporarily when it is opened. This is most likely due to the disturbance of sediments in the creek (and possible deposition of sulphidic rich sediments on nearby beaches) which then releases large quantities of hydrogen sulphide gas; and
- Additional pollutant loads (from conversion to an urban catchment) would increase the frequency and / or severity of odours from Surfside Creek.

Development of the Country Comfort Motel site will have to be cognisant of the history of algae problems in the Lincoln Downs lagoon. The existing catchment of the Lincoln Downs lagoon consists of some urban development and the Princes Highway. The potentially high levels of nutrients from these existing sources are likely to be the cause of algal problems in the lagoon. Any future urban development within this catchment will need to control the quality of urban runoff to ensure existing problems are not exacerbated.

### 5.3 Sewer Overflows

Studies are currently underway by Eurobodalla Shire Council to investigate the effects of the future sewage overflows and spills on water quality in Batemans Bay. Council is presently reviewing their proposed sewage management strategies and this will feed into this study.

## 6 REVIEW OF STATUTORY CONTEXT

This section presents an overview of the statutory context in which an Estuary Management Study and Plan reside. It reviews the role of State Government Authorities involved in estuary management as well as all local, regional and state planning policies/controls, protection policies etc that are applicable to the estuary and its management.

### 6.1 State Government Authorities with a Role in Estuary Management

Authority	Relevant Legislation	Responsibility
Department of Infrastructure Planning and Natural Resources (DIPNR) <i>[previously Land &amp; Water Conservation (DLWC)]</i>	Native Vegetation Conservation Act 1997 Native Title Act 1993 (Commonwealth legislation administered by the State) Catchment Management Act 1989 Coastal Protection Act 1979 Soil Conservation Act 1938 Rivers & Foreshores Improvement Act 1948 Water Act 1912*	DIPNR is responsible for developing, controlling and managing the State's water resources (both surface and ground water) for human use / recreation and ecological needs. DIPNR is also involved in: catchment, vegetation, coastal zone, estuary and floodplain management; and the provision of waterway infrastructure such as wharves, boat ramps and major fishing ports;
Department of Lands	Crown Lands Act 1989	The Department of Lands (formed April 2003) is responsible for the leasing and licensing of Crown land.
Department of Environment and Conservation	Protection of the Environment Operations Act 1997	The EPA is responsible for controlling, reducing and preventing pollution from premises required to hold an Environmental Pollution Licence or for which the EPA is the appropriate regulatory authority (for example, local Council). It is also involved in waste management and minimisation, sewage management, stormwater and contaminated sites.
Planning NSW <i>[Resource and Conservation roles fall under DIPNR jurisdiction as of April 2003]</i>	Environmental Planning & Assessment Act 1979 Heritage Act 1977 SEPP's (see below)	Planning NSW coordinates town and country planning in NSW and oversees the operation of environmental impact assessment legislation. It is responsible for planning at regional and State level and produces publications relating to planning, changes in planning laws, environmental issues, policies and heritage protection.  Planning NSW has carriage of coastal planning under the government's Coastal Policy. The Minister has a concurrence role or a consent authority role under SEPP 71 for coastal development.
NSW Fisheries (under Dept Environment & Conservation DEC)	Fisheries Management Amendment Act 1997 Fisheries Management Act 1994	NSW Fisheries legislative objectives are to conserve fish stocks and key fish habitats; conserve threatened species, populations and ecological communities of fish and marine vegetation; and promote ecologically sustainable development, including the conservation of biological diversity and where consistent with these objectives. NSW Fisheries promotes viable commercial fishing and aquaculture industries; quality recreational fishing opportunities; and appropriate sharing of fisheries resources between users.
Waterways Authority	Maritime Services Act 1935 Navigation Act 1901	Waterways are responsible for developing and managing waterways for recreation; controlling non-port traffic; and maintaining non-port waterways/ navigation channels.
State Forests NSW	Forestry Act 1916 and Forestry Regulation 1999	SF manages parts of the estuary foreshore and 44% of the Clyde catchment.
National Parks & Wildlife Service (under DEC)	Threatened Species Conservation Act 1995 National Parks & Wildlife Act 1974	NPS has statutory responsibilities for the care, control and management of National parks, nature reserves and State recreational areas. Responsibilities also relate to the protection and care of Aboriginal sites and relics, and native flora and fauna throughout New South Wales.

\* Note - the Water Management Act 2000 repeals the Water Act and Rivers & Foreshores Improvement (R&FI) Act, however, permit arrangements under the R&FI Act remain for an unknown duration.

## 6.2 Regional Plans

### 6.2.1 Lower South Coast REP No.1 – High Rise Buildings

This applies to coastal land within Bega Valley and Eurobodalla LGAs. The plan aims to conserve scenic and environmental character and protect the coast's visual quality by setting height limits of 14 m on most buildings.

### 6.2.2 Lower South Coast REP No.2

This REP provides a framework to guide decisions on local planning and development, and government and private investment in Bega Valley and Eurobodalla Shires. It provides regionally relevant guidelines for the preparation of local plans and lists matters to be considered when assessing development applications.

### 6.2.3 Lower South Coast Regional Settlement Strategy

This strategy identifies a hierarchy of settlement based on the varying roles and functions of existing towns and villages and their capacity and suitability for further growth.

### 6.2.4 Lower South Coast Land and Housing Monitor

This report was prepared by the then Department of Urban Affairs and Planning in 1996. It records land available for housing and provides an indication of the need to rezone land to cater for growth. For each settlement area, constraints to growth are presented. Council provides annual updates of this monitor by recording subdivision and development activity.

Of relevance to this study, the monitor in 1996 recorded a low demand or availability of rural lots around Nelligen, a trend that has continued to the present. The village of Nelligen is identified as having a need to retain its existing form and character. Nelligen is unsewered and without town water. It is seen as constrained, hence further expansion is limited.

Urban growth around the north of Batemans Bay was predicted to occur at the Urban Expansion zone at Long Beach. Growth of both Surfside and Maloneys Beach are limited by environmental constraints. On the south side of Batemans Bay, most urban growth was predicted to be taken up at Sunshine Bay and Lilli Pilli / Malua Bay.

### 6.2.5 Regional Forest Agreements and Ecologically Sustainable Forest Management Plan

Regional Forest Agreements (RFAs) and Integrated Forestry Operations Approvals (IFOAs) govern activities within State Forests. IFOAs specify the terms of licences under the *Protection of the Environment Operations Act 1997*, *Threatened Species Conservation Act 1995*, *Fisheries Management Act 1994*, together with heritage guidelines. The licence conditions under the *Protection of the Environment Operations Act* cover soil and water management and monitoring. Ecologically Sustainable Forest Management Plans are also part of the RFA and IFOA planning process.



The Ecologically Sustainable Forest Management Plan (ESFM Plan) for the South Coast Forestry Region is being drafted and is expected to be available in December 2004. It will guide the management of State Forests.

The goals of the Plan are the:

- conservation of biodiversity;
- protection of soil and water quality;
- protection of cultural heritage; and
- provision of social and economic benefits.

## **6.3 Local Government Planning Controls**

### **6.3.1 Eurobodalla Urban Local Environmental Plan 1999 "Our Towns Tomorrow"**

This Plan applies to the majority of urban lands in the Eurobodalla Shire. It lays out a framework of planning controls based on general and zone-specific objectives. It acts in conjunction with a number of Development Control Plans, which express more detailed planning provisions for certain classes of development or for certain localities.

The particular objectives of this plan are listed in Clause 8. Those broadly relevant to estuary management are paraphrased as follows in relation to:

#### *6.3.1.1 Environmental protection*

- to protect coastal areas, estuaries, wetlands, rainforests and other environmentally sensitive areas from inappropriate development;
- to promote the retention of tree cover and to maintain landscape quality and natural ecosystems;
- to conserve soil, flora and fauna and significant natural features;
- to conserve and manage significant natural resources so their essential values are maintained and enhanced;
- to maintain the overall scenic beauty of the rural landscape; and
- to provide for the functions of riparian and foreshore areas to ensure stability, and to protect water quality and ecological, visual and recreational values.

#### *6.3.1.2 Ecologically sustainable development*

- to protect biological diversity; and
- to ensure that natural and environmental assets are properly valued.

#### *6.3.1.3 Land management*

- to reduce impact of flooding and ocean inundation and to reduce public and private losses due to flooding and ocean inundation; and



- to ensure that coastal development is compatible with the degree of coastline hazard.

#### 6.3.1.4 Heritage Conservation

- to conserve items, structures and places of natural, historic, scientific or cultural significance, including Aboriginal relics and places.

Clause 75 lists heritage items and known archaeological sites. In some parts of the Shire these items are of an estuarine nature, such as wharf remnants, rock retaining walls and boatsheds. In relation to Batemans Bay and the Clyde River, there are no heritage items currently listed under Clause 75 that have a connection to the estuary.

#### 6.3.1.5 Recreation and tourism

- to protect the quality of the area's natural recreational resources and to protect their environmental characteristics and sensitivity.

### 6.3.2 Eurobodalla Rural Local Environmental Plan 1987 (Rural LEP)

The Rural LEP applies to most rural lands in the Eurobodalla Shire. It applies land-use controls and development standards in each zone or to a type or class of development.

The Rural LEP includes two specific environment protection zones – the Wetlands Zone and Coastal Lands Protection Zone. It also includes the Coastal Lands Acquisition Zone and the Rural (Environmental Constraints and Agriculture) Zone with objectives of environmental protection. The objectives of the Wetlands Zone are directly related to ensuring protection of breeding and feeding areas for birdlife, fish and shellfish, and to promote rehabilitation.

Council is currently considering the Rural LEP for amendment. This will include a detailed review of possible further Rural 1c zones, which permit rural smallholdings subdivisions, guided by DCP 156 (see below). Rural 1c zones in the study area are at Nelligen and along Nelligen Creek.

## 6.4 Eurobodalla Development Control Plans

### 6.4.1 Residential Design and Development Guidelines

These DCPs/Guidelines contain objectives and guidelines relating to sunlight and solar access, privacy, views, floor space ratio, building heights, set-backs and building lines (including minimum 12 m set-backs from foreshore reserves), private open space, landscaping, parking and access and bushfire protection. The 'Introduction and Design Considerations' document also includes guidelines for site analysis, energy efficiency and mitigation of flood impacts.

Erosion and sediment controls are imposed on developments as conditions of consent. In addition, depending on the magnitude of the development, a soil and water management plan may be required to be submitted and approved prior to release of a construction certificate.

### 6.4.2 Development Control Plan No. 156 Rural Subdivision

This DCP aims to promote rural smallholdings subdivisions which:

- Maximise retention of native vegetation;
- Minimise potential for erosion, sedimentation and contamination of water courses;
- Avoid intrusion of development on visually significant ridges, hill slopes, drainage lines and other environmentally sensitive areas;
- Provide opportunity for the location of dwelling houses in sympathy with the capability of the land;
- Provide a mix of lot sizes;
- Provide safe, practical and environmentally compatible vehicular access; and
- Ensure compatibility with existing and future surrounding development.

### 6.4.3 Eurobodalla Shire Plan of Management – Natural Areas and Undeveloped Reserves

The general objectives of the plan are:

- To restore, preserve and protect the valuable characteristics of each ‘Natural Area’ of Community Land;
- To manage passive recreation opportunities that meet the needs of the community in Natural Areas consistent with the conservation of natural values of the land concerned;
- To manage a portfolio of smaller undeveloped areas for passive recreation in urban areas; and
- To promote visitor safety, awareness and appreciation of the natural environment.

Management issues addressed include landscape character; soils, drainage and waterways; pesticides, herbicides and fertilisers; noxious weeds and feral animals; fuel, oil and hazardous materials; and vegetation clearing including fire hazard reduction.

## 6.5 State Environmental Planning Policies (SEPP)

### 6.5.1 SEPP 14 - Coastal Wetlands

SEPP No 14 was gazetted on 12<sup>th</sup> December 1985 with the aim of ensuring the protection and preservation of coastal wetlands mapped under the policy. The policy applies to developments that have the potential to damage or destroy wetlands and required development proponents to prepare Environmental Impact Statements (EIS) for development in designated wetlands which involve:

- Clearing of land;
- Construction of a levee on the land;
- Draining the land; and/or
- Filling the land.

This SEPP does not sterilise land – rather it defines wetland areas where, if proposed for development, a more stringent examination of development impacts and a higher level of public involvement in review of those impacts both take place.

### 6.5.2 SEPP 26 - Littoral Rainforests

SEPP 26 aims to preserve littoral rainforests in their natural state. The SEPP details a "core area" of rainforest and also includes a "buffer area" of 100 metres around the core area. Development within the core area is designated. There are no littoral rainforests designated in the study area.

### 6.5.3 SEPP 35 – Maintenance Dredging of Tidal Waterways

SEPP 35 deals with the winning or removal and the disposal of extractive material from the bed of a tidal waterway by Council or other public authorities to enable the waterway:

- To continue to function as a tidal waterway; or
- To resume its function as a tidal waterway.

It removes the requirement for development approval for this activity. Consultation with government agencies is required, and a Review of Environmental Factors and possibly an Environmental Impact Statement for the activity must be prepared, depending on the level of impact.

### 6.5.4 SEPP 71 – Coastal Protection

This policy aims for improved State, regional and local planning and management decisions to better protect the coast. It gives the Minister for Planning the consent authority role for specified developments or State significant developments. Proposals for development in sensitive coastal locations fall under SEPP 71.

SEPP 71 furthers the implementation of the NSW Government's coastal policy. It has a number of specific aims summarized as follows, focusing on the sustainable use and management of the coast.

- Protection and improvement of public access;
- Preservation of Aboriginal heritage and knowledge;
- Protection of visual amenity;
- Preservation of beach environments and beach amenity;
- Protection of native coastal vegetation, marine environments and rock platforms;
- Ensures that type, bulk, scale and size of development is appropriate for the location and scenic amenity is protected; and
- Encourages a strategic approach to coastal management.

SEPP 71 will be informed by the results of the Comprehensive Coastal Assessment (CCA). The CCA aims to identify, analyse and assess data and information on the physical, biological, social, and economic values of the State's coastline. The CCA will provide a wide range of information about the features and values of the land, estuaries, people and industries of the coast, and identify trends affecting them.

## 6.6 State Agencies - Principles and Policy Objectives Relevant to Estuary Management

The State policies below are listed in order from the broad to the more issue specific.

### 6.6.1 NSW Biodiversity Strategy

The aim of the strategy is to protect the native biodiversity of NSW and to maintain ecological processes and systems.

The following principles apply:

- Proposals/activities should not decrease native biodiversity of either individual species or communities of a site or area;
- Proposals/activities should not be part of any threatening process to the native biodiversity of a site or area; and
- The precautionary principle is to be taken into account by careful evaluation of the consequences of management/development options to avoid, wherever possible, serious or irreversible damage to native biodiversity.

### 6.6.2 NSW Coastal Policy

The NSW Coastal Policy was adopted in November 1997 to comprehensively define and coordinate the management responsibilities of government and non-government organisations for the NSW coastline. For the purposes of this policy, the coastal zone includes coastal lakes, lagoons and the estuarine sections of coastal rivers, as well as the open coast. The overriding vision of the policy is the ecological sustainability of the NSW coast, and policy goals align with the principles of Ecological Sustainable Development.

The goals of the Coastal Policy are to:

- Protect, rehabilitate and improve the natural environment;
- Recognise and accommodate natural processes;
- Protect and enhance aesthetic qualities;
- Protect and conserve cultural heritage;
- Provide for ecologically sustainable development and use of resources;
- Provide for ecologically sustainable human settlement;
- Provide for appropriate public access and use;
- Provide information to effectively manage the coastal zone; and
- Provide for integrated planning and management of the coastal zone.

The making in 1992 of SEPP 71 (see above) by the NSW Government strengthens the role of the Coastal Policy in planning and development assessment.

### 6.6.3 NSW State Rivers and Estuaries Policy

The aim of the policy is to encourage sustainable development of the natural resources of the State's rivers, estuaries, wetlands and adjacent riverine plains. This is to reduce and where possible halt:

- Declining water quality;
- Loss of riparian vegetation;
- Damage to river banks and channels;
- Loss of biodiversity; and
- Declining natural productivity.

It also aims to encourage projects and activities that will restore the quality of the river and estuarine systems such as:

- Rehabilitating remnant habitats;
- Re-establishing vegetation buffer zones adjacent to streams and wetlands;
- Restoring wetland areas;
- Rehabilitating of estuarine foreshores; and
- Ensuring adequate streamflows to maintain aquatic and wetland habitats.

Notable management principles are:

- Remnant areas of significant environmental values should be accorded special protection; and
- Environmentally degrading processes and practices should be replaced with more efficient and less degrading alternatives.

### 6.6.4 NSW Wetlands Management Policy

The aim of this 1996 policy is to encourage projects and activities, which will restore the quality of the State's wetlands. The following principles apply:

- Water regimes needed to maintain or restore the physical, chemical and biological processes of wetlands will have formal recognition in water allocation and management plans;
- Land use and management practices that maintain or rehabilitate wetland habitats and processes will be encouraged;
- New developments are to allow for suitable water distribution to and from wetlands;
- Water entering natural wetlands is to be of sufficient quality so as not to degrade the wetlands;
- The construction of purpose-built wetlands on the site of viable natural wetlands is discouraged;
- Natural wetlands should not be destroyed, but when this is required as a result of social or economic imperatives, compensatory wetlands are to be constructed or existing wetlands rehabilitated;
- Degraded wetlands and their habitats and processes are to be actively rehabilitated as far as is practical;

- Wetlands of regional or national significance are to be conserved; and
- The adoption of a stewardship ethos and cooperative action between land and water owners and managers, government authorities, non-government agencies and the general community is necessary for effective wetland management.

### 6.6.5 NSW Estuary Management Policy

The NSW Government recognises the ecological, social and economic importance of the State's estuaries and is concerned about the long-term consequences of their accelerating degradation. The general goal of this policy is to achieve an integrated, balanced, responsible and ecologically sustainable use of the State's estuaries.

As such, the State's estuaries should be managed to ensure:

- No adverse impacts on the physical processes operating within the estuary, for example:
  - a reduction in the existing tidal prism as a result of reclamation may affect an estuary's flushing and water quality characteristics, and
  - any associated retaining wall construction may result in erosion of adjacent properties and destruction of foreshore flora and fauna.
- Intertidal and aquatic flora and fauna are adequately protected;
- Potential impacts on water quality of proposals during construction and operational phases are appropriately mitigated;
- Conflict between estuary users and uses are minimised;
- The visual impact of potential development is assessed, for example, the length of jetties, the extent of foreshore walls, the form and colour of structures, the degree of land clearing, etc; and
- The cumulative impacts of activities/proposals are considered in terms of their contribution to overall habitat loss and disturbance, water quality degradation, alienation of intertidal areas, increase in boat traffic etc.

### 6.6.6 NSW Flood Policy

The primary objective of the State Government's Flood Policy is to reduce the impact of flooding and flood liability on individual owners and occupiers, and to reduce the potential private and public losses resulting from all levels of flooding.

With regard to new development, the Policy is merits based, in which the impacts of flooding are balanced against planning, social, environmental and economic issues.

In assessing development proposals, consideration needs to be given, where appropriate, to:

- The potential impacts of flooding on the proposed development;
- The impact of the proposed development on flood behaviour both upstream and downstream of the site; and
- The possible impacts of flooding on residents and other users of the floodplain.

Particular attention should also be given to the availability of safe access and egress from flood affected property in times of flood. In this regard, the full range of potential flood events, up to the probable maximum flood (PMF) should be considered, together with the likely cumulative effects of future development.

### **6.6.7 Coastal Crown Lands Policy**

This policy was introduced in 1991 to devise specific strategies and actions to be implemented and/or coordinated by the then DLWC, with the aim of responsible management of coastal Crown land. Policy objectives relate to the rehabilitation, conservation and appropriate use of coastal Crown lands and the acquisition of significant coastal lands for future public use.

The provision of public access to coastal reserves, beaches and foreshores is a prime consideration of the policy in the future planning and management of coastal Crown lands. This policy would now fall under the umbrella of Department of Infrastructure Planning and Natural Resources.

### **6.6.8 Crown Land Foreshore Tenures Policy (Non-Commercial Operations)**

This policy was introduced in 1991 and provides a basis for responsible management of environmentally sensitive foreshore, intertidal and submerged areas of Crown lands.

The objectives of the policy are to:

- Conserve and maintain the natural and cultural environment of Crown lands and adjoining foreshore lands;
- Facilitate and optimise the use of Crown tidal and adjoining foreshore lands consistent with sound environmental management;
- Facilitate and maximise public access to Crown tidal and adjoining foreshore lands;
- Retain Crown tidal and adjoining foreshore lands in public ownership; and
- Administer existing and future occupation of Crown tidal and adjoining foreshore lands consistent with the above objectives.

Any foreshore occupation of Crown land will generally require the following factors to be considered by the Department:

- Consistency of the proposed development with the preferred use of the site from a land assessment adopted under the Crown Lands Act, 1989;
- Owner's consent granted by the Department to the lodgement of the development application with Council;
- Consistency with the Crown Land Foreshore Tenures Policy and other government plans strategies, and policies; and
- Compliance with any conditions imposed by the Department should a licence be offered for the occupation of the subject Crown land.

### 6.6.9 Aquatic Habitat Management and Fish Conservation Policy and Guidelines

These guidelines were released in 1998 (and updated in 1999) by NSW Fisheries. The document outlines general NSW Fisheries policy and sets up a framework for Habitat Protection Plans under the Fisheries Management Act, 1994.

General policies for the conservation of fish, marine vegetation and aquatic habitat include:

- Fish and their aquatic habitats are important natural resources and impacts on these resources must be assessed in all development and planning procedures using a precautionary approach;
- Aquatic habitats must be protected when the habitat is important to maintain biodiversity at the ecosystem, species or genetic levels or is required to maintain harvestable fish populations;
- Terrestrial areas adjoining freshwater, estuarine and coastal habitats should be carefully managed in order to minimise land-use impacts on these aquatic habitats. As a precautionary approach, foreshore buffer zones at least 50 metres wide should be established and maintained with their natural features and vegetation preserved; and
- Degraded aquatic habitats should be rehabilitated wherever possible to repair past environmental damage.

### 6.6.10 Habitat Management Guidelines and Fish Habitat Protection Plans (NSW Fisheries)

These Plans are being developed to enable detailed management plans with statutory backing. They are designed for the protection of key fish habitats "whether the habitat is critical for the survival of the species or required to maintain harvestable populations of fish". These plans balance the needs of fish, the broader community and the way that the fish habitat should be managed.

**Fish Habitat Protection Plan No. 1** is a general plan applying to developments impacting on fish habitat including dredging or reclamation, impeding fish passage, damaging marine vegetation and de-snagging.

**Fish Habitat Protection Plan No. 2** deals with seagrasses. Seagrasses are vital due to their role in maintaining sediment stability, water quality and in providing habitat and food for all aquatic biota. The objective of the Plan is to ensure that there is no net loss of seagrasses within the coastal and estuarine waters of NSW.

### 6.6.11 "Landowners Consent Manual (Draft)" [Waterways Authority]

This draft guideline is being developed by Waterways to provide guidelines to the authority, other agencies and the public on aspects such as foreshore structures. There is a classification proposed for a "Passive Zone" for 30 metres either side of the banks of a waterway, however jetties are permitted within this zone.

Generally jetties no longer than 15 metres in an area where jetties already exist will meet the guidelines. Longer structures will be allowed if they match existing structures.



### **6.6.12 South East Catchment Management Board - Catchment Blueprint**

Catchment Blueprints have been under final stages of development by Catchment Management Boards (CMBs) across NSW. The Blueprint for this board area has been adopted by the Minister.

The Blueprint provides a framework to support council's activities in Estuary Management. It may provide avenues of funding to implement properly prepared Estuary Management Plans. Additional details of the South East CMB are included in Appendix A.

We note the recent replacement of the South East CMB with the Southern Rivers Catchment Management Authority. The Authority will be reviewing all Catchment Blueprints over its area of influence in coming years. The Estuary Management Plan may require some updating to reflect any changes in management direction that this review produces.

### **6.6.13 Others**

In addition to the strategies and policies listed above, an Urban Streams Policy is being developed by DIPNR, a Riparian Zone Policy by DIPNR and policies and guidelines will flow from consideration of the Water Reforms Act.

## **6.7 Statutory Issues of Relevance to Batemans Bay and Clyde River Estuary**

While the previous discussion in this section all has relevance generically to the study area, some local issues stand out as particularly significant to this study.

### **6.7.1 Foreshore Land**

The study investigates the status of all public land abutting the river, which comprises a mix of State Forest, National Parks, Crown Land and Public (Council) Reserve.

Particular issues to be resolved where the foreshore is in private ownership are the future consideration of licences for private structures such as jetties or boat ramps along the foreshore in the village of Nelligen.

### **6.7.2 Development Potential**

A major consideration of this study has proven to be the development potential of land around the estuary. Public consultation has pointed to key localities that have received attention in this study:

- Current Rural 1c (Rural Smallholdings) zoned land on Nelligen Creek and extending immediately to the west of the village of Nelligen; and
- Land at North Batemans Bay currently Rural 1c but under investigation by the owner for Urban 10 zoning.

This study, elsewhere in the document, examines the suitability of these zones in relation to estuary health considerations.

## 7 DEFINITION OF REGIONAL SIGNIFICANCE AND VALUES

This section describes the significance of the Clyde River and Batemans Bay in a National and Regional sense. The local significance (a combination of values and uses) of the Clyde River and Batemans Bay has been derived from community consultation activities undertaken with the local community and other stakeholders. Based on the derived National, Regional and Local significance of the Clyde River and Batemans Bay a vision statement for the estuary has been developed. The vision statement provides a concise statement of the aim of future management initiatives in relation to the estuary.

### 7.1 National Significance

The whole of the Clyde River estuary is listed as containing nationally important wetlands in “A Directory of Important Wetlands in Australia”. The Directory lists the whole Clyde River estuary downstream of Cyne Malloves Creek, due to the relatively large areas of mangrove, saltmarsh and seagrasses. These wetlands provide potential habitat for migratory waders and important nursery habitat for commercial fish species.

The Clyde River contains wetland types categorised as:

- Estuarine waters – permanent waters of estuaries and estuarine systems of deltas;
- Sub-aquatic beds including seagrasses;
- Intertidal mud or sand flats;
- Intertidal marshes including salt-marshes; and
- Intertidal forested wetlands, including mangrove swamp forests.

The criteria for inclusion of the Clyde River estuary into the Directory are described as follows:

- It is a good example of a wetland type occurring in Australia, (in this case particularly representative of estuarine wetlands on the south coast); and
- It is a wetland system that is important as the habitat for animal taxa at a vulnerable stage in their life cycles.

Bird species that can be found at these wetlands are reported as poorly studied, however they would almost certainly include migratory species subject to international agreements with Japan and China.

The chenier sand plain forming part of the Cullendulla wetlands is considered to be of national scientific significance. This sand plain, interspersed with a series of sand ridges, provides one of the few sites remaining intact to demonstrate evolution of a shoreline. The development of these ridges has occurred from sea level fluctuations commencing about 6,000 years ago.

## 7.2 Regional Significance

### 7.2.1 Habitats

Broad sedimentary habitats on the Clyde estuary (sand and mud banks) are mainly restricted to the lower reaches of the estuary and the larger tributaries (i.e. Buckenbowra River, Cyne Mallowes Creek). Within these sedimentary habitats are vegetated (seagrass) and non-vegetated areas, both of which have high ecological and conservation values.

Estuarine wetlands are well developed throughout the lower Clyde River, forming the largest area of wetlands on any estuary in the Illawarra - South Coast region. There are a total of 54 separate wetlands in the Clyde River estuary that are designated by legislation under State Environmental Planning Policy No. 14 (SEPP 14) (see Figure 3-8).

West et al (1985) lists the Clyde River, Cullendulla Creek and Batemans Bay as supporting areas of wetland vegetation as detailed in Table 7-1.

**Table 7-1 Clyde River Wetland Areas (after West et al 1985)**

	<b>Mangrove Area (hectares)</b>	<b>Seagrass Area (hectares)</b>	<b>Saltmarsh Area (hectares)</b>
Clyde River	231.8	9.2	101.7
Cullendulla Creek	91.6	6.4	0.6
Batemans Bay	0	7.1	0
<b>TOTALS</b>	<b>323.4</b>	<b>22.7</b>	<b>102.3</b>

The substantial mangrove forests on this estuary represent 70% of mangroves in the Eurobodalla Shire.

Batemans Bay is one of only two estuaries on the Eurobodalla coast that supports *Posidonia australis* (strapweed). *Posidonia* is sensitive to habitat change, and its recovery from disturbance is very slow. Healthy beds are located in a small sheltered patch at the southern end of Corrigans Beach.

Saltmarsh is generally in decline along much of the NSW coastline. On a regional basis, the Clyde River, Batemans Bay and Cullendulla Creek saltmarsh areas are of high significance. West *et al* (1985) suggested that the whole estuary contained the fourth largest area of saltmarsh in the Illawarra - South Coast region.

Terrestrial ecosystems that are defined as 'Vulnerable' (NPWS 2000) are well represented in the study area (refer Figure 3-6 and Figure 3-7). Many are associated with the estuarine wetlands described above. Also of note are the significant stands of Forest Redgum (ecosystem 54) in the Buckenbowra River catchment, which represent about one third of the remaining Forest Redgum remnants in the shire.

### 7.2.2 Fisheries and Aquaculture

The Batemans Bay/Clyde River estuary contains a regionally important oyster industry. The Sydney rock oyster (*Saccostrea glomerata*) industry within the estuary is the fifth largest in NSW and the largest on the NSW south coast.

Oyster leases covering an approximate area of 249 hectares are situated in the mid reaches of the estuary. Oyster production for the Clyde River estuary, averaging about 5,000 bags annually, represents 7.7% of NSW production (1995 to 2000), which was almost double the Clyde's market share in the period from 1937 to 1995. In the local context, current production represents almost 47% of the oyster production from all far south coast estuaries.

The annual oyster harvest in 2001/02 had a value of almost \$3 million. This was comprised of 716,554 dozen oysters or approximately 7,000 bags.

The Clyde River oyster industry relies on the estuary's high water quality. The availability of locally grown and processed oysters is an asset with potential for overseas export (A. Thors, pers. comm.). This requires the estuary waters to pass a stringent international classification procedure. Local growers have been investing in monitoring to achieve this classification over the last few years.

The Clyde River estuary is the eighth largest finfish producer of all NSW south coast estuaries. In terms of catch value, the Clyde ranks 10th of all south coast estuaries, with an annual average value over the 15 years from 1984/85 to 1998/99 of \$51,000. The average weight of annual catch over this period was 17,000 kilograms. These statistics notably exclude the Batemans Bay commercial prawn catch, which is seaward of the boundary that defines the estuary fishing zone.

### 7.2.3 Commercial, Tourism and Waterway Uses

Batemans Bay is the major commercial centre in the Eurobodalla Shire. 'The Bay' is currently expanding to become a major regional commercial centre. Hand in hand with this growth, a steady increase in tourism is expected, with Eurobodalla Tourism's active promotion of the area's natural attributes.

Batemans Bay provides a range of tourism experiences focussing on the estuary and access to offshore fishing, diving activities and seasonal whale-watching. Batemans Bay provides the only major marina berths between Ulladulla and Bermagui.

The presence of Batemans Bay is a substantial tourism drawcard. Inputs to the area's economy derived from recreational and commercial waterway activities are significant.

### 7.2.4 Conservation

The overall Clyde River system is recognised as a river of high conservation status by the South Coast Water Management Committee and the State Government. It is placed as high priority for water sharing plan development and vulnerability assessment by the South East Catchment Blueprint (SECMB 2003). It is also a high priority river for the development of a Fish Habitat Action Plan.

### 7.2.5 Cultural

Records of Aboriginal occupation identify numerous sites around the estuary that are considered culturally significant by the indigenous community. One of the most significant areas is the Cullendulla Creek lowlands, which contain Aboriginal burial, midden and artefact scatter sites. The site complex is unique in its representation of Aboriginal exploitation of an environment that occurs nowhere else in New South Wales (Mills, 1994).

Records of Berry and Johnston, who charted Batemans Bay in 1821 and 1822, reported a large Aboriginal population around the bay and the Clyde River, including occupation of Snapper Island and the Tollgates (in Mills 1994).

The Clyde River also holds significant European heritage value, with settlement of the foreshore areas dating back to the late 1820's. The earliest records of timber-getters working in areas north of Batemans Bay extend back to 1803 (Mills, 1994) with a report in the Sydney Gazette of conflicts with Aborigines in that year and also in 1821.

### 7.2.6 Scientific

The Clyde River is located in a drowned river valley. As a result, it has relatively narrow and steep intertidal shorelines. These attributes make the Clyde River estuary distinctive, compared to most other south coast estuaries.

The Clyde is one of a few coastal rivers known to deliver sand to the coastal zone. The interaction between river flows and oceanic processes shapes the sand shoals around Batemans Bay. Furthermore, the supply and movement of sand is related to the behaviour and stability of Batemans Bay's many beaches.

The Cullendulla embayment is of scientific interest. The chenier sand plain forming part of the Cullendulla wetlands is recognised for its national significance. The Aboriginal history of the Cullendulla area is a resource for scientific study and education.

## 7.3 Local Community Significance

Community consultation has been undertaken by WBM between April and August 2003 as part of the study in order to gain an appreciation of community/stakeholder uses and values of the estuary, and also to gain an understanding of the what are the estuaries perceived threats and current conflicting uses. Consultation work that has been undertaken to date in relation to this study includes:

- Holding a public meeting (early April);
- Distributing a discussion paper to the local and greater community (during May);
- Consulting with landowners, interested community members and key stakeholders;
- Inspecting the estuary and river with landowners, interested community members and key stakeholders;
- Maintaining a high profile in local media; and
- Maintaining a free call number and a project website.

In relation to the discussion paper, some forty-seven (47) people completed (and returned) the discussion paper and we also received several written submissions. This has provided us with some very useful insights into the community's uses, values and perceptions as to what are the key threats facing the estuary/river. However, it must be recognised that 47 responses represents only a relatively small percentage of the entire local populace. This does limit how "representative" the data is of the whole community, however, the intention of the discussion paper was to gain an insight and this goal has been achieved.

### 7.3.1 Estuary Uses

The results of the discussion paper indicated that the most common uses of the estuary are primarily recreational, as detailed below (ranked in order of apparent community priority):

1. Recreational fishing;
2. Swimming;
3. Riding and/or walking;
4. Picnicking;
5. Power boating; and
6. Sailing (note one response represents a large number of participants which is difficult to rank).

Of these primary uses, recreational fishing is considered the highest priority by more than half of the respondents.

Respondents indicated that the most highly utilised area is the stretch of the Clyde River spanning from the Princes Highway Bridge upstream to Nelligen. This region is primarily used for fishing, boating and oystering. The northern and southern foreshores of Batemans Bay are also highly utilised for riding, walking and swimming. The relative usage of Batemans Bay (between Snapper Rock and the Tollgates) and the Clyde River (upstream of Nelligen as far as Shallow Crossing) is much less than the section between the Bridge and Nelligen.

### 7.3.2 Estuary Values

These responses to the discussion paper reflect the values of the local community. The six most highly valued aspects from the recent community survey are detailed below:

1. Natural surroundings (i.e. native flora and fauna);
2. Recreational opportunities;
3. "Good" water quality;
4. Access to water;
5. Peace and tranquillity; and
6. Aesthetic appreciation (i.e. views).

Respondents' highest priority estuarine values included recreational opportunities, "good" water quality, natural surroundings and aesthetic appreciation. Other highest priority values included, access to water and peace and tranquillity. Given the average age of the respondents (approximately 58) it is likely that a high percentage of these persons are retired and use the Bay purely for recreational purposes. The priorities identified in the discussion paper are consistent with what would be expected for persons who use the Bay recreationally.

### 7.3.3 Previous Consultation

The Batemans Bay / Clyde River Estuary Management Committee at its meeting of 27th March 1997 adopted a prioritised list of issues and values, following lengthy consultation with committee members and user groups. These issues are summarised as follows:

#### 7.3.3.1 Major Issues

- Maintain quality of catchment runoff & estuary waters;
- Values of wetlands / aquatic vegetation and migratory birds;
- Batemans Bay sediment dynamics and sand supply related to beach amenity;
- River erosion / sedimentation;
- Value of aquaculture & oyster industry – reliance on water quality; and
- Wharves & jetties and user access.

#### 7.3.3.2 Intermediate Issues

- Heritage issues - European & Aboriginal; and
- Boating activity and potential water quality impacts.

#### 7.3.3.3 Minor Issues

- Fish habitat and Aquatic Reserves; and
- Recreational and foreshore access issues.

It is noted that, although a mix of issues and values, this list is more complete in the detail of its consideration of issues than the more recent community survey. This is to be expected as it includes input from a broad cross-section of estuary users and state agencies. Interestingly, these values incorporate many of the issues and values list developed by the community/stakeholders six years later. Other more specific values noted by the committee but not given emphasis by the community's recent discussion paper responses include:

- The area's significant Aboriginal and European heritage;
- Migratory bird habitat; and
- Beach amenity.

## 7.4 Economic Values

One of the major industries of the Shire is tourism. Advance Tourism (1997) listed the five most appealing features of the Eurobodalla Coast as:

- The beaches;
- National Parks;
- Montague Island cruises;
- Restaurants, food and wine; and



- Historic sites.

Batemans Bay offers opportunity for most of these facilities. Further to the above, offshore whale-watching tours departing from Batemans Bay have become a significant attraction in recent years.

Batemans Bay and the Clyde River are part of a package of coastal attractions in Eurobodalla Shire. The latest figures available from Tourism NSW estimate the number of visitors to the area in 2001 as 3.1 million. Total spending by visitors for the same period was estimated by Tourism NSW to be \$208 million, an increase of \$37 million since 1996/97 estimates.

The NSW oyster industry is the most valuable aquaculture industry in the State and the most valuable agricultural enterprise per unit of area (Healthy Rivers Commission 2003). The Clyde River's Sydney rock oyster industry is the largest on the NSW South Coast. It has a relatively stable annual production and is a consistent local employment generator. The value of this industry in direct income terms is almost \$3 million per annum. In indirect terms, there is considerable value to tourism of the attraction of a locally grown and harvested product. The Eurobodalla Nature Coast Tourism Development Strategy (Advance Tourism 1997) identified oyster bars and oyster tasting cruises as potential new tourism products that should be encouraged and supported.

## 7.5 Environmental Values

This section describes what we conclude to be the Clyde River estuary's regionally significant nature conservation values. Some of these values have been discussed in more detail in Sections 7.1 and 7.2.1.

The estuary provides limited habitat for a range of different species, many of which are listed threatened or migratory species. A compilation of available data on listed bird species occurring in the study area is shown below (*NPWS threatened species database and WBM May 2000*).

**Table 7-2 Bird species that are known to utilise the study area**

Common Name	Scientific Name	Status
Sooty Oyster Catcher	<i>Haematopus fuliginosus</i>	Vulnerable
Pied Oyster Catcher	<i>Haematopus longirostris</i>	Vulnerable
Hooded plover	<i>Thinornus rubicollis</i>	Endangered
Osprey	<i>Pandion haliaetus</i>	Vulnerable
Black Bittern	<i>Ixobrychus flavicollis</i>	Vulnerable
Eastern Curlew	<i>Numenius madagascariensis</i>	JAMBA, CAMBA
Bar-tailed Godwit	<i>Limnosa lapponica</i>	JAMBA, CAMBA
Sharp-tailed Sandpiper	<i>Calidrus acuminata</i>	JAMBA

*JAMBA and CAMBA denote protected migratory species under international agreements with Japan and China respectively.*

Of possibly the most significance is the presence of 54 separate SEPP-14 wetlands in the Clyde River estuary (see Figure 3-8). This attests to the extent of the areas' coastal wetlands, which provide diverse estuarine habitats. These wetlands also form part of the scenic quality of the estuary system.

The Clyde River is known to contain the Australian Grayling (*Prototractes maraena*), a federally-listed Endangered Species. The Australian grayling requires free movement between fresh water and



marine habitats. Larger populations are restricted to a few rivers (eg Tambo River in Victoria) and are reasonably common in freshwater reaches of the Clyde River. Larvae and juveniles are thought to spend some time in the estuary before migrating upstream to freshwater reaches.

The Cullendulla coastal floodplain contains sand ridge features of national geomorphological scientific interest (Mills 1994). Its relatively undisturbed saltwater wetlands (SEPP-14 Wetland 215) are of regional significance. The estuarine area at Cullendulla Creek, including the sand flats at the mouth of the creek, is an important area for wetland birds, including international migratory waders. Endangered fauna known or expected to occur in this area are the Pied Oystercatcher, Sooty Oystercatcher and Black Bittern. The White-bellied Sea-eagle is reported to nest on Square Head (Mills 1994).

Aboriginal sites in the Cullendulla Creek area represent a cultural landscape of considerable scientific and educational significance. Over thirty Aboriginal sites have been recorded in this area (Mills, 1994).

These values are given support by the area's Nature Reserve status. The Cullendulla Creek boardwalk established by National Parks and Wildlife Service provides a valuable education opportunity for the public to learn about estuarine wetlands and their ecosystems.

The terrestrial ecosystems of the Clyde River valley incorporate Forest Redgum (NPWS ecosystem 54) communities, forming one third of the remaining ecosystem 54 stands in the shire. Other ecosystems associated with wetlands and fringing riparian vegetation are also significant.

## 7.6 European Heritage Values

Items of European Heritage significance are noted in Clause 75 of Council's Urban LEP. There are no heritage items currently listed under the Urban LEP that have a connection to the estuary.

The river was a very important transport route for the timber industry. Early timber getters would have been seeking high quality boat building materials from local eucalypt forests. Some sites of historical interest should be considered for recognition:

- The old Perry's sawmill site in Batemans Bay adjacent to the river at Beach Road;
- A number of other riverside sawmill sites, especially upstream of Nelligen. There is evidence of ballast dumping at these sites;
- The remains of a number of log loading wharves/ramps in the upper estuary; and
- The remains of the sawn timber loading facility at the head of the 100 year old wood railed tramway in the Cullendulla Creek estuary.

The remains of a very old road, alleged to have been built by convicts in the mid 1800's, is located on State forest near the tidal limit of the Buckenbowra River.

Two old industries upstream of Nelligen have some local significance:

- Ship building site; and
- Starch factory site at Currowan.

The remains of the vehicle punt approaches at Batemans Bay and Nelligen are of local significance.

## 7.7 Vision Statement

Based on the derived National, Regional and Local significance of the Clyde River and Batemans Bay a vision statement for the estuary has been developed. The vision statement provides a concise statement of the aim of future management initiatives in relation to the estuary. The vision statement is detailed below:

**“The catchments, waterways and tributaries of the Clyde River estuary and Batemans Bay will be protected and enhanced to preserve their environmental, social and cultural (both Aboriginal and European) features that are of local, regional and national significance. Environmentally sustainable recreational and economic uses of the Clyde River estuary and Batemans Bay will be encouraged, to ensure that they remain a viable natural resource that can be appreciated in the same way by future generations.”**

The vision statement captures the community’s values and provides a focus for future estuary management.

## 8 DEFINITION OF MANAGEMENT OBJECTIVES

This section describes how management options and/or objectives were derived for the Batemans Bay and Clyde River estuary.

### 8.1 Development of Management Objectives

Management objectives presented in this section aim to address identified conflicts in use and threats to the long-term sustainability of the estuary. Management objectives also aim to protect and maximise inherent social/cultural, economic and environmental values, while providing the impetus for modifying inconsistent management approaches to allow the “vision” for the estuary to be achieved (refer Section 7.6).

In order to develop management objectives that encapsulated community and stakeholder opinions, a workshop was held with estuary management committee members, stakeholders and other interested members of the public, specifically to discuss the existing uses, values of the estuary, identified threats and conflicts in use, that currently exist.

The workshop facilitated by WBM and Peter Spurway was conducted in the afternoon of 7<sup>th</sup> August 2003 at the Catalina Country Club in Batemans Bay. There were approximately 30 people in attendance.

The format of the workshop included a presentation of all management options/objectives developed for Batemans Bay and the Clyde River. These management options/objectives were previously detailed in the ‘Community Workshop Background Document’ (WBM, 2003), which was distributed prior to the workshop. One additional management option was included for consideration at the workshop following discussion amongst workshop participants.

### 8.2 Management Option/Objectives

The management options/objectives put forward for consideration **at the workshop** were derived from diverse sources including community and stakeholder consultation, previous engineering and scientific investigations within the catchment and from our own previous estuarine management experience. Outlines of the specific management options/objectives presented at the workshop are provided below, with further details supplied in Appendix B.

#### 8.2.1 Conservation/Enhancement of Ecological Communities and Habitats

- **E1** - Protect/enhance vulnerable vegetation ecosystems and key faunal habitats and linkages;
- **E2** - Manage future development (rural, urban or semi-urban) in areas of high conservation value within the Clyde River catchment;
- **E3** - Protect, and where appropriate rehabilitate, riparian vegetation corridors;
- **E4** - Protect and enhance existing wetlands, saltmarshes, mangroves and other key estuarine habitat areas; and

- **E5** – Perform regular estuarine 'health' monitoring.

### **8.2.2 Maintenance/Improvement of Water Quality by Minimisation of Catchment (diffuse) Loads and Point-Source Pollutant Loads**

- **WQ1** - Ensure water quality within the estuary remains suitable for its current and future usages (including primary and secondary human contact, aquatic habitats and edible seafood);
- **WQ2** - Impose best management practices for water quality (including sediment from erosion) control practices on future development (rural, urban or semi-urban) in the Clyde River catchment;
- **WQ3** - Encourage best management of riparian buffers and other practices to manage potential pollutant loads to the estuary associated with human activities within the catchment;
- **WQ4** - Support and integrate aspects of the Estuary Management Plan with the recommendations of the South East Catchment Blueprint; and
- **WQ5** - Continue to implement stormwater controls and education programs to proactively manage the quality of urban runoff entering the estuary.

### **8.2.3 Sustainable Commercial and Recreational Uses of Estuaries and Visual Amenity**

- **S1** - Promote NSW Fisheries to develop a Fish Habitat Action/Management Plan of the existing Clyde River estuary and other areas of Batemans Bay;
- **S2** – Maintain the standard of socially and environmentally acceptable oyster farming practices in Clyde and continue to support the oyster industry's sustainable growth;
- **S3** - Maintain visual amenity of estuaries, foreshores and outlooks, by the promotion sympathetic developments to limit visual impacts;
- **S4** – Prepare water sharing agreements for the Clyde River;
- **S5** - Promote water and foreshore based recreational, commercial and tourist-oriented activities within the confines of social impacts, waterway capability and other EMP recommendations.
- **S6** – Perform cost/benefit analysis of bar dredging and additional studies to investigate enhancement of navigability and bar safety.<sup>1</sup>

## **8.3 Consultation Results**

After all the workshop items had been discussed with workshop attendees and agreed wording changes made to the options, attendees were requested to rank the objectives by voting for those they considered to be most important (i.e. highest priority). Attendees at the workshop are included in Appendix C.

The results are provided in Table 8-1.

<sup>1</sup> this option was included for consideration as a result of discussions held during the preceding Estuary Management Committee meeting, refer Appendix B for more information.

**Table 8-1 Results of Workshop Ranking of Management Options**

Option	Score	Option	Score	Option	Score
E1	1	WQ1	25	S1	33
E2	3	WQ2	11	S2	0
E3	0	WQ3	1	S3	5
E4	1	WQ4	0	S4	0
E5	2	WQ5	2	S5	5
-	-	-	-	S6	15

The highest ranked objectives from this exercise have highlighted cells in Table 8-1. These objectives have been given high priority for implementation (i.e. where possible these issues will be addressed first). The current priority ranking of the remaining objectives has been further detailed in Section 9.0.

It should be noted that some strategies appear to have been ranked highly due to current community concerns relating to these issues, i.e. these issues may have been topical in the local community. The priority of items is likely to change over time due to shifting community perception (maybe relating to shifts in topical issues), elimination/cessation of issues (i.e. the problem has reduced or been addressed), gaining of further scientific information, changes in required management approaches (as a result of policy changes at either a Local, State or National level). Later revisions of the Management Study will identify the required priority changes.

## 8.4 Further Explanation of Management Options/Objectives

Additional details of the basis and aim of the various management options/objectives included in Table 8-1 and expanded on in Section 9 are included in Appendix B. This information has been extracted directly from the 'Community Workshop Background Document' (WBM, 2003) supplied to workshop attendees in June 2003.

## 9 DEFINITION OF MANAGEMENT STRATEGIES

A successful Estuary Management Study identifies a set of management strategies that contribute to the greatest extent to the achievement of identified management objectives/options within available time limits. The ability of a management strategy to do this depends on how far the strategy goes to addressing the management objective and the success of responsible agencies (e.g. Council, DIPNR etc) in implementing the strategy (which is a factor of several things, such as difficulty, cost etc). There are many management strategies that may contribute to the achievement of the management objectives/options defined for the estuary in the previous section.

The community/stakeholder workshop assisted in identifying management options and/or objectives for the estuary considered to be of a high priority from a stakeholder/community viewpoint. The project team has applied their own judgement to the remainder of the management options in order to determine their priority. This process was not a rigorous one (i.e. based on specific methodology); rather, it relied on the knowledge/experience of the project team in having studied/dealt with the estuary, and other similar estuaries, over the past several years. It should be made clear that the priority of an option identifies, roughly, the order in which this requirement will be addressed by the nominated responsible authorities.

Strategies proposed to address the options are listed in the following tables, which provides details of the:

- Specific management strategies;
- Overall priority of the management option and strategies (high, medium and low) for implementation;
- Organisations responsible for implementing the strategies;
- Expected contribution (high, medium or low) that the strategy will make towards the achievement of the management options (note this item has on occasions been left blank as it can be difficult to estimate the effectiveness of strategies in addressing their objective);
- Potential impacts and benefits of the proposed strategies; and
- Reasons for implementing the management strategy.

Details on approximate capital and operational costs will be prepared as part of the development of the Estuary Management Plan, when the broad strategies provided are broken down into smaller sets of actions.

### 9.1 Further Explanation of Management Options/Objectives

Additional details of the basis and aim of the various management options/objectives included in Table 8-1 and expanded later in this section are included in Appendix B. This information has been extracted directly from the 'Community Workshop Background Document' (WBM, 2003) supplied to workshop attendees in June 2003.

## 9.2 Management Objectives and Options Matrices

**Table 9-1 Objective S1 - Develop Fish Habitat Protection Plan**

Management Strategies	Priority	Potential benefits and impacts	Responsible organisation(s)	Contribution to achieving Objectives	Reasons
<ol style="list-style-type: none"> <li>Scientifically assess the potential impacts of commercial and recreational fishing (if economically feasible to do so) on the habitats and species of Batemans Bay and the Clyde River. This management strategy is closely related to community expectations and concerns and should be focussed on sustainable outcomes.</li> <li>if as a result of these investigations there are identified impacts resulting from recreational and/or commercial fishing/prawning activities, Council will approach NSW Fisheries to declare Fishing Closures (as appropriate to the scale of the impact), to protect areas of the estuary potentially subject to habitat damage as a result of commercial and/or recreational fishing / prawning practices.</li> <li>Consider appropriate location for Aquatic Reserve in outer Batemans Bay.</li> </ol>	<ul style="list-style-type: none"> <li>High</li> </ul>	<p>B - Improved commercial and recreational fishing catches</p> <p>B – Improved tourism to area to capitalise on improved recreational fishing</p> <p>I – Possible changes in allowable fishing and/or boating locations, times and methods</p> <p>I – Possible review of current commercial fishing licences in area</p>	<ol style="list-style-type: none"> <li>Council/NSW Fisheries</li> <li>NSW Fisheries</li> <li>Marine Parks Authority NSW Fisheries NPWS</li> </ol> <p>(numbers relate to Management Strategies)</p>	<ul style="list-style-type: none"> <li>High</li> </ul>	<ul style="list-style-type: none"> <li>Potentially provides basis for sustainable recreational and commercial fishing and prawning on the estuary.</li> <li>Addresses community perceptions of overfishing.</li> <li>Addresses community concerns that there are insufficient fish habitat areas in the estuary.</li> <li>Addresses lack of representative Aquatic Reserves in NSW South Coast open embayments.</li> </ul>

Table 9-2 Objective WQ1 - Maintenance of water quality

Management Strategies	Priority	Potential benefits and impacts	Responsible organisation(s)	Contribution to achieving Objectives	Reasons
<ol style="list-style-type: none"> <li>Maintain the current water quality monitoring program and water quality database development.</li> <li>The Batemans Bay Oyster Growers Association (BBOGA) will provide water quality data, (and other eco-system health data) to Council on a regular basis.</li> <li>Prepare two yearly water quality interpretation reports for distribution to DIPNR, EPA, NSW Fisheries and the Batemans Bay Oyster Growers Association (BBOGA) for review.</li> <li>Revise water quality reporting and/or sampling methodologies based on comments received.</li> <li>Implement any actions arising out of the review of the water quality reports.</li> <li>Continue to investigate measures to reduce sewage pollution from vessels by auditing commercial vessels for compliance, and undertaking education campaigns regarding potential pollutant generation from boating.</li> <li>Develop local contingency plan for vehicle accident / oil or contaminant spill on Princes Hwy bridge.</li> <li>Ensure regular review of sewer spill response plan.</li> <li>Discuss with Southern Energy alternatives for slashing power lines at wetland and creek crossing locations.</li> <li>Allocate ongoing funding to progressively seal and improve drainage on gravel roads at creek crossings or at locations where road drainage directly enters the Clyde River or its tributaries.</li> <li>Adopt the ANZECC (2000) guidelines as the basis for developing revised Water Quality Objectives for Batemans Bay and the Clyde River</li> </ol>	<ul style="list-style-type: none"> <li>High</li> </ul>	<p>B - Expanded markets for Clyde River oysters.</p> <p>B – Maintenance of long term water quality data records which will assist in identifying long term trends</p> <p>B – Maintenance of a long term water quality database representative of a near pristine estuary</p> <p>B - Maintain and enhance the Clyde's reputation as a pristine waterway.</p>	<ol style="list-style-type: none"> <li>Council/DIPNR</li> <li>Oyster Growers</li> <li>Council</li> <li>Council</li> <li>Council/Others</li> <li>Waterways</li> <li>NSW Fire Brigade / RTA / Council</li> <li>Council</li> <li>Council / Southern Energy</li> <li>Council</li> <li>DEC/Council</li> </ol> <p>(numbers relate to Management Strategies)</p>	<ul style="list-style-type: none"> <li>Potentially High</li> </ul>	<ul style="list-style-type: none"> <li>Provides a sound benchmark for regular review of estuary water quality.</li> <li>Combines reasons and makes management of water quality multi-disciplinary.</li> <li>Assists in addressing community values for "good" water quality.</li> </ul>



**Table 9-3 Objective S6 - Cost/benefit analysis of bar dredging and additional studies to investigate enhancement of navigability and bar safety**

Management Strategies	Priority	Potential benefits and impacts	Responsible organisation(s)	Contribution to achieving Objectives	Reasons
<ol style="list-style-type: none"> <li>1. Initiate a technical review of the navigability of the ocean bar in Batemans Bay, backed up by field-data collection as required. The review would include cost benefit analyses of required improvements to bar (if any) and likely economic benefits these would bring to the community. Consideration of wider environmental impacts of bar improvement options will be incorporated in the assessments. Operational, advisory and safety improvements would be investigated as part of this review and other strategies will feed into the review e.g. from the Waterway Users Management Plan (WUMP).</li> <li>2. Formulate a proactive bar depth monitoring and reporting procedure to provide RVCP with detailed bar depth and channel alignment information to pass on to mariners.</li> </ol>	<ul style="list-style-type: none"> <li>• High</li> </ul>	<p>B - Clarify cost and benefit implications of bar improvements.</p> <p>B - Allow all feasible management options to be scrutinised.</p>	<ol style="list-style-type: none"> <li>1. Council / Waterways</li> <li>2. Council / Waterways</li> </ol> <p>(numbers relate to Management Strategies)</p>	<p>Strategies will address management objective</p>	<ul style="list-style-type: none"> <li>• Relates to community concerns that insufficient bar depth is limiting growth of some forms of boating activity.</li> <li>• Provides up to date information on bar safety to mariners.</li> </ul>

**Table 9-4 Objective WQ2 - Stormwater and water quality management of future development**

Management Strategies	Priority	Potential benefits and impacts	Responsible organisation(s)	Contribution to achieving Objectives	Reasons
<ol style="list-style-type: none"> <li>1. Closely monitor construction practices (including construction of roadways and landclearing activities) that are likely to have impacts that would affect the ability of the estuary to meet its water quality objectives.</li> <li>2. Monitor annual levels of land clearing and report in Council's State of the Environment Report.</li> <li>3. Continue to implement erosion and sediment controls for new developments and stormwater education programs to proactively manage the quality of urban runoff entering the estuary.</li> <li>4. Promote the appropriate use of Water Sensitive Urban Design for urban development.</li> <li>5. Ensure pollutant reduction requirements in the USQMP for construction and post-construction phases of new development will allow WQO for Batemans Bay and Clyde River to be achieved.</li> <li>6. Seek funding to install 'at-source' control of litter in stormwater pits around Batemans Bay CBD.</li> </ol>	<ul style="list-style-type: none"> <li>• High</li> </ul>	<p>B - Maintain and enhance the Clyde's reputation as a pristine waterway.</p> <p>B – Supports the aquaculture and fishing industries of Batemans Bay.</p>	<ol style="list-style-type: none"> <li>1. Council</li> <li>2. Council</li> <li>3. Council</li> <li>4. Council</li> <li>5. Council</li> <li>6. Council</li> </ol> <p>(numbers relate to Management Strategies)</p>	<ul style="list-style-type: none"> <li>• Potentially High</li> </ul>	<ul style="list-style-type: none"> <li>• Relates to community concerns regarding the number of water polluting activities happening in the catchment.</li> <li>• Relates to community concerns regarding the style of landclearing happening in the catchment.</li> </ul>

**Table 9-5 Protect/enhance vulnerable vegetation ecosystems and key fauna habitats and linkages**

Management Strategies	Priority	Potential benefits and impacts	Responsible organisation(s)	Contribution to achieving Objectives	Reasons
<ol style="list-style-type: none"> <li>1. Protect (and where possible enhance) vulnerable vegetation areas, key habitat areas and/or key faunal movement corridors by extending the funding for Council's 'Habitat Recovery and Incentive Program' into the Clyde catchment.</li> </ol>	<ul style="list-style-type: none"> <li>• Medium / Low</li> </ul>	<ul style="list-style-type: none"> <li>• Low impact as this strategy has (in part) been put into place in Council's planning and NRM policies.</li> </ul>	<ol style="list-style-type: none"> <li>1. Council</li> </ol> <p>(numbers relate to Management Strategies)</p>	<ul style="list-style-type: none"> <li>• Potentially High</li> </ul>	<ul style="list-style-type: none"> <li>• Biodiversity preservation for key attributes of the 'Nature Coast'.</li> <li>• Partly addresses community values of having/maintaining natural surroundings</li> </ul>

**Table 9-6 Protect, and where appropriate rehabilitate, riparian vegetation corridors**

Management Strategies	Priority	Potential benefits and impacts	Responsible organisation(s)	Contribution to achieving Objectives	Reasons
<ol style="list-style-type: none"> <li>1. Protect riparian vegetation through the implementation of planning controls. Controls should be placed on any further clearing of riparian corridors along the Clyde River to a minimum depth of 100m from the bank. Appropriate riparian corridor widths should be applied for lower order tributaries and stream.</li> <li>2. Address any poor management practices that may be occurring on Crown Land Leases within the catchment.</li> <li>3. Enhance areas of riparian vegetation that will assist in improving stormwater quality, faunal movement or provide key habitat. Disseminate information pertaining to degraded habitats to landowners and Landcare groups.</li> <li>4. Impose best management practices in relation to riparian buffers to manage potential pollutant loads to the estuary associated with new development within the catchment.</li> </ol>	<ul style="list-style-type: none"> <li>• Medium</li> </ul>	<p>B – Improvement in water quality, key habitat extent and movement of faunal species throughout the estuary and its catchment.</p> <p>B – Improved community and landowner awareness of benefits of riparian zones.</p>	<ol style="list-style-type: none"> <li>1. Council</li> <li>2. Dept Lands</li> <li>3. Council</li> <li>4. Council</li> </ol> <p>(numbers relate to Management Strategies)</p>	<ul style="list-style-type: none"> <li>• Potentially High</li> </ul>	<ul style="list-style-type: none"> <li>• Consistent with WQO and sustainable biodiversity management.</li> <li>• 100m is consistent with State Forest reserve practices on 30km of the estuary.</li> <li>• Addresses community concerns for protecting these areas</li> </ul>

**Table 9-7 Protect and enhance overall estuarine health and health / extent of existing wetlands, saltmarshes, mangroves and other key estuarine habitats**

Management Strategies	Priority	Potential benefits and impacts	Responsible organisation(s)	Contribution to achieving Objectives	Reasons
<ol style="list-style-type: none"> <li>1. Map the extent, location and condition of key estuarine habitats (not just SEPP14 wetlands) to enable identification of stressed or damaged habitat areas for remediation or repair. Ongoing aquatic vegetation mapping programs by NSW Fisheries and Wollongong University may provide data and change analysis.</li> <li>2. Continue regular estuarine health monitoring and rapid habitat assessments of instream and riparian habitats throughout the tidal zones of the Clyde River (for example seagrass health monitoring) to serve as an indicator of overall estuarine health.</li> <li>3. Continue public awareness program to reduce chance of <i>Caulerpa taxifolia</i> and other invasive aquatic species being introduced to the estuary.</li> </ol>	<ul style="list-style-type: none"> <li>• Medium</li> </ul>	<p>B – Maintenance of wetlands (and other key estuarine habitats) of national significance.</p> <p>B - Maintenance of a scientific database of information on estuary condition that can be used to benchmark near pristine wetlands, and used to identify long-term trends.</p>	<ol style="list-style-type: none"> <li>1. Council</li> <li>2. Council</li> <li>3. NSW Fisheries</li> </ol> <p>(numbers relate to Management Strategies)</p>	<ul style="list-style-type: none"> <li>• Potentially High</li> </ul>	<ul style="list-style-type: none"> <li>• Addresses community concerns for protecting ecologically sensitive areas</li> </ul>

**Table 9-8 Improve the scientific knowledge database**

Management Strategies	Priority	Potential benefits and impacts	Responsible organisation(s)	Contribution to achieving Objectives	Reasons
<ol style="list-style-type: none"> <li>Determine the population status of rare and threatened species.</li> <li>Investigate the inclusion of Snapper Island into National Parks estate and improve management to protect penguin colony.</li> <li>Improve information on shorebirds and terrestrial fauna at and adjacent to the study area.</li> </ol>	<ul style="list-style-type: none"> <li>Medium / Low</li> </ul>	B - Improved scientific information will assist in identifying future issues/threats and provide important information to the future management of the estuary and its catchment	<ol style="list-style-type: none"> <li>NPWS</li> <li>NPWS</li> <li>NPWS</li> </ol> <p>(numbers relate to Management Strategies)</p>		<ul style="list-style-type: none"> <li>Assist in development of and involvement in recovery plans.</li> <li>Addresses community values regarding having natural surrounds</li> <li>May assist in management of oyster industry</li> </ul>

**Table 9-9 Support and integrate aspects of the Estuary Management Plan with the recommendations of the South East Catchment Blueprint**

Management Strategies	Priority	Potential benefits and impacts	Responsible organisation(s)	Contribution to achieving Objectives	Reasons
<ol style="list-style-type: none"> <li>The Clyde River has been identified in the South East Catchment Blueprint as a high conservation river. Various agency processes are prioritised as a result of the Blueprint. The Estuary Management Plan should adopt and integrate the recommendations of the Blueprint.</li> </ol>	<ul style="list-style-type: none"> <li>High / Medium</li> </ul>	<p>B - This provides a local focus to the regional Blueprint.</p> <p>B – May be an avenue for additional funding.</p>	<ol style="list-style-type: none"> <li>State Natural Resources agencies.</li> </ol> <p>(numbers relate to Management Strategies)</p>		<ul style="list-style-type: none"> <li>Consistency with State Government policy.</li> </ul>

**Table 9-10 Maintain the standard of socially and environmentally acceptable oyster farming practices in Clyde and continue to support a sustainable oyster industry**

Management Strategies	Priority	Potential benefits and impacts	Responsible organisation(s)	Contribution to achieving Objectives	Reasons
<ol style="list-style-type: none"> <li>1. Improve the visual and safety aspects of oyster farming by implementing continual voluntary improvement of local practices.</li> <li>2. Gain improved understanding of the possible effects of oyster leases in promoting sedimentation in tributaries. Some adjustment of lease boundaries by negotiation may be necessary for improved navigation at the mouth of tributaries.</li> <li>3. Determine the impacts of oyster leases and local Pacific oyster populations on estuarine ecology.</li> <li>4. Review the Statement of Intent to be released by the NSW Government as a result of the Healthy Rivers Commission Independent Inquiry into Oysters. The Final Report was released in March 2003 and contained five key recommendations relating to the prioritisation of oyster growing in certain areas, and the interrelationship of oyster growing with catchment management.</li> </ol>	<ul style="list-style-type: none"> <li>• Medium</li> </ul>	<p>B - Maintain the oyster industry's public and visitor image.</p> <p>B – Improved navigability of some waterways which are suffering from enhanced rates of sedimentation</p>	<ol style="list-style-type: none"> <li>1. Oyster Growers</li> <li>2. NSW Fisheries</li> <li>3. NSW Fisheries</li> <li>4. NSW Fisheries/ DIPNR / Council</li> </ol> <p>(numbers relate to Management Strategies)</p>	<ul style="list-style-type: none"> <li>• High</li> </ul>	<ul style="list-style-type: none"> <li>• Addresses community concerns regarding visual appeal and impacts of oyster farming</li> </ul>

**Table 9-11 Maintain visual amenity of estuary, foreshores and outlooks, by the promotion of sympathetic developments to limit visual impacts**

Management Strategies	Priority	Potential benefits and impacts	Responsible organisation(s)	Contribution to achieving Objectives	Reasons
<ol style="list-style-type: none"> <li>1. Modify planning controls (e.g. local DCP's or REP's) where required to minimise the scale of development at highly visual locations, by considering aspect from the estuary.</li> <li>2. Negotiate with rural landowners around Nelligen and Sheep Station Creek with unauthorised and unsightly riverbank protection works.</li> </ol>	<ul style="list-style-type: none"> <li>• Low</li> </ul>	B - Preservation of scenic amenity	<ol style="list-style-type: none"> <li>1. Council</li> <li>2. Council</li> </ol> <p>(numbers relate to Management Strategies)</p>		<ul style="list-style-type: none"> <li>• Addresses the community value placed on aesthetic appreciation.</li> <li>• Reflects concerns about coastal development and supports the State Government's Coastal Policy.</li> </ul>

**Table 9-12 Promote waterway and foreshore based recreational, commercial and tourist-oriented activities consistent with social and environmental impacts and waterway capability**

Management Strategies*	Priority	Potential benefits and impacts	Responsible organisation(s)	Contribution to achieving Objectives	Reasons
<ol style="list-style-type: none"> <li>1. Provide approval to Waterways for the sensitive clearing of dunal vegetation around the bar lead lights.</li> <li>2. Make application for funding to install grey water / portable toilet waste dump point at the Nelligen public toilet block.</li> <li>3. Consider in the longer term additional sewage pumpout facilities at Fishermans Jetty and Nelligen.</li> <li>4. Continue to monitor camping and associated toilet facilities on those parts of the estuary foreshore above Nelligen utilised informally as waterskiing camps.</li> </ol>	<ul style="list-style-type: none"> <li>• Medium (exceptions stated below)</li> </ul>	B – Waterway management leading to improved recreational usage (in terms of environmental impact, safety and enjoyment) of the estuary and reduced incidence of conflict in use.	<ol style="list-style-type: none"> <li>1. Council</li> <li>2. Council</li> <li>3. Council</li> <li>4. Council</li> <li>5. Council / Waterways</li> <li>6. Council</li> <li>7. Council</li> </ol>	<ul style="list-style-type: none"> <li>• High</li> </ul>	<ul style="list-style-type: none"> <li>• See Waterways Users Management Plan for full details</li> </ul>

Management Strategies*	Priority	Potential benefits and impacts	Responsible organisation(s)	Contribution to achieving Objectives	Reasons
5. Support the Estuary Management Committee to seek agency funding for a study into enhancing the navigability and safety of the Batemans Bay bar. 6. Promote passive recreation activities within the upper Clyde estuary around Shallow Crossing & Currowan. 7. Consider disabled access when planning new boating facilities in Batemans Bay. 8. Carry out Environmental Review for proposed new mooring area in the lee of Square Head south of the Cullendulla shoal. 9. Install a 4-knot zone in Cullendulla Creek. 10. Install south cardinal mark (defining a line beyond which boating activity shall be carried out with extreme caution) to limit boat and PWC use adjacent to Cullendulla Beach and Cullendulla shoal. 11. Convert the existing 4-knot zone south of Budd Island around the oyster sheds to a 'No Wash' zone and maintain 4-knot zone in McLeods Creek upstream of the entrance. 12. Extend the 200-metre exclusion zone to 300 metres from the PWC hire area to the southern end of Corrigan's Beach. Relocate PWC hire area buoys to 300 metres off Corrigan's Beach and assess impacts on PWC behaviour and noise. 13. Actively manage PWC usage and monitor complaint numbers by locality. 14. Monitor boat use in the estuary above Cockwhy Creek and in the estuary's tributaries. 15. Enforce the Waterways Sewage Plan when introduced. 16. Formulate a proactive bar depth monitoring and reporting procedure to provide RVCP with detailed bar depth and channel alignment information to pass on to mariners. 17. Encourage the provision of a refuelling facility at the Batemans Bay Marina, once construction of the marine pumpout jetty is completed.	High (Item 5)		8. Waterways 9. Waterways 10. Waterways 11. Waterways 12. Waterways 13. Waterways 14. Waterways 15. Waterways 16. Waterways 17. Dept Lands 18. Dept Lands 19. Council, DIPNR, State Forests  (numbers relate to Management Strategies)		

Management Strategies*	Priority	Potential benefits and impacts	Responsible organisation(s)	Contribution to achieving Objectives	Reasons
18. Given the recent growth of Batemans Bay as a regional centre and current waiting list for marina berths, high priority should be given to expansion of the marina by the Department of Lands*. The expansion should address the needs of the wider boating community in the short and long terms.  19. Examine the potential for water based recreation development on State Forest including funding sources.	High (Item 18)				

(\* refer to *Waterway Users Management Plan* for more information on these strategies)



## 10 REFERENCES

- Advance Tourism (1997), Eurobodalla Nature Coast Tourism Development Strategy for Eurobodalla Shire Council.
- ANZECC (1992), Australian Water Quality Guidelines for Fresh and Marine Water Quality.
- ANZECC (2000), Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Report 4 of National Water Quality Management Strategy.
- DLWC (1999) Crown Land Information Database.
- DLWC (1999a), Stressed Rivers Assessment Report, NSW State Summary.
- DLWC (2000), Vulnerability Assessment of Estuaries in Eurobodalla and Bega Valley Shires, draft report. Report prepared for Eurobodalla and Bega Valley Shires.
- EcoGIS (2001), Vulnerable Ecosystems of Eurobodalla Shire, Final Report on protection options to Eurobodalla Shire Council.
- Eurobodalla Shire Council (1987), Urban Local Environment Plan.
- Eurobodalla Shire Council (1987), Rural Local Environment Plan.
- Eurobodalla Shire Council (2001), Urban Stormwater Quality Management Plan.
- Healthy Rivers Commission (2003) Oysters – Independent Review of the Relationship between Healthy Oysters and Healthy Rivers. Final Report.
- Mills, K. & Associates Pty Ltd (1994), The Eurobodalla Coast - Its Natural and Cultural Values. Report prepared for NPWS, Eurobodalla Shire Council and The Coastwatchers Association.
- NSW National Parks and Wildlife Service (May 2000), Terrestrial Ecosystems of the Eurobodalla Local Government Area - Report of the Eurobodalla LGA Vegetation Mapping Project, derived from the Southern Comprehensive Regional Assessment (1997- 2000). A project undertaken by NPWS with Eurobodalla Council and the Lower South Coast Catchment Management Committee.
- NSW National Parks and Wildlife Service (January 2001), Fauna Key Habitats and Habitat Linkages of Eurobodalla Local Government Area - A Preliminary Investigation. A report commissioned by Eurobodalla Shire Council as part of the Natural Heritage Trust - Coast and Clean Seas Coastal and Marine Planning Program - Eurobodalla Coastal Environment Capacity Planning Project.
- NSW Government (1992), Estuary Management Policy.
- NSW Government (1997), Coastal Policy.
- Peter Spurway and Associates Pty Ltd (2003), Waterway Users Management Plan. Unpublished draft report prepared for WBM Oceanics Australia.
- South East Catchment Management Board (2003), South East Catchment Blue Print.

Spooner *et al* (2003), Discharges and nutrient, suspended solid and carbon loads from catchments with varied land cover on the south coast NSW, Australia, 2003. Draft catchment loads paper prepared as part of PhD thesis submitted to University of Canberra.

TEL (2002), Assessment of Seagrass Habitats in the Clyde, Tomaga and Moruya Rivers, Report prepared for Eurobodalla Shire Council.

TEL (2002a), Assessment of the Effects of Possible Septic Tank Effluent Seepage near Nelligen on Benthic Estuarine Communities. Report prepared for Eurobodalla Shire Council.

WBM (May 2000), Batemans Bay/Clyde River Estuary Processes Study Ecological Component. Report prepared for Eurobodalla Shire Council.

WBM (March 2000), Batemans Bay/Clyde River Estuary Processes Study, Water Quality and Sedimentation Components, Final Report. Report prepared for Eurobodalla Shire Council.

WBM (2003), Batemans Bay/Clyde River Community Workshop Background Document. Unpublished report prepared for Eurobodalla Shire Council.

West R. J., *et al* (1985), An estuarine inventory for New South Wales, Australia. Report prepared for NSW Department of Agriculture, Division of Fisheries NSW. Published in Fisheries Bulletin No. 1.

## APPENDIX A: INTEGRATED CATCHMENT MANAGEMENT PLAN FOR SOUTH EAST CATCHMENTS

The Integrated Catchment Management Plan for the South East Catchment was finalised in February 2003. This document is also known as the South East Catchment Blueprint. It is one of 21 catchment blueprints covering the whole of the State of NSW. The blueprints are 10-year plans for integrated catchment management. The Catchment Blueprints are “whole-of-government” plans which have been developed through a community/government partnership. They set overarching natural resource priorities, consistent with NSW and Commonwealth Government Policy. The blueprint management actions are not compulsory because the blueprints are advisory, not regulatory, plans. Their influence will be in setting the direction for management of native vegetation, biodiversity, water sources and soils in our catchments.

Consistency of natural resource management plans, such as estuary management plans, will assist in the implementation of the blueprint. Actions arising from the Blueprint have been divided into:

- Biodiversity
- Water and Coasts
- Soil Stability and Health
- Social and Economic

The most relevant portion of the Blueprint applicable to the Batemans Bay and Clyde River EMP is the Water and Coasts section. The overall catchment target provided in the Blueprint is, “by 2012 river flow objectives will be met in the 24 priority catchments and the health indicators (including water quality) in priority rivers; coastal areas and estuaries will be improved by a minimum of 10%”.

The blueprint acknowledges that there are many pressures on our fresh water resources and there needs to be equitable sharing between resource users, minimisation of any upstream and downstream impacts of using this resource and equitable access to human and financial resources to improve the current condition of water bodies in the South East.

Although the plan acknowledges that the Clyde does not suffer from hydrological stress (refer Section 4.1.1 on Stressed Rivers Assessments), however due to its high conservation value requires management to ensure that it is not degraded over time.

The Blueprint identifies that the EMP must integrate with other management plans, which relate to the river or coasts. A number of these plans are already in preparation or have been prepared and are currently being implemented such as the Batemans Bay Coastline Hazard Management Plan, Eurobodalla/Batemans Bay Waterways Infrastructure Strategy etc.

Relevant Water and Coasts Management Actions arising from the Blueprint in order of priority, include:

- 1 High priority for a water sharing agreement in the Clyde River catchment (due to high conservation status). To be performed by DIPNR by 2012.

- 2 High priority for a river rehabilitation plan in the Clyde River catchment (due to high conservation status). To be performed by DIPNR by 2012.
- 3 High priority for a negotiated plan to protect the Clyde River from development pressure (due to high conservation status). To be performed by DIPNR by 2005.
- 4 Programs to improve decrease inputs of faecal coliforms into the Clyde River. To be performed by DIPNR by 2012.
- 5 Programs to improve decrease inputs of sediments into the Clyde River. To be performed by DIPNR by 2012.
- 6 Development and implement an Estuary Management Plan for the Clyde (i.e. this study). To be performed by ESC by 2012.
- 7 Development and implement coastal management plans. To be performed by ESC by 2012.
- 8 Map and undertake rapid assessment of all wetland in the South East region to determine current status and assess management priorities. To be performed by DLWC, 2012.
- 9 Development and implement floodplain management plans for priority areas. To be performed by DIPNR and ESC by 2012.
- 10 Identify Crown lands with specific environmental values for reservation and appropriate management. To be performed by DIPNR by 2012.
- 11 Undertake measures to reduce sewage and ballast pollution from vessels by auditing commercial vessels. To be performed by Waterways by 2005.
- 12 Undertake an education program for private vessel owners on the importance of containing all pollutants on board. To be performed by Waterways.
- 13 Increase the number of pumpout facilities in South East region. Clyde River has been identified as the number one priority with a completion date of 2004.
- 14 Develop Fish Habitat Action Plans (including fish management) for the Clyde River by end 2003. To be completed by NSW Fisheries.
- 15 Encourage water sensitive urban design (WSUD) including re-use and other demand management strategies for all new developments and redevelopments. To be completed by ESC by 2012.

It is important that the current and future revisions of the Estuary Management Plan reflect these priorities. It should also be noted that at present there is no vegetation management plan or water management plan covering the catchment of the Clyde River.

## APPENDIX B: COMMUNITY WORKSHOP BACKGROUND DOCUMENT

### CONSERVATION/ENHANCEMENT OF ECOLOGICAL COMMUNITIES AND HABITATS

#### **E1. Protect/enhance vulnerable vegetation ecosystems and key faunal habitats and linkages.**

Studies have identified areas of vulnerable vegetation communities throughout the catchment. Furthermore, several areas have been identified as key fauna habitats and/or fauna movement corridors linking areas of high fauna habitat value. Management strategies should be developed which aim to control any further impacts on vegetation and /or communities of high conservation value. Impacts may be a result of urban, rural or semi-rural developments (often associated with land clearing).

**E2. Manage future development (rural, urban or semi-urban) in areas of high conservation value within the Clyde River catchment.** There are a number of strategies that can be implemented to assist in managing the impacts of future developments. These include underground placement of power lines, positioning houses to retain significant vegetation and maintaining adequate buffer zones to creeks, dedicating habitat linkages where required etc. The Clyde River has been identified in the South East Catchment Blueprint as a high priority for the development of a negotiated plan to protect it from development pressure (owing to its high conservation status) – WCMA3.

**E3. Protect, and where appropriate rehabilitate, riparian vegetation corridors.** Well-vegetated riparian corridors provide a range of ecosystem functions, including provision of habitat, bank stabilisation and water quality improvement. Several areas with degraded riparian vegetation have been identified along the tributaries and upstream of Nelligen. Furthermore, some riparian corridor sections along Nelligen Creek contain areas of potential koala habitat (*based on a sighting in 1967 listed in the NPWS database*). Rehabilitation strategies (through Landcare) that rehabilitate riparian vegetation should be continued and supported. Strict controls should be placed on any further clearing of riparian corridors along the Clyde River to a minimum depth of 100m from the bank. The Clyde River has been identified in the South East Catchment Blueprint as a high priority for the development of a river rehabilitation plan (owing to its high conservation status) - WCMA2.

**E4. Protect and enhance existing wetlands, saltmarshes, mangroves and other key estuarine habitat areas.** A large number of significant wetlands are already protected in Batemans Bay and the Clyde River through SEPP14 designation. Additional surveys and mapping of the extent, and condition of key estuarine habitats will assist in any planned remediation of damaged key estuarine habitats. Council should maintain information relating to key habitat areas and information pertaining to degraded habitats should be disseminated to Landcare groups. The enhancement of these habitats should integrate with any river rehabilitation plans (see previous point) developed for the Clyde.

**E5. Regular estuarine ‘health’ monitoring.** This option aims to establish a regular regime of estuarine ‘health’ monitoring. Monitoring would focus on key indicators of estuarine health, e.g. seagrasses, benthos and other key floral/fauna indicators. Surveys should be repeated at a regular

and specified time frames to enable changes in estuarine ‘health’ to be identified early to allow for the development of remediation actions. This is consistent with recommendations of the South East Catchment Blueprint, which recommends that rapid assessments of all wetland in the South East region to be undertaken and mapped to determine current status and assess management priorities – WCMA9.

## **MAINTENANCE/IMPROVEMENT OF WATER QUALITY BY MINIMISATION OF CATCHMENT (DIFFUSE) LOADS AND POINT-SOURCE POLLUTANT LOADS**

- WQ1. Ensure water quality within the estuary remains suitable for its current and future usages (including primary and secondary human contact, aquatic habitats and edible seafood).** To ensure that water quality in the Clyde remains high there is a need to continue Council’s monitoring program. The program may be strengthened by a possible integration of information between oyster farmers and catchment managers to provide an additional feedback loop. Given size and importance of oyster farming industry, it is suggested that two yearly water quality interpretation reports are prepared and submitted to the oyster farmers association for review. Flexibility should be built into the monitoring program to allow for specific sampling events to monitor specific water quality aspects, if such a need is identified from the monitoring reports, eg regular or repeated exceedence of key parameters. Conversely the oyster farmers association need to provide regular reports to Council and other waterway managers on other oyster/ecosystem health indicators to allow for more informed decision-making. Future development within catchment should not compromise the viability or sustainability of the oyster industry. Appropriate development controls will be maintained by Council and applied to future development assessments. In accordance with the South East Catchment Blueprint Waterways are to continue to investigate measures to reduce sewage and ballast pollution from vessels by auditing commercial vessels and undertaking education campaigns regarding potential pollutant generation from boating –WCMA14/15.
- WQ2. Impose best management practices for water quality (including sediment from erosion) control practices on future development (rural, urban or semi-urban) in the Clyde River catchment.** This option aims at avoiding unsuitable development at high-risk locations and unsuitable construction practices (including roadways) in order to avoid deleterious water quality impacts. Poor examples of development control were noted during site inspections in April. This option is consistent with recommendations of the South East Catchment Blueprint – WCMA5.
- WQ3. Encourage best management of riparian buffers and other practices to manage potential pollutant loads to the estuary associated with human activities within the catchment.** Riparian buffers can provide for a significant improvement of stormwater prior to entry to a receiving waterway. Relates to actions WCMA 4 and WCMA5 of the South East Catchment Blueprint.
- WQ4. Support and integrate aspects of the Estuary Management Plan with the recommendations of the South East Catchment Blueprint.** The South East Catchment Blueprint has given the Clyde River a High Conservation Status.

**WQ5. Continue to implement stormwater controls and education programs to proactively manage the quality of urban runoff entering the estuary.** A Shire wide approach to managing urban stormwater and improving education is already in place. Based on the results of estuarine health or water quality studies additional stormwater controls may need to be implemented in addition to those already proposed under the Shire wide plan. The plan should promote the use of Water Sensitive Urban Development in any planned urban or rural developments whether they are new or retrofit in nature. This is consistent with the recommendations of the South East Catchment Blueprint – WCMA19.

## **SUSTAINABLE COMMERCIAL AND RECREATIONAL USES OF ESTUARIES AND VISUAL AMENITY**

- S1. Promote NSW Fisheries to develop a Fish Habitat Action/Management Plan of the existing Clyde River estuary and other areas of Batemans Bay.** This option aims to protect areas of the estuary potentially subject to habitat damage a result of commercial and/or recreational fishing/prawning practices. The object of this option is to gain an increased understanding of the potential impacts of commercial fishing on habitats and species of Batemans Bay and develop additional management tools as required. As part of this monitoring of fish catch and fishing effort statistics for the Clyde should be maintained on a yearly basis for identification of trends. There is a possibility that habitat monitoring can integrate with other estuarine health assessments. The preparation of Fish Habitat Action Plans for the Clyde River was nominated in South East Catchment Blueprint by the end of 2003 - WCMA18.
- S2. Maintain the standard of socially and environmentally acceptable oyster farming practices in Clyde and continue to support the oyster industry's sustainable growth.** In association with this there may be some need to improve the visual and safety aspects of oyster farming, such as the prompt removal and appropriate disposal of all old or unused racks and sticks. This may be improved by more regular or flood based monitoring (whichever is the sooner) of suspect oyster lease areas. An understanding of the possible effects of oyster leases in promoting sedimentation in tributaries needs to be gained.
- S3. Maintain visual amenity of estuaries, foreshores and outlooks, by the promotion sympathetic developments to limit visual impacts.** This option supports the State Government's Coastal Policy and council's planning guidelines for commercial development. Planning controls over visual impact and site density of urban areas that are highly visible from the estuary require consideration.
- S4. The Clyde River has been identified as a high priority for the development of water sharing agreements.** This issue falls under DIPNR and the South Coast Water Management Committee (see action WCMA1). This Plan should identify and support these actions.
- S5. Minimise social impacts of water-based and foreshore-based recreational, commercial and tourist-oriented activities.** It is suggested that social impacts should be recognised if they are seen by sectors of the community as representing a valid majority viewpoint. Decisions on these issues can be quite difficult. For instance, some sectors of the community would like to have commercial fishing banned on the river; others would like to prevent prawn trawling on Batemans Bay over the Christmas holiday period. These conflict with having a local supply of fresh fish for peak tourist periods.



## ADDITIONAL OPTIONS PUT FORWARD FOR CONSIDERATION AT THE WORKSHOP

An additional management option was included for consideration as a result of discussions held during the preceding Estuary Management Committee meeting. Mr Harry Watson Smith a mariner who uses Batemans Bay marina occasionally, presented to the Estuary Management Committee (and other attendees) a powerpoint presentation entitled, '*A Mariner's Point of View, Is this bar safe? It is closing!*'

Mr Tony McAlister of WBM spoke after Mr Watson Smith to clarify some of the minor points of the presentation. After this a vote was held and the majority vote meant that the following option was included for consideration along with other management options described earlier:

- **S6** – Perform cost/benefit analysis of bar dredging and additional studies to investigate enhancement of navigability and bar safety.



## APPENDIX C: WORKSHOP ATTENDEES

BATEMANS BAY AND CLYDE RIVER ESTUARY MANAGEMENT STUDY/PLAN WORKSHOP 7 AUGUST 2003			
NAME	POSTAL ADDRESS	PHONE	EMAIL
Audrey Thors	PO Box 599 B. Bay 2536	44 751010	athors@bigpond.com.
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ROB MOLSDON	WATERWAYS AUTHORITY	0427 751854	
Errol McLean	DIPNR	422A 9627	
Tony Macquard	SOCOTAI CL.	44711930	
ROICE TONNET	ESC		
HARRY WATSON	15 WYLLY PLACE HUGHES ACT 2605	0412482066	
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NAME	POSTAL ADDRESS	PHONE	EMAIL
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Colin GEORGE	488 JENNIS CR Surf Beach NSW 2536	44716942	georgec@acr.net.au
ALLAN BROWN	E.S.C.		
JEFF MORGAN	ESC		

Note: Mr Ian Barnes attended the Estuary Management Meeting but had to leave prior to the commencement of the workshop due to other commitments.

## APPENDIX D: STRESSED RIVERS ASSESSMENT MAPS

### Map 5 - Clyde Catchment Environmental Stress



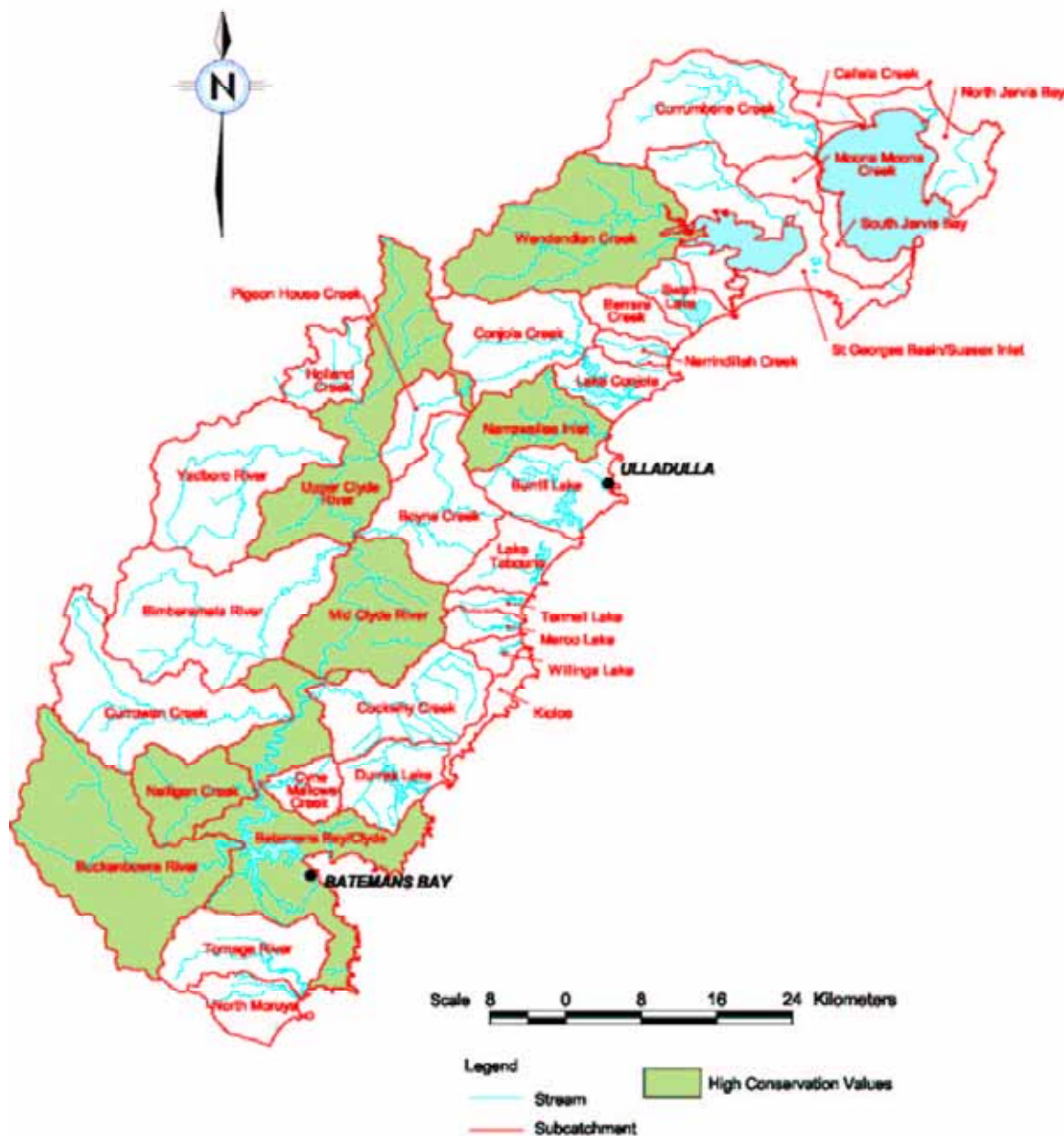
Note: The classification of the tidal sections of coastal subcatchments are currently unresolved and awaiting an appropriate estuary stress assessment method.

Produced by: Data Management Branch, IM&T (1999)





## Map 7 - Clyde Catchment High Conservation Values



Note: The classification of the tidal sections of coastal subcatchments are currently unresolved and awaiting an appropriate estuary stress assessment method.

Produced by: Data Management Branch, IM&T (1999)



## Map 8 - Clyde Catchment Full Development Management



Note: The classification of the tidal sections of coastal subcatchments are currently unresolved and awaiting an appropriate estuary stress assessment method.

Produced by: Data Management Branch, IM&T (1999)

