

**LAKE CONJOLA  
ESTUARY MANAGEMENT  
PLAN**

**Shoalhaven**  
**CITY COUNCIL**

## EXECUTIVE SUMMARY

### Introduction

The Lake Conjola Estuary Management Plan (EMP) provides a comprehensive and integrated set of strategies to restore, protect and conserve the natural resources of the Lake and to ensure their use is ecologically sustainable in the long term.

The plan is the outcome of a lengthy investigation and consultation process initiated by Shoalhaven City Council (SCC) in accordance with the NSW Government's Estuary Management Policy. SCC is committed to maintaining and, where appropriate, improving the condition of its tidal waterways to ensure ecological integrity and people's enjoyment into the future. Including Lake Conjola, five EMPs are currently being developed or implemented in the Shoalhaven area by SCC.

### Community and Government Involvement

The plan was developed with close participation by members of the Lake Conjola Task Force (LCTF), the local community, SCC Councillors and officers and State Government Departments and incorporates comments raised during public exhibition of the plan during August 1996. Each of these parties will be involved in plan implementation.

### The Study Area

Lake Conjola is one of 18 coastal waterways within the area administered by SCC and is located approximately 50 kms south of Nowra and 200 kms south of Sydney.

Lake Conjola is typical of many south coast lakes and lagoons:

- it covers an area of about 7 km<sup>2</sup>;
- it is generally open to the sea, but more recently closed by shoaling in the entrance area;
- it is shallow near the entrance, with depths in the lake of typically less than 2m and up to 10m deep in the middle reaches;
- it is a popular tourist and recreation area, with the permanent residential population swelling during peak holiday periods;
- urban development is minor (~5% of the catchment area) and confined to the southern side of the lake entrance and the upper reaches of the lake; and
- it drains a small catchment of 145 km<sup>2</sup>, 95% of which remains undeveloped and mostly forested (the majority (75%) divided between lands managed by State Forests and National Parks and Wildlife Service.

### Plan Development

In the course of formulating the EMP for Lake Conjola:

- values and issues associated with the lake were identified;
- the natural processes and human impacts of importance to the lake were defined (using quantitative data and, where appropriate, anecdotal evidence);
- specific management objectives were developed; and
- options for management of the lake were assessed.

The key values identified for Lake Conjola were the:

- ecologically valuable habitats such as seagrasses, SEPP 14 wetlands and bordering National Park;
- variety and high quality of both passive and active recreational activities; and
- Low key tourism and residential developments.

Current concerns raised by the community, Government representatives and by the outcomes of the Estuary Processes Study for Lake Conjola were often discrete and localised in area. However, concern was also raised, during development of the plan for future damage to the lake's environment and for the lack of information on which to develop sound management strategies.

For ease of management, values and issues raised were grouped into six areas. Particular management issues raised during the EMP were as follows:

Management Area	Key Issues
1) Water Quality	<ul style="list-style-type: none"><li>• <i>elevated levels of nutrients and faecal coliforms in specific areas of the lake</i></li><li>• <i>lack of modern sewerage services</i></li></ul>
2) Erosion & Sedimentation	<ul style="list-style-type: none"><li>• <i>erosion caused by development, recreation and agriculture.</i></li><li>• <i>shoaling of entrance channel from shifting sands</i></li></ul>
3) Flooding	<ul style="list-style-type: none"><li>• <i>flooding of low lying properties</i></li><li>• <i>relationship of lake entrance to flood levels</i></li></ul>
4) Lake Ecology	<ul style="list-style-type: none"><li>• <i>impact of recreational and commercial fishing</i></li><li>• <i>impact of recreational activities and lake entrance manipulation on aquatic habitats</i></li></ul>
5) Recreation & Tourism	<ul style="list-style-type: none"><li>• <i>concern over informal and insufficient boat launching facilities</i></li><li>• <i>conflict among passive and active lake users</i></li></ul>
6) Entrance Management	<ul style="list-style-type: none"><li>• <i>concern of lake closure and impacts on water quality, ecosystem health and flooding</i></li><li>• <i>appropriate opening policy</i></li></ul>

Management objectives were developed for these six management areas which ensured that the lake's key values were maintained or improved and which addressed the issues identified by the community. For each

management area, a large number of alternative strategies were developed and then considered at a workshop held with the community and representatives from Council and State Government Departments.

### The Plan

As a result of the community workshop, submissions received from the exhibition of the Draft Plan and findings of the Estuary Processes Study, the most feasible and cost-effective strategies were selected and prioritised for implementation from I to IV. Within each priority, strategies were grouped into:

- planning and development controls;
- protective and remedial works;
- education; and
- research and monitoring.

Indicative costs and timing of implementation were also estimated. The following table summarises the strategies adopted (a more detailed table is provided in Section 2 of the EMP).

A combination of strategies has been developed that tend to favour the non-structural options of planning and development controls, research and monitoring and education initiatives rather than works. The major exception being the upgrading of the sewerage system. This reflects the generally undeveloped nature of the catchment and consequently the good condition of the lake's resources. Most of the strategies are therefore protective rather than remedial in nature although some further works may flow from the research and monitoring and planning strategies, particularly the development of entrance management strategies. As a result, the cost of implementing the plan is considered to be reasonable and achievable. Costing for Stage I to implement all strategies is estimated at \$44 000, 80% of which is estimated for implementation of Priority I strategies.

## Implementation

Specific actions for each strategy were developed for implementation by Council and the various State Government Departments, in conjunction with the LCTF and the local community. A wide range of State and Commonwealth funding sources are available to assist Council with implementation of the plan.

## Linkage with Statutory Planning System

Some of the strategies will require amendments to existing Council planning and development controls (eg the Local Environmental Plan and Council policies), creation of new environmental planning or development approvals, permits and/or licences for capital works to repair existing degradation (eg bank revegetation) and to prevent future damage (eg sediment traps). Where possible any EPIs to be amended or created have been identified in the actions for each strategy. Provision of any capital works will have to comply with relevant legislation (eg. *Fisheries Management Act 1994*, *Crown Lands Act 1989*).

The information in the plan will also be used by Council to develop its annual State of the Environment report and its Strategic Business Plan which forms part of its internal Management Plan required by the Local Government Act.

## Plan Review

Environmental performance measures and targets for each strategy were developed to enable the plan to be assessed for the progress of implementation of strategies and the success of the strategies in meeting the objectives. Performance measures will be used to review and update the EMP.

## Adaptive Management

The EMP is an evolving document. Regular review and updating of the plan is therefore critical to amend strategies once implemented, incorporate new information and address the community's changing needs.

## Acknowledgments:

The draft Estuary Management Plan was prepared by Gutteridge Haskins and Davey Pty Ltd and was steered by the Shoalhaven Lakes & Estuaries Management Committee. The Department of Land and Water Conservation (DLWC) managed the commission on behalf of Council. Funding was provided by Council and the State Government's Estuary Management Program on an equal basis.

This document, the final plan, was prepared by DLWC in association with WBM Oceanics subsequent to exhibition of the draft plan and incorporates comments from the community, LCTF, SCC and Government Departments of State Forests, NSW Fisheries, Waterways, Environment Protection Authority and National Parks and Wildlife Service.

**Table 3.1.5 Actions, responsibilities, performance measures and targets for Water Quality Strategies. Primary responsibility for an action is indicated in bold and other groups involved are indicated in brackets.**

<i>Strategy</i>	<i>Action</i>	<i>Responsibility</i>	<i>Environmental Performance Measures</i>	<i>Target</i>
<b>Control Bacteria Levels in the Lake</b>				
WQ 1 Upgrade sewerage scheme	<ul style="list-style-type: none"> <li>Encourage septic tank pump out rather than disposal into absorption trenches (short term)</li> <li>Reticulated sewerage scheme (long term)</li> <li>Detect illegal septic discharges</li> </ul>	<p>SCC</p> <p>SCC (DLWC)</p> <p>SCC</p>	Bacterial levels, dissolved oxygen, nutrient levels and algal scums	as per Table 3.1.4
WQ 2 Monitor bacterial levels in lake	<ul style="list-style-type: none"> <li>Monitor faecal coliforms at swimming areas of lake</li> <li>Monitor faecal coliforms during a storm event at selected sites within the lake</li> <li>Public education in septic tank management</li> </ul>	<p>SCC</p> <p>SCC</p> <p>SCC (DLWC, EPA)</p>		
WQ 3 Prohibit on-site disposal system for new developments	<ul style="list-style-type: none"> <li>Insert provision into DCP to make pump outs or alternative systems in accordance with Draft Guidelines for Onsite Wastewater Management Systems for Domestic Households (EPA, NSW Health, DLWC, Local Govt., 1996) compulsory for all new developments on flood liable land until sewer is available</li> </ul>	SCC	Bacterial levels, dissolved oxygen, nutrient levels and algal scums	as per Table 3.1.4

Table 3.1.5 continued.

<i>Strategy</i>	<i>Action</i>	<i>Responsibility</i>	<i>Environmental Performance Measures</i>	<i>Target</i>
<b>Minimise Sediment Loads entering the Lake</b>				
<b>WQ 4 Amend LEP to incorporate erosion and sediment control requirements</b>	• provision of minimum buffer zone widths	SCC	Turbidity	as per Table 3.1.4
	• control clearing and vegetation disturbance	SCC	Turbidity	as per Table 3.1.4
<b>WQ 5 Undergo works to minimise sediment loads</b>	• Implement erosion control during construction and maintenance of roads	SCC (RTA)	Turbidity Bank erosion rates	as per Table 3.1.4
	• Sediment control structures near unsealed catchment roads	SCC (DLWC, SFNSW, RTA)	Turbidity	as per Table 3.1.4
	• Structural and vegetative creek bank stabilisation adjacent to Fisherman's Paradise boat ramp	SCC	Turbidity Bank erosion rates	as per Table 3.1.4
	• Assess the feasibility of installing sediment traps in areas of high sediment loads	SCC	Turbidity	as per Table 3.1.4
	• Edge strip around caravan park launching ramp	SCC	Turbidity Bank erosion rates	as per Table 3.1.4

Table 3.1.5 continued.

<i>Strategy</i>	<i>Action</i>	<i>Responsibility</i>	<i>Environmental Performance Measures</i>	<i>Target</i>
<b>WQ 6 Ensure dissolved oxygen is at appropriate levels to maintain the aquatic ecosystem</b>	• Investigate feasibility and cost of septic tank pump out rather than disposal into absorption trenches (short term)	SCC	Dissolved oxygen	as per Table 3.1.4
	• Provide incentives to residents for conversion to alternative systems	SCC	Dissolved oxygen	as per Table 3.1.4
	• Reticulated sewerage scheme (long term)	SCC	Dissolved oxygen	as per Table 3.1.4
	• Detect illegal septic discharges	SCC	Dissolved oxygen	as per Table 3.1.4
	• Public education in dissolved oxygen pollution	SCC	Dissolved oxygen	as per Table 3.1.4
	• Implement erosion and sediment control during construction activities	SCC	Dissolved oxygen Turbidity	as per Table 3.1.4
<b>WQ 7 Restore Pattimores Lagoon Salinity to appropriate regime</b>	• Assess the influence of Pattimores Lagoon weir on salinity	NPWS (SCC, DLWC, Fisheries)	Salinity	as per Table 3.1.4
	• Determine previous salinity regime and methods of restoration	NPWS (SCC, DLWC, Fisheries)		
<b>WQ 8 Improve Water Quality in Pattimores Lagoon Channel</b>	• Implement short & long term bacterial controls for Lake Conjola township	SCC	Faecal coliforms dissolved oxygen	as per Table 3.1.4



**Table 3.2. 2 Actions, responsibilities, performance measures and targets for Sedimentation and Erosion Strategies. Primary responsibility for an action is indicated in bold and other groups involved are indicated in brackets.**

<i>Strategy</i>	<i>Action</i>	<i>Responsibility</i>	<i>Environmental Performance Measures</i>	<i>Target</i>
<b>ES 1 Provide a consistent approach to embankment protection and revegetation</b>	• Amend LEP to provide foreshore protection through retention of a buffer zone	SCC	Foreshore vegetation	no loss of foreshore vegetation
	• Amend LEP to incorporate long term strategy of public ownership of foreshore lands and wetlands	SCC	Foreshore vegetation, wetlands	no loss of foreshore vegetation
	• Public education in management of foreshore and riparian vegetation	SCC (Community)		
<b>ES 2 Bank Stabilisation</b>	• Implement boat speed restrictions in areas sensitive to wave action	WA (SCC)	erosion / sedimentation rates, turbidity	no change or decrease rate of erosion / turbidity
	• Identify and fence off sensitive foreshore areas	SCC	foreshore vegetation	no loss of foreshore vegetation
	• Creek bank stabilisation adjacent to Fisherman's Paradise boat ramp	SCC (DLWC)	bank erosion rates, turbidity	no change or decrease rate of erosion / turbidity
	• Provide dinghy racks at foreshore caravan parks	SCC		
<b>ES 3 Entrance dune stabilisation</b>	• Formalise foreshore access (including board and chain paths, dinghy racks and fencing)	SCC	bank erosion rates sedimentation	no change or decrease rate of erosion / sedimentation
	• Investigate appropriateness of vegetation planting on entrance dune	DLWC (SCC)		
	• Investigate feasibility of realignment of main channel away from current position near southern dune	SCC (DLWC)		

**Table 3.3.2 Actions, responsibilities, performance measures and targets for Flooding Strategies. Primary responsibility for an action is indicated in bold and other groups involved are indicated in brackets.**

<i>Strategy</i>	<i>Action</i>	<i>Responsibility</i>	<i>Environmental Performance Measures</i>	<i>Target</i>
<b>FL 1 Prepare and implement a floodplain management plan</b>	• Form Floodplain Management Committee	SCC (DLWC)		
	• Carry out flood study (including influence of entrance characteristics, catchment and ocean conditions etc.)	SCC (DLWC)		
	• carry out floodplain management study (assessment of management options including structural and non-structural measures)	SCC (DLWC)		
	• review flood standard incorporating both flooding and environmental considerations	SCC (DLWC)		
	• develop and implement a floodplain management plan	SCC (DLWC)		
<b>FL 2 Assess the ecological/water quality issues in conjunction with the flood study</b>	• identify level of flooding which will inundate septic systems	SCC (DLWC)		
	• review management study options with consideration of environmental impacts	SCC (DLWC)		

**Table 3.4.2 Actions, responsibilities, performance measures and timing for Aquatic Ecology Strategies. Primary responsibility for an action is indicated in bold and other groups involved are indicated in brackets.**

<i>Strategy</i>	<i>Action</i>	<i>Responsibility</i>	<i>Environmental Performance Measures</i>	<i>Target</i>
<b>AE 1 Maintain and Protect Seagrass Beds</b>	• Further delineate areas of seagrass by channel markers and buoys	Waterways (Fisheries, SCC, DLWC)	% area of degraded seagrass, seagrass density	decrease in % area of degraded seagrass
	• Stabilise eroding banks that are determined to be increasing sedimentation and/or turbidity levels in the lake (see Water Quality)	SCC (DLWC)	erosion rates and turbidity levels	no change or decrease in erosion rates and turbidity levels
	• Treat stormwater to reduce sediment and nutrient loads entering the lake (see Water Quality)	SCC (EPA, DLWC)	turbidity and nutrient levels	see Table 3.1.4
<b>AE 2 Sustainably Manage Fish Communities</b>	• Undertake a recreational fish catch (creel survey) over a full year to determine the nature and magnitude of the current recreational fishery including fishing effort, species catch, total catch, catch per unit effort etc.	Fisheries (DLWC, SCC)	fish assemblages	
	• Continue to monitor and assess the commercial fish catch, effort and catch per unit effort trends for individual species and all species	Fisheries (DLWC, SCC)	fish assemblages	no decline in catch per unit effort

Table 3.4.2 cont'd

<i>Strategy</i>	<i>Action</i>	<i>Responsibility</i>	<i>Environmental Performance Measures</i>	<i>Target</i>
<b>AE 2 continued</b>	<ul style="list-style-type: none"> <li>• Compare the commercial and recreational catches to determine if the resource is being shared appropriately and is not declining</li> </ul>	<b>Fisheries (DLWC, SCC)</b>	<b>fish assemblages</b>	
	<ul style="list-style-type: none"> <li>• Continue to enforce the existing commercial and recreational fisheries regulations and closures</li> </ul>	<b>Fisheries</b>	<b>catch per unit effort</b>	<b>Fish assemblages within range of natural variation</b>
	<ul style="list-style-type: none"> <li>• Educate fishing community of current rules to ensure conservation of the fish resource and its habitat</li> </ul>	<b>Fisheries</b>	<b>fish assemblages</b>	<b>Fish assemblages within range of natural variation</b>
<b>AE 3 Public Education on importance and value of aquatic ecology of Lake Conjola</b>	<ul style="list-style-type: none"> <li>• Develop and implement public awareness &amp; education programs (brochures, signs, personal contact) to describe ecological value of the lake, identifying vulnerable habitats and management plan</li> </ul>	<b>SCC (DLWC)</b>		
<b>AE4 Maintain and Protect SEPP 14 wetlands</b>	<ul style="list-style-type: none"> <li>• Amend LEP to provide Environment Protection zonings for all SEPP14 Wetlands</li> </ul>	<b>SCC</b>	<b>% area of degraded wetland</b>	<b>no loss of SEPP 14 wetlands</b>

**Table 3.5.1 Actions, responsibilities, performance measures and targets for Recreation and Tourism Strategies. Primary responsibility for an action is indicated in bold and other groups involved are indicated in brackets.**

<i>Strategy</i>	<i>Action</i>	<i>Responsibility</i>	<i>Environmental Performance Measures</i>	<i>Target</i>
<b>Land based activities</b>				
<b>REC 1 Improve and manage boat launching facilities</b>	• Assess usage of formal and informal launching sites	WA (LCTF)	% area of foreshore vegetation degraded	Decrease in % area degraded
	• Assess feasibility of new boat launching facility in western part of lake, in particular Killarney	SCC (DLWC)	bank erosion	'0' change or decrease in bank erosion
	• Assess relocation of caravan park boat ramp	WA (SCC)		
	• Assess areas of bank erosion near formal and informal launching sites	SCC (DLWC)		
	• Provide formal boating access in western area of lake	SCC (DLWC, WA)		
<b>REC 2 Coordinate future tourist development to preserve the ecological and recreational values of the lake</b>	• Develop a local tourism plan	SCC (LCTF)		
	• Assess the cumulative impacts of current developments on the ecology and water quality of the lake	SCC (DLWC)	water quality, fish and seagrass communities	'0' change or improvement in variable measured

Table 3.5.1 cont'd.....

<i>Strategy</i>	<i>Action</i>	<i>Responsibility</i>	<i>Environmental Performance Measures</i>	<i>Target</i>
<b>Water Based Activities</b>				
<b>REC 3 Minimise conflict between boating activities</b>	• Review and develop new lake boating controls	WA (LCTF)		
	• Enforce speed limits	WA		
	• Install boat speed limit signage	WA		
	• Initiate public education of boating controls	WA (LCTF, Community)		
	• Monitor effect of new lake boating controls on bank erosion and other environmental factors (e.g. Mella Mella Bay)	WA (LCTF, Community)		
	• Investigate the need for and potential statutory mechanisms for defining active/passive waterway usage areas	WA (SCC, DLWC, LCTF, Community)		

**Table 3.6.2 Actions, responsibilities, performance measures and targets for Lake Entrance Management Strategies. Primary responsibility for an action is indicated in bold and other groups involved are indicated in brackets.**

<i>Strategy</i>	<i>Action</i>	<i>Responsibility</i>	<i>Environmental Performance Measures</i>	<i>Target</i>
<b>EM 1 Develop an appropriate management policy for the lake entrance</b>	• Assess the relative contribution of the barrier dune to entrance shoaling through photogrammetric techniques	DLWC (SCC)		
	• Identify and/or confirm historical lake opening position along barrier dune from aerial photography	DLWC (SCC, LCTF)		
	• Investigate costs and benefits of various management strategies which include options other than dredging the entrance channel (see Section 3.3 Flooding). The dredging strategies should include assessment of effects on erosion of dune adjacent to the entrance channel	SCC (DLWC)		
	• Assess the impacts of entrance conditions on flooding (incorporate in to Flood Study, see Section 3.3 Flooding)	SCC (DLWC)		
	• Develop, document and adopt an Entrance Management Policy using the outcomes of the floodplain management study and the actions listed above.	SCC	Fringing wetlands, seagrasses, tidal/water level ranges, aquatic fauna distribution, abundance and type	Tidal/flood ranges to return to a more natural regime for intermittent lake, aquatic fauna and flora within natural variability
<b>EM 2 Investigate effects of artificial opening on lake ecology and water quality</b>	• collate information on the effects of artificial lake opening on the abundance, distribution and community structure of various biological groups	SCC, NSW Fisheries, DLWC, LCTF and community		

Table 3.6.2 cont'd

<i>Strategy</i>	<i>Action</i>	<i>Responsibility</i>	<i>Environmental Performance Measures</i>	<i>Target</i>
EM 2 continued....	<ul style="list-style-type: none"> <li>Assess feasibility carrying out a biological monitoring program using appropriate indicator organisms/community and/or vegetation identified above.</li> <li>Monitor faecal coliforms at selected sites during rises in lake levels, during and after artificial lake entrance opening.</li> </ul>	DLWC, NSW Fisheries, SCC, LCTF		
		SCC, DLWC, LCTF, Community	Faecal coliform levels	Levels do not exceed ANZECC guidelines
EM 3 Increase community awareness of possible advantages and disadvantages of frequent artificial lake opening	<ul style="list-style-type: none"> <li>Prepare advertisement/brochure including ecological impacts, flood risks and water quality, costs of artificial opening.</li> </ul>	SCC, DLWC	Fringing wetlands, seagrasses, tidal/water level ranges, aquatic fauna distribution, abundance and type	Tidal/flood ranges to return to a more natural regime for intermittent lake, aquatic fauna and flora within natural variability