Review of the
1997 Tweed Coast Estuaries
Management Plan

Cudgen, Cudgera and Mooball Creeks

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Prepared For

Tweed Shire Council

Prepared by

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Executive Summary

An Estuary Management Plan was created by WBM Oceanics Australia in 1997 for the estuarine systems of Cudgen, Cudgera and Mooball Creeks. The Plan proposed management actions for environmental protection and rehabilitation, bank erosion, recreational facilities, and entrance management.

A management plan employs an integrated approach to maintaining the values of estuaries, including both recreational and environmental aspects, while incorporating recommendations for best management practices for any potential development within the estuarine catchment boundary.

The initial Plan was completed without the background information of an Estuary Processes Study. As such, the available information for the three estuary and catchment systems does not at present provide a comprehensive basis for future management.

A substantial number of recommended actions have been completed, with others underway now (for example, a canoe trail, recreational facilities, and revegetation).

Several recommendations have not been implemented, including event monitoring of water quality, dredging of Cudgen Creek entrance, construction of a footbridge across Cudgen Creek, the removal of rubble from under Hastings Point Bridge, and the provision of a bicycle track from Pottsville to Wooyung.

The Plan recommended water quality monitoring to be carried out every two months at set monitoring points along the three estuaries. Since 1999, Tweed Shire Council has been carrying out water quality testing every two to six weeks.

Implementation of the recommendations has been reliant on funding and support. The Plan has provided a good basis for the next phase of managing the three estuaries of Cudgen, Cudgera and Mooball Creeks.
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1 Introduction

In 1997, WBM Oceanics Australia created a Tweed Coast Estuary Management Plan for the estuarine systems of Cudgen, Cudgera and Mooball Creeks (WBM 1997). The Plan was adopted by Tweed Shire Council and the NSW Government under the NSW Estuary Management Policy, and the last six years have been a period of implementation. A review of the Plan is now due.

The 1997 Plan examined the situation in the three estuaries, and developed a plan that identified environmental and social values of the three ecosystems, set key management objectives and proposed management actions for bank erosion, recreational facilities, environmental protection and rehabilitation, and entrance management.

The purpose of this document is to review the 1997 Plan and construct a new Plan valid until 2008. This document is composed of two parts:
- Part A - Review of the existing Plan, its achievements or otherwise, and whether the recommendations have been carried out

1.1 The Purpose of Estuarine Management

The 1997 Plan was written under the Policy context of the time, particularly the Estuary Management Policy. Under this Policy, estuaries must be managed under a formal Estuary Management Plan that "should reflect the agreed position of all regulatory authorities and interested parties in relation to the future nature conservation, rehabilitation and development of the estuary" (NSW Government 1992).

A management plan employs an integrated approach to maintaining the values of estuaries, including both recreational and environmental aspects, while incorporating recommendations for best management practices for any potential development within the estuarine catchment boundary.

1.2 Relevant Policies and Legislation

NSW Estuary Management Policy and Manual
The primary goal of the Policy is to achieve an integrated, balanced, responsible and ecologically sustainable use of estuaries.

The two specific objectives of the Policy are:
- Protection of estuarine habitats and ecosystems in the long-term
- Preparation and implementation of a balanced long-term plan for the sustainable use of each estuary and its catchment
The boundaries of the estuary study can stretch as far inland, seaward and along the coast as necessary to take in management issues that may impact on the ecological and recreational values of the estuary, as well as development controls (NSW Government, 1992)

**Environmental Planning and Assessment Act 1979 (EPA Act 1979)**

When considering development applications within the estuarine catchment boundary, local Councils must incorporate the provisions set out in any environmental planning instrument for the area, including final and draft State Environmental Planning Policies (SEPPs) and Regional Environmental Plans (REPs) (NSW Government, 1992)

Estuary Management Plan recommendations become policy statements to be implemented through the range of plans, strategies and management practices - for local Councils this includes zoning and development standards in LEPs, DCPs and building and engineering policies on which assessment of development applications is based.

### 2 Background to the 1997 Estuary Management Plan

#### 2.1 Estuary Processes Study

The initial Plan was completed without the background information of an Estuary Processes Study, as recommended by the Estuary Management Manual (NSW Government, 1992) A Processes Study provides the baseline information about the physical processes, water quality, and ecological and biological parameters of the estuary, which can then be used to direct the future management of the system.

As such, the available information for the three estuary systems does not at present provide a comprehensive basis for future management.

#### 2.2 Management Objectives for the 1997 Estuary Management Plan

The following management objectives formed the basis of the 1997 Plan:

- Preservation and enhancement of high conservation values, and retention of valuable habitat

- Enhancement of passive recreational activities, with emphasis on "nature-based" activities

- Protection and enhancement of water quality such that there is no negative impact from population increase and development

- Maintenance or improvement of tidal flushing
- Reduction of unnatural bank erosion
- Maintenance or reduction of flood levels
- Rehabilitation and revegetation of degraded areas
- Improvement of boating access and navigability where it is consistent with other objectives and does not affect amenity for more passive uses

2.3 Community Consultation

WBM Oceanics held a community consultation forum to discuss management objectives and actions for the three estuaries. Primary environmental concerns identified by the community were:

- **Bank erosion**, wash from power boats, jetskis, trampling by pedestrians, 4WD access
- **Siltation and shoaling**; alterations to creek hydraulic regime, increased urbanisation, poor navigability, dredging
- **Water Quality**; acid sulphate runoff, stormwater from increasing urbanisation, poor creek flushing
- **Recreation**; speed of power boats/jet skis, clogging with debris and snags, improvement of park facilities, opportunities to enhance passive recreation
- **Ecological**; rehabilitation of areas degraded by sand mining, acid soil runoff, algal blooms, reduced abundance of aquatic fauna
- **Management**; coordinated and integrated management by NPWS, DLWC and Council

2.4 Overall Strategy Recommendations

The Plan presented overall strategy recommendations for the management of the three estuaries. These are highlighted below

2.4.1 Environmental Protection

New Development Applications
All applications for new development adjacent to the creeks should provide assessment of potential effects on estuarine environmental values, including the need for mitigation measures and enhancement of estuarine values
Water Quality
Emphasis required on minimising inputs of urban stormwater to the estuaries, and new developments should use infiltration measures wherever practical.

Buffers
Provision of a buffer strip of a minimum 50 metres of undeveloped land along the estuarine foreshores. Revegetation over time recommended where buffer strips are less than 50m wide.

Habitat Enhancement
Degraded areas of vegetation should be rehabilitated with native species, Bitou to be removed.

2.4.2 Recreation
Options for enhanced recreational facilities within or adjacent to the creeks should be considered wherever practical, and emphasis should be placed on passive recreational activities.

2.4.3 Water Quality
Options to reduce acidic water inputs (from exposed acid sulphate soil areas) should be investigated. Appropriate management of the catchment should be adopted where all drainage, both rural and urban based, discharging into the creeks is managed to avoid contamination of the waterways. Education programs for residents should be aimed at reducing contaminants in stormwater. A detailed Stormwater Management Plan should be prepared for each creek highlighting options for control and improvement of stormwater management practices.

2.4.4 Acid Sulphate Soil Management
All development proposals involving excavations or drainage works in low-lying areas (<5m AHD) of the catchment of each creek should be required to include assessments by specialists approved by Council to determine the presence of acid sulphate soils. Council should also continue to work with Government bodies and tertiary institutions to assess the viability of remedial techniques for areas currently experiencing an acid sulphate soil problem.

2.4.5 Hydraulics and Morphology
Natural erosion should be allowed to continue, unless it threatens environmental or recreational values, or adjacent developments. Remediation through the construction of rock or timber revetment walls to halt or slow down erosion may be used where warranted. Monitoring of erosion should occur at certain sections of each estuary to manage nearby land uses in the future.
3 Specific Issues and Associated Action Strategies

The following tables (Tables 1-3) details issues, strategies and priorities from the 1997 Plan, with assessment notes from inspections carried out in 2003. A summary of achievements and completed actions from the original Plan are as follows.

3.1 Cudgen Creek

- Investigative papers have been compiled by DIPNR regarding entrance management
- Plans are in place to re-deck the Kingscliff bridge, incorporating a cycleway/footpath, to be funded by the SALT development
- Dunes are being revegetated
- General compliance of the recommended 50m buffer zone between development and the creek
- Ongoing improvements by Council to public amenities in parks, including BBQ's, picnic benches, toilets, etc.
- Speed signs have been installed for water traffic, with 4 knots below Kingscliff Bridge and 8 knots above the bridge
- One third of the proposed boardwalk between Rotary Park and the boat ramp has been constructed
- Landscaping and provision of public facilities have been constructed on ex-rutile mine site
- The Canoe Trail is currently at the planning and design stage
- Car bodies have been removed from the Old Bogangar Road Bridge area
- Council has successfully retained for protection the section of land between the Coast Road and Cudgen Creek adjacent to Casuarina

3.2 Cudgera Creek

- General compliance of the recommended 50m buffer zone between development and the creek
- A rehabilitation plan for degraded areas is currently in draft form
- Rehabilitation and revegetation of some degraded areas within the Cudgera Creek lower catchment has been carried out
- Creek Street sewage pump has been upgraded
- A new overflow warning system has been installed at Hastings Point STP
- Access points for Hastings Point Headland to the beach have been maintained
- Speed signs have been installed for water traffic, with 4 knots downstream of Hastings Point Bridge and 8 knots above the bridge
- The Canoe Trail is currently at the planning and design stage
- A cycleway/footpath has been constructed on the western side of the Coast Road between Hastings Point and Pottsville
3.3 Mooball Creek

- Timber revetment walls have been constructed in sections of the lower estuary, although these are failing.
- New Plan of Management for Mooball Creek Reserve at Overall Drive (Pottsville Waters) has been completed.
- Revegetation and rehabilitation of sections of the coastal strip have been implemented, with removal of bitou bush.
- Several informal tracks from the Coast Road to the beach and the creek have been formalised, with parking areas.
- Water quality within Pottsville Waters canal has been monitored broadly monthly in accordance with Council's water quality monitoring program.
- General compliance of the recommended 50m buffer zone between development and the creek, although there are some areas that have not complied.
- Littoral rainforest has been rehabilitated by Pottsville DuneCare.
- Speed signs have been installed for water traffic, with 4 knots downstream of Pottsville Bridge, No Wash between the bridge and opposite Pottsville Waters canals, and 8 knots upstream of the canal outlets.
- Black Rocks Estate Bridge has been constructed, with compensatory planting of mangroves occurring.
- Wooyung Nature Reserve has been zoned in upper estuary zone.
- Rubbish and car bodies have been removed.
### Table 1 Cudgen Creek Implementation Assessment

<table>
<thead>
<tr>
<th>Key</th>
<th>Management Issue</th>
<th>Action Strategy</th>
<th>Priority given</th>
<th>Status</th>
<th>Investment</th>
<th>2003 Assessment</th>
</tr>
</thead>
</table>
| A   | Shoaling affecting entrance navigation and boat ramp efficiency                    | > periodic and ongoing dredging and dredge material placement strategies will be required to maintain a navigable channel  
> placement of dredged sand to the west of the creek mouth on Kingscliff Beach is essential  
> consider economic costs and effects (social, ecological and sediment transport) of sand placement west of creek mouth  
> investigate sources of funding for ongoing dredging | High                         | Not done         | Nil            | Entrance is not navigable all the time, dredging has not occurred. Much research and detailed investigation conducted by R. Hagley (DIPNR) in relation to entrance clearance. Coastal Committee has asked Tweed Shire Council to remove spur wall |
| B   | Bank erosion                                                                     | > soft options such as fencing and revegetation to be considered at suitable sites  
> Fence vulnerable areas and create access in suitable areas  
> stabilisation of banks using rock revetment of treated log retaining walls  
> realign the channel by periodic ongoing dredging  
> works will need to be consistent with coastal PoM  
> introduce erosional buffer zones | High                        | Partially completed (stairs, access points, fencing) | $30,000          | Still eroding, no revetment wall, etc. Has been left as natural erosion. Erosion noted in two other sites, north side of the estuary, east and west of the bridge, erosional buffer zones in place at west of bridge, as well as rock rubble walls. Erosion due in part to a spring that exits at the waters edge, trampling, and boat wash |
| C   | Constriction of flood tidal flows associated with the bridge                      | > when the bridge is replaced, ensure the design of the bridge allows improved flood/tidal water flow | High                        | Not done | nil            | Bridge has not been replaced, although the SALT development will replace the decking |
## Draft Review of the 1997 Tweed Estuary Management Plan

**Tweed Shire Council**

### Issues and actions: Cudgen Creek North - Environmental

<table>
<thead>
<tr>
<th>Key</th>
<th>Management Issue</th>
<th>Action Strategy</th>
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<th>Status</th>
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<th>2003 Assessment</th>
</tr>
</thead>
</table>
| D   | Sand mining in the past has removed plant species | ✓ revegetation of dunal areas with native plant species  
     |                   | ✓ assist with the production of a detailed landscape plan for revegetation of the old Cudgen Headland sandmining site which should include a variety of landscape features, facilities and an endemic species list | High | Commenced | $15,000 | Dunes are being revegetated, both naturally and with human input, although there is much Horsetail Casuarina and Coastal Tea-tree, not local to the area |
| E   | Large area of vegetation of potentially good quality forest with moderate weed levels | ✓ revegetation and rehabilitation of vegetation along the creek edge associated with the development in this region  
     |                   | ✓ initiate a weed removal program to encourage the growth of existing native vegetation | High | Not done | nil | No development yet, retain as action |
| F   | Buffer zone to development | ✓ Minimum buffer widths of 50m to be observed  
     |                   | ✓ Assessment of buffers and rehabilitation/revegetation options with al new application for development  
     |                   | ✓ rehabilitate areas of existing riparian vegetation  
     |                   | ✓ buffers to the creek and riparian vegetation from recreational activities on Council and Crown land  
     |                   | ✓ Council to investigate implementation via LEP amendments, Regional Open Space and other planning instruments, taking into account existing landuse rights | High | Ongoing | In-kind | General compliance, but some areas of concern, Regional Open Space plan covers facilities of regional importance, and does not include environmental work |
# Issues and actions: Cudgen Creek North - Recreational

<table>
<thead>
<tr>
<th>Key</th>
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<th>Status</th>
<th>Investment</th>
<th>2003 Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>G</td>
<td>Opportunity to improve park facilities</td>
<td></td>
<td></td>
<td>Low</td>
<td>Ongoing</td>
<td>$50,000 (since 1997)</td>
</tr>
<tr>
<td>H</td>
<td>Speedboats limiting opportunities for swimming, canoeing, windsurfing etc</td>
<td></td>
<td></td>
<td>High</td>
<td>Complete</td>
<td>$8,000 (Waterways Authority)</td>
</tr>
<tr>
<td>I</td>
<td>No public access along foreshore between boat ramp and constructed footbridge</td>
<td></td>
<td></td>
<td>Med</td>
<td>Partially constructed</td>
<td>$20,000 (TCC) $60,000 (developers)</td>
</tr>
<tr>
<td>K</td>
<td>Public access across creek difficult, being possible on low tide only or via the road bridge</td>
<td></td>
<td></td>
<td>High</td>
<td>Not done</td>
<td>nil</td>
</tr>
<tr>
<td>L</td>
<td>Sand extraction operations have ceased</td>
<td>rehabilitate (in association with sand mining company) to create parkland integrated with river bank picnic area in accordance with the Coastal PoM</td>
<td>High</td>
<td>Stage One complete More works as funds available</td>
<td>$200,000</td>
<td>Appears good progress in landscaping, public facilities in place, sign advertising Stage One Rehabilitation, although work is more landscaping than rehabilitation Access to creek is present however not utilised at all times</td>
</tr>
<tr>
<td>M</td>
<td>Opportunity to provide safe and easy access for canoe launching combined with improving parklands</td>
<td>Provide canoe launching facilities and enhanced facilities for water-based recreation</td>
<td>Med</td>
<td>Ongoing</td>
<td>$10,000</td>
<td>Canoe facilities not present, amenities built, bollards in place</td>
</tr>
<tr>
<td>N</td>
<td>Opportunity to enhance passive boating activities</td>
<td>Provide canoe trail, marked as appropriate with points of local interest (e.g. wetland vegetation, description of fish/bird life present)</td>
<td>Med</td>
<td>Design stage</td>
<td>$7,000 (for 3 creeks)</td>
<td>No evidence of canoe trail at present, but planning is at design stage</td>
</tr>
</tbody>
</table>

### Issues and Actions: Cudgen Creek South - Environmental

<table>
<thead>
<tr>
<th>Key</th>
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</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>Rubbish Dumping detracts from the aesthetics of the creek bank</td>
<td>initiate a rubbish removal program including liaison with private landowners where appropriate</td>
<td>On-going</td>
<td>Ongoing</td>
<td>?</td>
<td>Little rubbish seen at times of inspection, most likely removed by SALT development</td>
</tr>
<tr>
<td></td>
<td>Car bodies in the creek and along banks near bridge detracting from visual appeal Bank vegetation disturbed</td>
<td>Remove litter/car bodies</td>
<td>Prevent vehicle access along creek bank with physical barriers</td>
<td>High</td>
<td>Complete</td>
<td>?</td>
</tr>
<tr>
<td>---</td>
<td>------------------------------------------------------------------------------------------------------</td>
<td>--------------------------</td>
<td>-------------------------------------------------------------</td>
<td>------</td>
<td>---------</td>
<td>---</td>
</tr>
<tr>
<td>P</td>
<td>Buffer zone to development</td>
<td>Minimum buffer widths of 50m to be observed</td>
<td>Assessment of buffers and rehabilitation/revegetation options with all new applications for development</td>
<td>High</td>
<td>Ongoing</td>
<td>In-kind</td>
</tr>
<tr>
<td>Q</td>
<td>Good quality vegetation including a large area of mangroves</td>
<td>Target the area for protection under State Environmental Protection policies</td>
<td>Initiate weed removal program</td>
<td>High</td>
<td>Complete</td>
<td>In-kind</td>
</tr>
<tr>
<td>R</td>
<td>Opportunity to revegetate and provide public open space as part of development</td>
<td>Planting of native species</td>
<td>Med</td>
<td>Ongoing</td>
<td>Developers completed some revegetation as condition of consent Council now land owners</td>
<td></td>
</tr>
</tbody>
</table>
**T** Need for liaison with NPWS as managers of Cudgen Nature Reserve and future manager of coastal reserve

- Consistent aims between this and Cudgen Lake Management Plans and the Coastal PoM
- TCMC to become coordinating body for all plans associated with parts of the estuary

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>U</td>
<td>Opportunity to incorporate canoe launching exit facility in association with the bridge crossing</td>
<td>Include appropriate launching facility locations/designs and need for car parking facilities which could be incorporated into the design of the new bridge crossing</td>
<td>Low</td>
<td>Not done</td>
<td>nil</td>
<td>Not installed - rather, there is a koala fence that has informal tracks throughout area. Need further investigation for potential access on North-East side of bridge</td>
</tr>
<tr>
<td>V</td>
<td>Opportunity to enhance passive boating activities</td>
<td>Provide canoe trail, marked as appropriate with points of local interest (e.g., wetland vegetation types, description of fish types/birdlife present)</td>
<td>Med</td>
<td>Design stage</td>
<td>Planning underway, should have input from NPWS as a stakeholder</td>
<td></td>
</tr>
</tbody>
</table>
Table 2 Cudgen Creek Implementation Assessment

<table>
<thead>
<tr>
<th>Key</th>
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<th>Status</th>
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</thead>
<tbody>
<tr>
<td>A</td>
<td>Shoaling affecting recreational activities and flushing of the creek</td>
<td>▶ Sand movement is a dynamic process and shoaling will vary over time and should continue as a natural process&lt;br▶ Monitoring of siltation/shoaling within the creek&lt;br▶ If siltation/shoaling increases flooding processes to levels of public concern or such that water quality is adversely affected, investigate limited dredging and dredge material placement strategies</td>
<td>Ongoing</td>
<td>Ongoing&lt;brFor review</td>
<td>$1000&lt;brStill siltting up, as yet of no concern to flooding&lt;brEntrance opening has occurred only twice in last 15 years (J Lofthouse)</td>
</tr>
<tr>
<td>B</td>
<td>Bank erosion</td>
<td>▶ Allow natural erosion processes to continue as long as this area remains undeveloped&lt;br▶ If development options are considered for this region, provision of buffer zones to accommodate erosion is recommended to maintain natural bank character and processes. For any necessary stabilisation of banks using small scale rock revetments or treated log retaining walls can be considered</td>
<td>Low</td>
<td>Not done</td>
<td>nil&lt;brErosion still apparent, though only slow. Rubble has been placed along bank south of the caravan park, near SPS5006 Erosion behind the Council-owned caravan park and at the bridge. Unchecked access to creek has caused erosion</td>
</tr>
<tr>
<td>C</td>
<td>Bridge restriction</td>
<td>▶ Investigate removal of concrete rubble under bridge to increase flushing capacity</td>
<td>Med</td>
<td>Work went to tender&lt;brNot done</td>
<td>In-kind&lt;br$220&lt;brRubble still present. An REF was completed, works was tendered but there were no suitable tenderers</td>
</tr>
</tbody>
</table>
### Issues and Actions: Cudgera Creek - Environmental

<table>
<thead>
<tr>
<th>Key</th>
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<th>Priority given</th>
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</tr>
</thead>
</table>
| D   | Debris obstructing the safe navigation of creek for canoes and small boats | > Periodic clearing of fallen logs and debris from the creek, especially after flood events, that hampers use of the creek by canoes and restricts flood flows  
> Removal of accumulated rubbish | Ongoing | Not done | Nil | Large woody debris is still apparent in some areas, although this is good for the waterways |
| E   | Buffer zone to development | > Minimum buffer widths of 50m to be observed  
> Assessment of buffers and rehabilitation/revegetation options with all new applications for development  
> Rehabilitate areas of existing riparian vegetation in accordance with the Coastal PoM  
> Buffers to the creek and riparian vegetation from recreational activities on Council and Crown Land  
> Buffer zones to allow for well designed bicycle/pedestrian pathways where appropriate  
> Council to investigate implementation via LEP amendments, Regional Open Space and other planning instruments, taking into account existing landuse rights | High | Ongoing | In-kind | Appears to be kept in most new developments, still a few where clearing has gone to waters edge or close |
### F Revegetation of degraded areas
- Initiate weed removal program
- Planting of native species
- Rezoning of land for environmental protection
- Control of access as appropriate

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>Revegetation of degraded areas</td>
<td>High</td>
<td>Ongoing</td>
<td>?</td>
<td>High</td>
<td>Ongoing</td>
</tr>
</tbody>
</table>

Degraded areas appear to be rehabilitating well, still some weeds present, though there is obvious ongoing attempts to remove them. Area behind houses/caravan park not revegetated. A rehabilitation plan is at draft stage.

### G Hastings Pt STP wet weather overflow into creek
- Maximise reserve capacity for wet weather events to reduce incidence of overflows into Christies Creek
- Duplication of filter system pumps to increase pumping capacity to dunal disposal system
- Investigate flow monitoring alarm system
- Include a sample site in the Water Quality Monitoring System to ensure compliance with EPA requirements
- Awareness program on impacts of treated effluent vs untreated stormwater and the presence of the dunal disposal system

<table>
<thead>
<tr>
<th>Key</th>
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<tbody>
<tr>
<td>G</td>
<td>Hastings Pt STP wet weather overflow into creek</td>
<td>High</td>
<td>Done</td>
<td>$2.5M</td>
<td>No formal records of overflows have been kept, Council staff advise no overflows in 2002-03, but two overflows in flood conditions in 2001, increased pump and storage capacity to be included at the upgraded STP, aim is to eliminate overflows, sample site was installed - results show no discernible impacts. Creek Street Pump Station has been upgraded.</td>
<td></td>
</tr>
</tbody>
</table>

### Issues and Actions: Cudgera Creek- Recreational

<table>
<thead>
<tr>
<th>Key</th>
<th>Management Issue</th>
<th>Action Strategy</th>
<th>Priority given</th>
<th>Status</th>
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</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>Opportunity to enhance passive recreational facilities</td>
<td>Upgrade the existing parkland and improve facilities consistent with the Coastal PoM</td>
<td>Low</td>
<td>Facilities upgraded</td>
<td>$30,000</td>
<td>Parkland has easy access points to beach and foreshore, facilities present.</td>
</tr>
<tr>
<td>I</td>
<td>Opportunity to provide safe and easy access for canoe launching</td>
<td>Provide canoe launching areas and enhanced facilities for water-based recreation  &gt; All works should be in accordance with the Coastal PoM  &gt; Expand picnic, parking and playground facilities</td>
<td>Med</td>
<td>Not required</td>
<td>nil</td>
<td>Minor works have occurred within the carpark. Boat ramp was present adjacent to bridge before 1997 EMP, and so the provision of canoe launching/exit area is not needed</td>
</tr>
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</tr>
<tr>
<td>K</td>
<td>Speedboats limiting opportunities for swimming, canoeing, windsurfing etc</td>
<td>Impose 4kt boat speed limit for areas upstream of creek mouth  &gt; Post &quot;no wash&quot; signs along the creek banks upstream of the bridge</td>
<td>High</td>
<td>Complete</td>
<td>$2,000 (Waterways Authority)</td>
<td>4kt signs in place, no &quot;no wash&quot; signs, instead there are 8kt signs from bridge upstream. Complaints about unlawful and nuisance use of PWC's have reduced significantly since signage was put in.</td>
</tr>
<tr>
<td>L</td>
<td>Opportunity to enhance passive boating activities</td>
<td>Provide canoe trail, marked as appropriate with points of local interest (e.g. wetland vegetation types, description of fish types/birdlife present)</td>
<td>Med</td>
<td>Design stage</td>
<td>not yet implemented, planning underway</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>Opportunity to enhance recreational opportunities for cyclists</td>
<td>Construction of a bike trail in conjunction with the upgrade of the roads and bridges along the creek from Pottsville north</td>
<td>Low</td>
<td>Complete</td>
<td>$80,000</td>
<td>Bike/walking track constructed to the west of the road</td>
</tr>
<tr>
<td>N</td>
<td>Opportunity to provide recreational park facilities</td>
<td>Provide picnic tables and playground facilities</td>
<td>Low</td>
<td>Not done</td>
<td>nil</td>
<td>Not needed. Area has been earmarked as possible sports area in future</td>
</tr>
<tr>
<td>O</td>
<td>Opportunity to enhance recreational facilities</td>
<td>Construction of a foreshore boardwalk along/through existing creek bank vegetation  &gt; Signs to provide information of interest about the local area and its ecological significance  &gt; Link to Leisure Gardens Pottsville and existing wetland walks in this area</td>
<td>Med</td>
<td>Ongoing, link created</td>
<td>A track from the bridge south to the oval exists, linking this area with the Leisure Gardens. Other actions not pursued</td>
<td></td>
</tr>
</tbody>
</table>
### Table 3 Cudgen Creek Implementation Assessment

<table>
<thead>
<tr>
<th>Key</th>
<th>Management Issue</th>
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</tr>
</thead>
</table>
| A   | Shoaling at creek entrance reducing creek flushing | ➤ Sand movement is a dynamic process and shoaling will vary over time and should continue as a natural process  
➤ Management of the current and future uses of the catchment land will decrease sediment inputs into the creek and may reduce the level of siltation within the creek  
➤ Monitoring of siltation/shoaling within the creek  
➤ If siltation/shoaling increases flooding processes to levels of public concern or such that water quality is adversely affected investigate limited dredging and dredge material placement strategies (beach sand should be placed on downdrift beach system) | Ongoing | No dredging | nil | Still silted/shoaled heavily, no adverse affects on flooding apparent, non-dredged, good condition, with indurated rocks stopping dredging option |
| B   | Bank erosion | ➤ The majority of the bank erosion in this area is apparently due to wash from boat traffic, therefore need to limit boat speeds  
➤ Where practicable, allow natural bank erosion to occur to preserve the natural bank character and processes  
➤ Where necessary to protect adjacent facilities, stabilisation of banks using treated log retaining walls  
➤ Works will need to be consistent with the Coastal PoM | High | Ongoing Some works completed | See C & D | Erosion still occurring Timber walls in place in some areas, although these are failing into creek and allowing erosion to occur Plan of Management for Mooball Creek Reserve on Overall Drive has just been completed |
### Issues and Actions: Mooball Creek North - Environmental

<table>
<thead>
<tr>
<th>Key</th>
<th>Management Issue</th>
<th>Action Strategy</th>
<th>Priority given</th>
<th>Status</th>
<th>Investment</th>
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</tr>
</thead>
</table>
| C   | Continue revegetation/rehabilitation | ➢ Support continued replanting of native vegetation and weed removal  
➢ Ongoing maintenance consistent with the Coastal PoM | Ongoing | Ongoing | $10,000 materials  
$160,000 labour in-kind | Revegetation and rehabilitation apparent, Bitou being killed, natural and assisted regeneration occurring |
| D   | Access to creek undefined leading to bank erosion | ➢ Provide access, via stairs from the road adjacent to the bridge on the southwest side of the creek, to the foreshore beach area  
➢ Works in accordance with the Coastal PoM | Med | Ongoing | $40,000 materials  
$160,000 labour in-kind | DuneCare sign in place, advising people to not enter creek from this point, rehab area |
| E   | Access to creek from Wooyung/Pottsville Road poorly defined | ➢ Widen and construct formal tracks through vegetation in areas where informal tracks already exist  
➢ Signs should be placed at the entrance to indicate the location of these access points to the creek  
➢ Incorporate parking facilities, formal walking trails and picnic facilities, as appropriate, at access points  
➢ Works will need to be consistent with the Coastal PoM | High | Ongoing | See C & D | Tracks formalised and noticeable, car parking and trails present |
| F   | Access to creek poorly defined leading to bank degradation | ➢ Construct formal access points to the creek from the road | High | Some works completed  
Design stage | $11,000 | Access points still informal, bank erosion occurring, large chunks eroded in some places  
Plan for rehabilitation of erosion areas newly in place |
### Potential for poor water quality

<table>
<thead>
<tr>
<th>G</th>
<th>Potential for poor water quality</th>
<th>Monitor water quality and potential adverse influences</th>
<th>Med</th>
<th>Ongoing</th>
<th>$5,000</th>
<th>Water quality monitored monthly at junction of arms. Water quality is good in the canal</th>
</tr>
</thead>
</table>

### Buffer zone to development

<table>
<thead>
<tr>
<th>H</th>
<th>Buffer zone to development</th>
<th>Minimum buffer widths of 50m to be observed</th>
<th>High</th>
<th>Ongoing</th>
<th>In-kind</th>
<th>Buffer not strictly adhered to in Black Rocks Estate area, though there is saltmarsh protection area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Assessment of buffers and rehabilitation/revegetation options with all new applications for development</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Rehabilitate areas of existing riparian vegetation</td>
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<td></td>
<td></td>
<td>Buffers to the creek and riparian vegetation from recreational activities on Council and Crown Land</td>
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<td></td>
<td></td>
<td>Council to investigate implementation via LEP amendments, Regional Open Space and other planning instruments, taking into account existing landuse rights</td>
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</tbody>
</table>

### Issues and Actions: Mooball Creek North - Recreational

<table>
<thead>
<tr>
<th>I</th>
<th>Opportunity to enhance/ rehabilitate littoral rainforest in this area along with enhancing beach access</th>
<th>Initiate a weed removal program</th>
<th>High</th>
<th>Complete, with ongoing weed removal maintenance</th>
<th>Mostly completed by DuneCare, small areas left to do</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Construct formal beach access using treated log fences</td>
<td></td>
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<td></td>
<td></td>
<td>Works will need to be consistent with the Coastal PoM</td>
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</tbody>
</table>

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**Draft Review of the 1997 Tweed Estuary Management Plan**

**Tweed Shire Council**
<table>
<thead>
<tr>
<th></th>
<th>Speed boats limiting opportunities for swimming, canoeing, windsurfing, etc</th>
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</thead>
<tbody>
<tr>
<td>K</td>
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<tr>
<td></td>
<td></td>
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<tr>
<td></td>
<td>High</td>
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<table>
<thead>
<tr>
<th></th>
<th>Enhance recreational facilities</th>
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<tbody>
<tr>
<td>L</td>
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<tr>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Med</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Recreational opportunities for cyclists</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td></td>
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<tr>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Low</td>
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<tr>
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<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Opportunity to create formal access points to the creek</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Med</td>
</tr>
<tr>
<td></td>
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</tbody>
</table>

Australian Wetlands
### Issues and Actions: Mooball Creek South - Hydraulics and Morphology

<table>
<thead>
<tr>
<th>Key</th>
<th>Management Issue</th>
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<th>Priority given</th>
<th>Status</th>
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<th>2003 Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>Threat to road from bank erosion</td>
<td>➢ Assess long term erosion trends and potential impacts to the road&lt;br&gt; ➢ Assess requirements for protective works on the creek bank adjacent to the road consistent with the Coastal PoM&lt;br&gt; ➢ Re-aligning road to accommodate future courses of the creek is also an option however this option must take into consideration dune and beach protection in re-alignment of the road</td>
<td>High</td>
<td>Not done</td>
<td>nil</td>
<td>Erosion still occurring. A small attempt at revetment/rubble wall, although this has not been too successful. Slumping occurring, indicating early signs of bank erosion. Road not aligned. Potential to fence off area to stop people assisting in erosion by climbing the banks, making other access points available.</td>
</tr>
</tbody>
</table>

| P   | Proposed new bridge location | ➢ Bridge design should be such that it does not impede the flow of tidal or flood waters along the creek<br> ➢ Locate so as to minimise vegetation disturbance and stabilise localised bank erosion | High | Bridge built | Bridge constructed, no apparent impact on tidal flow or restriction. Small amount of vegetation removed during construction, with compensation plantings undertaken. |

### Issues and Actions: Mooball Creek South - Recreational

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>Q</td>
<td>Opportunity to enhance recreational areas for cyclists</td>
<td>➢ Construct a bike track in conjunction with the upgrade of the road along the creek&lt;br&gt; ➢ Works will need to be consistent with the Coastal PoM and taking into account SEPP 26</td>
<td>Low</td>
<td>Not completed</td>
<td>$100,000</td>
<td>Not constructed on eastern side of Creek Cycleway on western side of Creek from Overall Drive north complete.</td>
</tr>
</tbody>
</table>
### Issues and Actions: Mooball Creek South - Environmental

<table>
<thead>
<tr>
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<th>Status</th>
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</tr>
</thead>
</table>
| R   | Access to creek from Wooyung/ Pottsville Road poorly defined | ➢ Widen and construct formal tracks using existing informal tracks where appropriate and close others  
➢ Signs should be placed at the entrance to indicate the location of these access points to the creek  
➢ Incorporate parking facilities, formal walking trails and picnic facilities at these access points  
➢ Works will need to be consistent with the Coastal PoM | Med | Not done | Some tracks have been made formal, although there are still many informal tracks, parking and other facilities partly installed Wooyung Nature Reserve in now present, informal tracks through this area should be removed under NPWS Plan of Management |
| S   | Litter/rubbish and old bridge pylons obstructing the creek | ➢ Removal of rubbish and bridge pylons  
➢ Works will need to be consistent with the Coastal PoM | Med | Not done | nil | Rubbish/car bodies removed No further action needed |
| T   | Buffer zone to development | ➢ Minimum buffer widths of 50m to be observed wherever possible  
➢ Assessment of buffers and rehabilitation/revegetation options with all new applications for development  
➢ Rehabilitate areas of existing riparian vegetation  
➢ Works will need to be consistent with the Coastal PoM  
➢ Buffers to the creek and riparian vegetation form recreational activities on Council and Crown Land  
➢ Council to investigate implementation via LEP amendments, Regional Open Space and other planning instruments, taking into account existing landuse rights | High | Ongoing | In-kind | Development only occurring in Black Rocks Estate, 50m buffer kept along most sections |
<table>
<thead>
<tr>
<th>Potential for rehabilitation for native vegetation areas which have a weed problem</th>
<th>Initiate an ongoing weed removal program</th>
<th>Med</th>
<th>Ongoing</th>
<th>Bitou removal underway, rehabilitation occurring with natural regeneration of sally wattle Area is now in Wooyung Nature Reserve</th>
</tr>
</thead>
</table>


4 Water Quality

The 1997 Plan recommended that water quality sampling should be carried out every two months, with at least two specific events to be monitored each year (e.g., heavy rain). It was suggested that events should be monitored through a full tidal cycle, while the regular sampling should be taken at high spring tides, and should involve samples taken from near the surface and near the bottom of the water column.

Since 1999, Tweed Shire Council has been undertaking water quality testing at set monitoring points along the three estuaries. The timing of sampling has ranged from fortnightly to six-weekly. The monitoring results have been assessed for trends and key features over the four years (see Draft Tweed Coast EMP 2004-2008).

5 Ecological Assessment

5.1 Bank Erosion since 1997

The field inspections included assessments of prominent bank erosion sites highlighted in the 1997 Plan. Unfortunately, as no measurements of the erosion focus points were made in 1997, it is difficult to know how much erosion has occurred since then. However, the following observations were made for each estuary.

5.1.1 Cudgen Creek Estuary

Bank erosion was still occurring along the southern cut bank of the estuary, from the bridge seawards. This appears to be natural, and eroding relatively slowly, possibly due to the vegetation covering parts of the sand.

Another two areas of erosion were seen during the field audits that were not highlighted in the 1997 EMP. These were both located on the northern bank of the estuary, both west and east of the bridge in the recreational parks. The erosion occurring in the eastern park was relatively minor, however, it is still of some concern.

Erosion in the western park, stretching from the bridge to past the Cudgen Creek Rainforest Walk, was active over a larger area, probably a result of the combined effects of undermining by the rising and falling tides, boat wash, and pedestrian access to the estuary with passive water craft.

Remediation works had been attempted through the dumping of rubble, although this appears to have failed in halting erosion in some sections, and only increased the hazards in the water.
5.1.2 Cudgera Creek Estuary

Remediation methods used to manage bank erosion in the lower Cudgera Creek estuary include the placement of rubble on an affected site. This method has had varying levels of success, with erosion still occurring in sections. Most areas in the lower estuary have remained unprotected, though with little ongoing erosion occurring.

A small section has been eroding upstream of Koala Beach Bridge. There is now a section of rock revetment under a small stormwater pipe leaving the Pottsville Public School site, evidently in order to disperse the energy from stormwater to reduce its impacts on the estuary bank.

There is also substantial erosion occurring on the scour-bank at the Koala Beach Estate park, along the western arm of Cudgera Creek. There is considerable bank undercutting at this point, which appears to be ongoing.

5.1.3 Mooball Creek Estuary

Bank erosion had been remediated in parts of the lower estuary through the use of treated-timber revetment walls. However, erosion was still occurring behind parts of the timber walls in some sections.

The placement of 'No Wash' signs upstream of Pottsville Bridge appears to have slowed the erosion process in unprotected areas, although there are parts where informal access to the estuary has heightened the erosion. The area highlighted in the 1997 EMP ("D") next to the eastern side of the bridge appears to have come under remediation, with signage to discourage people entering the area.

Small-scale attempts at rock and rubble walls in the upper estuary have slowed the erosion process, although it is still occurring. The section of estuary that is closest to the Wooyung-Pottsville Road is eroding, apparently partly due to people climbing the shear bank to and from the water.

5.2 Fauna

5.2.1 Cudgen Creek Estuary

- A distinct lack of rocky shore biota along breakwalls
- Some bream and whiting observed inside entrance
- Oysters, limpets, macroalgae along walls near boat ramp
5.2.2 Cudgera Creek Estuary

- Pelicans in estuary, shorebirds on beach; dogs present
- Sooty Oystercatcher and Crested Terns present
- Lower estuary floor with good cover of worm and yabbie (Callianassa sp) holes, many stingray depressions
- Rubble under bridge could be removed, apparently not much value as habitat, most fish present are associated with bridge shading and piles
- Nesting Osprey taking fledgling out for first flights

5.2.3 Mooball Creek Estuary

- Stingrays at least as far upstream as the Black Rocks Estate bridge
- Schools of small and large fish in and near canal culverts
- Oysters occurring around entrance, up to bridge
- Yabbies and worms scattered throughout estuarine flats of lower-middle estuary
- Many fish species utilising both sand and rocky substrate - whiting, bream, porcupine-fish, rock cod, blennies, wrasse, many rock-pool associated fish, hermit crabs, snails, red and green marine algae, etc present

5.3 Stormwater Management

5.3.1 Cudgen Creek Estuary System

**Bogangar section**
- stormwater from residential areas is piped to a stormwater pond/wetland on the western edge of the Bogangar subdivision;
- the only stormwater treatment device in Bogangar Canal appears to be a gross pollutant trap, in the form of a litter boom, stormwater runoff from this area enters the canal then flows to Cudgen Lake

**Casuarina Beach Stormwater System**
- individual infiltration devices and filters at house lots
- litter racks in main pipe system
- dry vegetated sandy swales - then enters directly into creek
- high risk zone of creek for nutrient rich waters

**Kingscliff**
- two CDS pollutant traps installed near urban area
- otherwise little stormwater management
5.3.2 Cudgera Creek Estuary System

Koala Beach
• stormwater ponds treat stormwater
• other houses have pipes onto ground - overland down hill to wetland/creek
• substantial areas of grassed surfaces may promote infiltration
• Roads are narrow, reducing hard surfaces
• Standard kerb and guttering
• Uncertainty about roof water runoff - no sign of street entries
• Appears to be good sediment control during construction
• Stormwater pond appears to have breached ASS - iron colour, anaerobic smell of water leaving pond and entering natural wetland
• Second pond (no apparent entry or exit points) has possibly breached ASS on the western edge
• no obvious rainwater tanks

Stormwater pipes at Cudgera Bridge discharge into mangroves

5.3.3 Mooball Creek Estuary System

Pottsville Waters and Black Rocks Estates
• Drain dug out and planted with Lepronia (wetland sedge) appears to have scraped ASS - iron bacteria, colour, turbidity in both Lepronia drain and mangrove drain on eastern side of road
• no litter traps in stormwater pit drains
• Pottsville Waters canal entrance/exit to Mooball Creek has 4 stormwater drains outside, 3 inside canal on first canal arm (northern) - 2 large drains form one drain inside canal arm
• Rudimentary litter trap devices on some of the drains
• Southern canal arm has 2 exit/entrance pipes
• Simple litter trap device on one drain
• Black Rocks/Pottsville Waters estates border has large stormwater wetland/pond with floodgates
• Appears that most road and house stormwater enters pond/wetland, with only those bordering the canal discharging into the canal
• Stormwater pipes some distance out into Mooball Creek, with scour holes in front of each

General
• Most stormwater pipes have no form of litter collection
• Appears that there are no stormwater outlets below bridge into Mooball Creek
5.4 Other Issues Identified

5.4.1 Cudgen Creek Estuary System

- Severe Acid Sulphate Soil conditions observed in Clothiers Creek catchment: iron oxides in drains, indicator vegetation of lilies and spikerush. Extending from the highway turnoff to Clothiers Creek locality.
- No general concerns for water quality or lake health on southern end of Cudgen Lake at the caravan park. Water quality appears reasonably healthy at this dry time of year.

Kingscliff Entrance
- Isolated danger marker needs reflective tape
- Spur wall has minor scouring on western (upstream) side
- Sandbars within entrance shallow, almost impassable during spring low tide

Canoe Park
- No canoe launching facility has been installed
- 8 knot speed zone (planned to be no wash)
- New park facilities have been installed

5.4.2 Cudgera Creek Estuary System

- Dune injection of sewage effluent signed as "re-use" for dunal revegetation
- Flood tide deltas both sides of the bridge
- Dynamic entrance kept open by the natural channeling of sand through reefs and headland
- Bridge has narrowed estuary channel by about half when it was constructed
- "Debs" not apparent in Christies Creek
- 4 knot speed limit from bridge to estuary mouth, 8 knot speed limit elsewhere
5.4.3 Mooball Creek Estuary System

- Car bodies present on western side of estuary, south of Black Rocks Estate, on old dirt road - visible from Black Rocks bridge
- Crabbies Creek drains, ASS indications in drains, tidal, cattle and horses on drain banks
- Three formal and several informal tracks to the beach from Wooyung-Pottsville Road
- No formal tracks to the estuary
- Illegal rubbish dumping on estuary banks and in informal tracks
- Wetland area west of Pottsville Waters extensive, mostly draining into Cudgera Creek (culvert under Cudgera Creek Road) through artificial drains
- Some tracks along estuary and beach made formal, rubbish dumping still occurring
- Entrance and estuary to bridge heavily shoaled, with narrow channel (fast moving current on ebb tide)
- Natural rock outcrops would make dredging extremely difficult, if considered
- Very difficult for motor boats to exit and enter on low tides; relative shallowness of channel at low tide would only allow for small boats
- Track to Southern Wall now bitumen-sealed, facilities in place
- Speed signs in place - 4 knots downstream of bridge, No Wash upstream until Pottsville Waters canals, becomes 8 knots
6 Conclusions

The 1997 Estuary Management Plan was developed with a very broad focus on the estuary, particularly since it was not based on an Estuary Processes Study.

There were generally few references to the impacts of catchment processes and products on the estuaries. It is difficult to manage a healthy and thriving estuary without addressing the fundamental impacts of poor water quality entering from the catchment.

Overall, many of the basic recommendations have been implemented. However, there are some areas of concern, especially in regard to stormwater management, acid sulphate soils investigation and management, completion of recreational facilities, entrance management, and the enforcement of zonings.

Some of the estuarine water quality monitoring points are not in the best position to assess the quality of runoff from the drainage system in regard to pH, Dissolved Oxygen, iron and aluminium concentrations, all indicators of ASS.

Rehabilitation and regeneration of damaged areas of native vegetation has been an ongoing and successful aspect of the Plan. Continued support for this work is essential for the coming years.

The 1997 Estuary Management Plan began a long-term management phase for the three systems. Implementation of the recommendations has been reliant on funding and support. The Plan has provided a good basis for the next phase of managing the three estuaries of Cudgen, Cudgera and Mooball Creeks, with many projects underway.

7 References
