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## **Shoalhaven City Council**

Lake Conjola Entrance  
Management

Discussion Paper

January 2012



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## 1. Preamble

This paper provides a summary of progress in the development of an Interim Entrance Management Policy for Lake Conjola (the Lake). When completed, this interim policy will clearly outline the circumstances where Shoalhaven City Council (SCC) is to artificially open the Lake entrance and provide a rational decision making procedure for undertaking such works. A number of key issues associated with Lake Conjola entrance are discussed within this paper, including:

- ▶ Current Lake Conjola Entrance Management Plan;
- ▶ NSW Government positioning on the management of Intermittently Closed and Open Lakes and Lagoons (ICOLL);
- ▶ Lake entrance sensitivity;
- ▶ Lake Conjola flooding;
- ▶ Lake water quality;
- ▶ Lake ecology;
- ▶ Lake Conjola Community expectations; and,
- ▶ Options for management.

The paper serves to inform and allow key stakeholders to provide comment and direction in relation to each of the above considerations.



## 2. Introduction

### 2.1 Project Overview

Shoalhaven City Council (SCC) is responsible for maintaining the entrance of Lake Conjola in line with NSW Government Guidelines, and considering the sometimes competing expectations of the Lake Conjola community. SCC is also responsible for ensuring that the entrance management policy adopted maintains the ecological diversity of the estuary, water quality and minimises any potential impact on lake assets as a result of catchment flooding or storm surge inundation.

GHD has been engaged by SCC to undertake a review of the *Lake Conjola Entrance Management Plan* prepared by Manly Hydraulics Laboratory (MHL) in 2003, and develop an Interim Entrance Management Policy in order to reflect current community values, scientific knowledge, strategic direction and technical understanding. This Interim Entrance Management Policy will provide updated direction to SCC in managing the Lake Conjola Entrance using new information gathered since the adoption of the existing Entrance Management Plan.

### 2.2 Scope

The scope of works for the development of the Interim Entrance Management Policy has included review of available background literature, review of relevant NSW Guidelines as well as evaluation of the current management methods adopted by SCC. Based on this review updated methods for management of the Lake Conjola Entrance will be developed and included within the Interim Entrance Management Policy.

### 3. Background

#### 3.1 Study Area

Lake Conjola is a coastal lake located approximately 50 km south of Nowra on the NSW south coast as shown in Figure 1. The lake has a surface area of approximately 4.3 km<sup>2</sup> and a catchment area of 145 km<sup>2</sup>. Lake Conjola is classified as a predominantly open lake and historically has remained open for approximately 62% of the time.

**Figure 1 Lake Conjola Locality (SCC Estuary Management Plan 1998)**



The main lake is separated from the ocean by a shallow sandy inlet some 3 km long. The entrance to the lake comprises a tidal delta of clean marine sand with pronounced sand lobes which are elevated up to 1 m above sea level. The inlet itself is shallow with extensive intertidal muddy sand flats and an average channel depth of the order of 1 m compared with the lake which has water depths up to 10 m.

The entrance shoals constantly change due to environmental factors such as floods, tidal flows, storm waves, littoral sand supply and wind blown sand from Conjola Beach. Average tidal flows between the lake and ocean maintain a relatively small entrance channel which is typically located against the

northern rock shelf of Cunjarong. The entrance is prone to closure and can remain closed for years in the absence of large rainfall events and/or mechanical intervention; this usually occurs as a result of floods assisted by mechanical intervention in the way of excavation of a pilot channel.

In the past water quality issues have been a concern during prolonged periods of entrance closure. This however is no longer as significant an issue as septic disposal systems have been upgraded to a village sewerage reticulation system and regular water quality monitoring is undertaken.

Several of the villages bordering Lake Conjola are low lying and susceptible to inundation if the levels in the lake exceed approximately 1 m AHD. The Lake is a popular tourist destination with many attractions situated on low lying land. It is therefore important that water levels in the lake are monitored and the entrance effectively managed in order to minimise disturbance to the local community, tourism industry and assets.

### **3.2 Entrance Physical Processes**

Lake Conjola is classified as a barrier estuary with steep valley sides a central basin that formed when the sea level rose and drowned the river valley. It is an immature estuary that has remained largely unaffected by fluvial deposition.

A study undertaken by Patterson Britton and Partners in 1999 identified four basic entrance states, specifically; Regime State, Flood Scoured State, Intermediate State and Storm Washover State. The Regime State describes the steady end state whereby the entrance naturally and gradually establishes in the absence of any sudden changes caused by major floods and storms. Flood Scoured state describes the condition whereby a sudden change occurs to the entrance as a result of a significant flood leading to a net loss of sand from the entrance shoals and widening of the entrance. Intermediate State is characterised by rapid infilling of entrance shoals after a major flood and before reaching regime conditions (1-2 years). The final state, Storm Washover, describes the scenario whereby a sudden change occurs to the entrance caused by major to severe storm waves washing over the entrance spit leading to blocking of the entrance channel.

### **3.3 Entrance History**

A history of the state of the Lake Conjola entrance dating back approximately 20 years is summarised in Table 1 and historic aerial photos and newspaper clippings are provided in Appendix A.

Review of the entrance reveals that closure has been regular but infrequent and is most often due to storm washover deposits shoaling the entrance channel followed by minimal rainfall. On average over the past 20 years the entrance has largely been classified as open or in the regime state. The review of Council records reveals that the entrance has been mechanically opened during six of the twenty years as documented below.

**Table 1 History of State of the Entrance (Sourced from SCC records)**

Year	State of Entrance	Rainfall (Highest monthly (mm))	Ocean Storms	Comments
1991	Flood scoured	200 – Nov.	Severe ocean storm - August	Highest June flow on record scoured entrance By November delta shoals re-established Internal flood scour against high dune
1992	Regime state	400 – Feb.	No major ocean storms	Pronounced erosion of high dune by February 1992 flood
1993	Regime state	150 – Jan.	No major ocean storms	Internal scour
1994	Storm washover Heavily shoaled  Closed	200 – Mar.	Severe ocean storm – March  Major ocean storm - April	Washover fan from March/April storms closed ebb channel Entrance almost closed by storms Shallow, choked secondary ebb channel formed Entrance closed toward end of year
1995	Closed	200 – May	Major ocean storm – March  Severe ocean storm - September	Freshwater Inflows (FWI) not enough to open entrance Storm washover caused by September storm
1996	Closed	200 – Sept.	Two severe ocean storms – Sept & Nov	Several council attempts to open entrance Major storm washover in Sept and Nov Minor FWI only Wind blown sand build up
1997	Closed	200 - June	Severe ocean storm - May	Major washover by May 1997 storm Minor freshes Wind blown sand build up
1998	Manually opened Flood scoured	400 – Aug.	Not recorded	Artificial opening in south – August August flood scoured entrance Flood scoured high dune

Year	State of Entrance	Rainfall (Highest monthly (mm))	Ocean Storms	Comments
1999	Manually opened – 8500 m <sup>2</sup> dredged	200 – Oct.	Not recorded	Channel dredged Spit raised to reduce storm washover
2000	Open	200 - March	Not recorded	High waves from a storm event infill entrance which recovers quickly
2001	Open	150 - July	Not recorded	No major storms and a few FWI maintain the entrance open Entrance progressively shoaling
2002	Open	300 – Feb.	Not recorded	February FWI and low storm activity maintain entrance open
2003	Open	350 - May	Not recorded	FWI and tidal flushing maintain the entrance open
2004	Open	200 – Oct.	Not recorded	FWI and tidal flushing maintained entrance open
2005	Open	150 – Oct	Not recorded	Storm washover <b>Lake slowly shoaling towards closure</b>
2006	Open	200 - June	Not recorded	Storm washover Significant coastal storm combined with an unusual 0.5 m storm surge which washed over the beach and heavily shoaled the eastern ebb channel <b>Lake close to closure</b>
2007	Open	380 - June	Not recorded	FWI and tidal flushing maintained entrance open
2008	Open	150 – Feb	Not Recorded	Very large storm and very low rainfall lead to heavily shoaled entrance <b>Lake close to closure</b>
2009	Open	200 - June	Not recorded	May moderate north east storm formed second channel and improved efficiency of the entrance End 2009 single channel along the northern rock wall
2010	Closed	Not recorded	Not Recorded	May intervention failed to trigger a persistent channel due to a coastal storm

Year	State of Entrance	Rainfall (Highest monthly (mm))	Ocean Storms	Comments
				Second attempt in September however coastal storms closed the lake Pre-Christmas intervention at 1 m AHD
2011	Open	Not recorded	Not Recorded	<b>Closure early March</b> Emergency mechanical opening following heavy rainfalls on 21 <sup>st</sup> March – lake level 1.32 m AHD

Prior to the twenty years documented above, Council records and a review of the *Entrance Processes Study* prepared by Patterson Britton in 1999 indicate that:

- ▶ Between the period 1973 – 1999 the entrance closed 8 times;
- ▶ As per the events documented above closure was as a result of severe storms shoaling the entrance channel;
- ▶ Entrance closures were observed to last for several years until flood events of suitable magnitude scoured the entrance channel;
- ▶ Over 62 years prior to 1999, the cumulative duration of various entrance states were:
  - Closed – 9.5 years, i.e. 15%
  - Open – 38.5 years, i.e. 62% (ie. Regime, flood scoured or intermediate state)
  - Shoaled – 14 years, i.e. 23% (ie. Heavily shoaled, or storm washover state)
- ▶ The longest continuous period of static open entrance conditions was the period from February 1971 to August 1986, a period of 15.6 years. This period was characterised by very quiet sea conditions; there were 9 years with major storms. The only year with a severe storm (1974) corresponded with the second wettest year (of the period 1973 to 1998) during which numerous floods and freshwater inflows occurred. This period of prolonged entrance stability was ended by a severe storm in August 1986 which occurred in a dry year.

In summary, the review of available records indicates that:

- ▶ Entrance closures are as a result of severe storms shoaling the entrance channel;
- ▶ Periods of entrance stability correspond with periods of minimal storm activity; and
- ▶ The key to maintaining entrance stability is to minimise the impact of storm washover.

## 4. Lake Conjola Entrance Management Plan

Management of the entrance is currently conducted in accordance with the *Lake Conjola Entrance Management Plan*, developed by Manly Hydraulics Laboratory (MHL) in 2003. The plan aims to ensure a permanently open entrance with entrance dredging works implemented when necessary to prevent closure.

Closure of the Lake entrance occurs over a relatively long period of time. The management plan includes measures to maintain a commitment to an open entrance by Council and government agencies, a decision support system to provide adequate warning of closure and procedures for pre-construction activities so that entrance works can be commenced prior to closure.

The dredging works outlined in the entrance management plan comprise dredging approximately 100,000 m<sup>3</sup> of sand from the entrance channel and depositing it on the entrance spit. The sand is to be placed and stabilised so that it restricts waves washing over the spit and depositing sand in the channel.

Since implementation of the 2003 entrance management plan, Council's position as well as NSW Government requirements have changed in relation to the management of intermittently closed and open lakes and lagoons (ICOLL), hence the need to review and update the existing plan. The long term goal of the NSW Government in relation to entrance management policies is now to retain or progressively reinstate natural entrance behaviour and to progressively remove, relocate or modify assets or activities that are affected by inundation if the entrance is allowed to return to a natural regime.

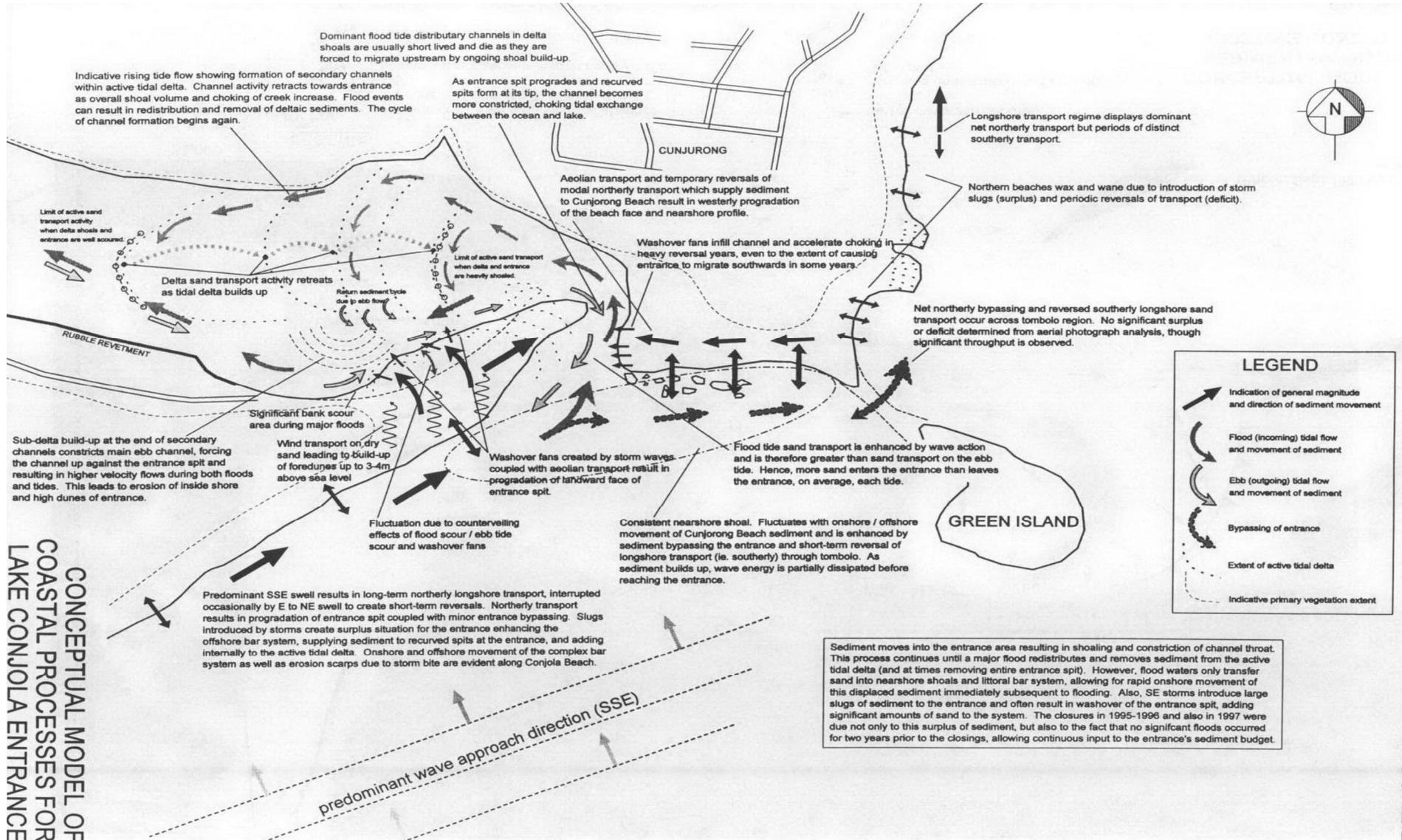
As well as the changed view of the NSW Government the permanently open entrance of the 2003 Plan was required in order to alleviate concerns in relation to water quality within the Lake. With the upgrade to the Lake Conjola Sewerage System in 2008, water quality concerns in relation to the Lake have now been alleviated. These variations to the views originally held by governmental bodies combined with changing community expectations and the ongoing upgrades to the sewerage systems within Lake Conjola have resulted in the need to review the existing entrance management plan for the Lake.



## 5. Lake Entrance Sensitivity

Entrance behaviour is a complex process due to the unpredictable nature of coastal processes acting to infill the entrance with beach sand and fluvial processes resulting from rain acting to scour sand out of the entrance as is depicted in Figure 2. Shoalhaven City Council undertook a study in 1996 and Patterson Britton and Partners (PBP) undertook investigations into the sensitivity of the lake entrance in 1999 as presented in the *Lake Conjola Entrance Study* in order to improve understanding of the complex entrance behaviour.

Figure 2 Conceptual Model for Coastal Processes for Lake Conjola (PBP 1999)



CONCEPTUAL MODEL OF COASTAL PROCESSES FOR LAKE CONJOLA ENTRANCE

## 5.1 Wind Blown Sand Transport Regime

The entrance study (PBP 1999) identified a strong sand drift regime resulting in a strong south-easterly spit growth habitat. The strong south-easterly regime was also described as being a significant factor to entrance stability particularly during periods when the entrance spit is undisturbed by floods and a considerable volume of sand can drift from Conjola Beach and build foredunes and sandhills on the entrance spit and add to the build-up of the tidal delta. Analysis of wind data identified the wind blown sand supply to the entrance can vary from less than 4,500 m<sup>3</sup> p.a when the beach is heavily scarped to 13,500 m<sup>3</sup> p.a when the beach is in an accreted state. Wind blown sand has the potential to build the entrance 3-4 m above sea level.

It should be noted the growth of the spit is seasonal based on trends in prominent wind directions and thus spoil disposal sites need to be determined based on the known seasonal wind trends.

## 5.2 Longshore Transport

Investigations have also indicated a longshore transport regime characterised by an accumulation of sand in the northern half of Conjola Beach, estimated at an average of approximately 50,000 m<sup>3</sup>/a. This net northerly movement of sand impacts on the susceptibility of the entrance to slowly shoal.

## 5.3 Tidal Hydrodynamics

Tidal investigations (PBP, 1999) showed that under a heavily shoaled entrance condition, peak tidal velocities do not exceed 0.5 m/s, except in the vicinity of the boat ramp and the entrance throat where peak velocities of 1 m/s and 1.4 m/s occur during the flood and ebb tide respectively. These small tidal velocities are thus insufficient to cause any significant scour of the bed and banks upstream of the boat ramp leading to an inability to create an open entrance channel. The modelling undertaken indicated during the ebb tide the majority of flow is confined to the main entrance channel however during the flood tide, tidal flows can access the minor channels.

## 5.4 Catchment Flows

High flow volumes from the Lake Conjola catchment have the effect of assisting ebb flows to scour the entrance channel. During periods of increased rainfall the entrance may gradually expand as the net effects of flow from the river/estuary dominate entrance forming processes.

## 5.5 Storm Washover

Based on review of available information entrance closure in the past has been as a result of storm activity.

Storm waves of suitable size and period create substantial storm surge against the entrance channel. Under these conditions, the entrance spit is prone to overtopping by waves and the main channels of the entrance become susceptible to rapid infilling by wave washover sand deposits thus leading to closure.

## 5.6 Entrance Stability

The above factors all contribute to the stability of the entrance. Of those factors above storms and flooding play a considerable role in the stability of the entrance as was detailed in 3.3. In every case of



entrance closure, closure has been triggered by a severe storm resulting in sediment washover deposits which block the entrance channel.

In summary, investigations have deduced the following in relation to the characteristics of the entrance of Lake Conjola:

- ▶ Wind blown sand from Conjola Beach is a significant contributor to the build-up of the entrance spit, dunes and tidal delta shoals. Wind blown sand can build the entrance to 3 – 4 m above sea level;
- ▶ There is a northerly net longshore transport of sand along Conjola Beach which drives northward growth of the entrance spit and forces the entrance channel towards the northern shoreline. The northerly movement of sand also results in extensive nearshore shoals adjacent to the entrance channel and entrance spit. These shoals dissipate wave energy and produce a wide surf zone;
- ▶ The entrance spit is always low unless dredge spoil is on the spit and thus is susceptible to storm washover which leads to entrance closure;
- ▶ Entrance closures are caused by severe storms;
- ▶ Wave stirring of the bed enhances flood tide transport so that there is a net infeed of sand every tide;
- ▶ When the entrance is scoured the tidal range within the lake is greater and as such tidal flows are strong causing sand to be transported to the western extremity of the delta shoals on the flood tide. As the entrance shoals, the tidal range reduces as does the scouring effect of the tidal flow; and,
- ▶ Floods periodically scour the entrance channel and the surface of the tidal delta thereby rejuvenating tidal flows and sediment infeed.

## 6. Lake Flooding

A flood study undertaken in 2007 (BMT WBM) identified two main causes of flooding within Lake Conjola. These comprised flooding as a result of intense rainfall in the catchment (catchment flooding) and flooding resulting from severe ocean conditions (ocean flooding), causing elevated ocean water levels to extend into Conjola Lake.

Hydraulic calculations undertaken during the flood study demonstrated that the entrance channel geometry at the constriction created by the entrance sand berm is the critical parameter determining flood levels in Lake Conjola. The entrance channel geometry affects flood levels for both types of flooding.

Review of the available information indicates the most significant flooding in the lake occurs as a result of a 1 in 5 year storm surge corresponding with a 1 in 100 year flood event corresponding with an open entrance. Mitigating the effects of such flooding should be considered during the development of the Flood Risk Management Plan for Lake Conjola which is currently being prepared by BMT WBM. Table 2 summarises the flood assessment results as determined by PBP in 1999.

**Table 2 Predicted Flood Levels in Lake Conjola (PBP 1999)**

Location	Flood Level (mAHD)				
	Storm surge only <sup>1</sup>	Major flooding scenario <sup>2</sup>	1 in 100 yr flood with no storm surge	Minor flooding scenario <sup>3</sup>	1 in 5 yr flood with no storm surge
Ocean Tailwater	2.2	2.2	0.6	2.2	0.6
Deep Sea Caravan Park	1.5	2.6	1.7	2.2	1.3
Lake Conjola PO	1.5	2.9	2.0	2.3	1.4
Conjola Lake	1.5	4.0	3.1	2.9	1.9

<sup>1</sup> 1 in 5 year storm surge of 1.6m superimposed on a tide of mean spring ie. Peak ocean level of 2.2m AHD.

<sup>2</sup> 1 in 100 year freshwater flow coinciding with 1 in 5 year storm surge.

<sup>3</sup> 1 in 5 yr freshwater flow coinciding with 1 in 5 yr storm surge



Taking into consideration these flood levels and the minimum floor levels in Table 3 it can be seen there is a potential for inundation of low lying properties as a result of both catchment and ocean flooding. The options for management discussed in section 10 have taken into consideration the need to manage impacts from catchment flooding and ocean flooding, the surveyed floor levels detailed below, and the potential effects the entrance regime has on the community of Lake Conjola.

**Table 3 Conjola Floor Levels<sup>4</sup> (Floor level survey provided by BMT WBM)**

Floor Level	Number of Properties
≤ 1 m AHD	0
1 m AHD < but ≤ 1.2 m AHD	0
1.2 m AHD < but ≤ 1.5 m AHD	12
1.5 m AHD < but ≤ 2 m AHD	95
2 m AHD < but ≤ 2.5 m AHD	364
2.5 m AHD < but ≤ 3 m AHD	250
3 m AHD < but ≤ 3.5 m AHD	146
3.5 m AHD < but ≤ 4 m AHD	70

<sup>4</sup> Table 3 does not account for surveyed ground levels only surveyed floor levels of buildings.

## 7. Lake Water Quality

Water quality is one of the key factors determining the ecological character of an estuary. It is also an important factor to those people using the estuary for recreational or commercial purposes and for those living on its foreshores and adjacent areas.

Water quality within Lake Conjola is considered to be good and improving. In the past when the entrance was heavily shoaled high bacteria levels could occur in sections of the estuary, in particular in the canal leading to Pattimores Lagoon. This localised decline in water quality was one of the governing factors in maintaining an open entrance regime. Since implementation of the Entrance Management Plan (2003), SCC has developed an estuary health monitoring project that sets key actions and strategies in order to improve the health of Lake Conjola.

In the past the community of Lake Conjola has raised the following concerns in relation to the health of the estuary:

- ▶ Elevated levels of faecal coliforms, particularly in Conjola Creek and Pattimores Lagoon;
- ▶ Turbidity related to increases in sedimentation;
- ▶ Decrease of dissolved oxygen levels; and
- ▶ The change of salinity regime in Lake Conjola and Pattimores Lagoon.

In order to improve the water quality within the estuary and address community concerns, SCC has and is continuing to undertake the following:

- ▶ In 2008 a reticulated sewerage system was implemented for Lake Conjola village. This system reduced the potential for elevated levels of faecal coliform within the estuary during a closed entrance regime;
- ▶ Ongoing monitoring of bacterial levels in the Lake is undertaken to ensure levels are in accordance with ANZECC guidelines for Fresh and Marine Water Quality;
- ▶ The LEP was amended to incorporate erosion and sediment control requirements in order to decrease the levels of sedimentation occurring in the estuary as a result of run off;
- ▶ Ongoing monitoring of the dissolved oxygen levels in the estuary are undertaken to ensure levels are in accordance with ANZECC guidelines for Fresh and Marine Water Quality;
- ▶ The weir to Pattimores Lagoon has been removed and ongoing discussions are being had regarding the construction of a new weir to restore the salinity regime to the lagoon which was originally a freshwater wetland; and,
- ▶ Banks have been revegetated and stabilised in order to reduce erosion and thus increased sedimentation within the estuary.

The works undertaken by SCC have improved the overall water quality of the estuary and as such it is no longer a requirement to keep the entrance open solely in order to maintain water quality. Regular water quality monitoring is proposed to be maintained to ensure that levels remain compliant with ANZECC guidelines for Fresh and Marine Water Quality.

## 8. Lake Ecology

Due to the unpredictable nature of rainfall in south-east Australia, the opening behaviour of estuaries can be intermittent and erratic and the salinity regime is comparatively variable (Roy *et al.* 2001). As the opening and closing of estuary entrances is a natural occurrence, the plants and animals residing in and around them have adapted to the variability in environmental conditions.

A diverse array of aquatic habitats exist within Lake Conjola including seagrasses, mangroves, shoals, wetlands, rocky outcrops and walls and timber pilings. Lake Conjola is a dynamic estuary, with each of these habitats being directly affected by the open or closed state of the entrance.

### 8.1 Flora

The vegetation of Lake Conjola consists of saltmarshes, mangroves and seagrasses. As well as these species, in the past the area has been infested by the invasive marine plant, cold tolerant *Caulerpa taxifolia*.

#### 8.1.1 Seagrasses

Review of the available documentation relating to the ecology of the lake indicates that there are two seagrass communities *Zostera* and *Halophila*. The coverage of the seagrasses is directly related to whether the entrance is open, closed or intermittent. If the entrance is open the extent of seagrass may decrease however their overall health may improve. If the entrance is closed opportunistic growth of seagrass may occur with the increase in water depth. Variations on the extent and growth of seagrass may occur based on a number of different factors including rainfall, sediment and nutrient input, boat traffic current velocities and water levels.

Seagrasses serve three main key functions: they provide habitat for fish and other aquatic fauna, they help to reduce erosion and improve water quality, and they are a source of food for fish and other aquatic fauna.

#### 8.1.2 *Caulerpa Taxifolia*

Much of the estuary is vulnerable to the invasive marine algae, *Caulerpa Taxifolia*. The population in Lake Conjola is thought to have become established between 1987 and 1995 and is most closely related to populations from Moreton Bay, Queensland. This algae is listed as noxious marine vegetation and it presents a serious threat to estuarine ecosystems in NSW. In an effort to halt the spread of the algae the *NSW Department of Industry and Investment* (formally *NSW Fisheries*) introduced new fishing restrictions in 2001. Haul netting was banned entirely and boating avoided near any infestations to reduce the incidence of fragmentation of existing beds.

A review of environmental factors (MHL,2003) outlines that flushing appears to have increased the fragmentation of the algae thus spreading the infestation, however states that there is no evidence to assess the validity of this mechanism. Initial research on control methods for *Caulerpa* identified the application of salt as the most useful control tool, and many hundreds of tonnes have been applied to infestations in NSW. However, many factors can reduce the feasibility of this treatment technique, including the depth of the infestation, the area of the seabed that requires treatment and the extent of other native seagrass species intermingled with *Caulerpa*. Consequently, salt is now only used in limited circumstances.

A study undertaken specific to Lake Conjola in 2007 (E. J. West R. J. West) concluded that the *Caulerpa* appears to die off when the Lake is closed to the ocean. The paper outlined that one option for management that could be considered is the return of Lake Conjola to its natural opening regimes, which may in the future include long periods of closure and lowered salinity. The paper outlined that based on the evidence from laboratory experiments and existing literature, entrance closure, if associated with lowered salinity, would have a negative impact on growth and may lead to mortality of large areas of the invasive alga.

As such it appears that restoring the Lake to its natural regime may assist in eradicating and reducing the spread of the noxious weed. In light of the very limited information available in relation to *Caulerpa* it is recommended to adopt the guidelines as set down by the *NSW Department of Industry and Investment*.

### **8.1.3 Saltmarsh and Mangroves**

Saltmarsh vegetation occurs in Pattimores lagoon with a variety of communities occurring including *Sacocornia* samphire flats in the small embayment around the perimeter of the lagoon, extending into *Juncus* and *Phragmites* reed beds. Very little in the way of mangroves have been documented.

## **8.2 Fauna**

Over the years numerous studies have been prepared on the fauna of Lake Conjola; a brief summary of those species identified is provided below.

### **8.3 Fish**

Fish from seagrass beds were sampled by the Environment Research Institute in spring 1998 and summer and autumn 1999. 42 species were collected, 16 of which were considered of commercial importance. The greatest numbers of fish were found in the upper reaches of the estuary, however there was a greater diversity in the entrance and mid-estuary regions. The entrance was open during the sampling however it was been preceded by a closure of over a four year period.

### **8.4 Threatened Species**

In 2002 the Ecology Lab conducted an assessment of the threatened fish species of Lake Conjola. During this assessment four threatened fish species were identified, all of which were of the pipefish variety. The pipefish use the seagrass as their primary habitat. No fish species currently recorded in the *NSW Fisheries Management Act* were recorded in Lake Conjola.

Other endangered species known to be within 10 km of Lake Conjola include amphibians (frogs), aves (birds), mammals and reptiles.

The shallow waters of the estuary entrance provides important habitat for many bird species. High water levels usually have a negative impact on many wetland birds because it reduces the availability of habitat and as such has been taken into consideration in the development of the Interim Entrance Management Plan. Three threatened bird species have been observed in Lake Conjola, specifically the Hooded Plover, the Little Tern and the Pied Oystercatcher. These threatened shorebird species nest within the lake system, on the islands and the sand spit. The Hooded Plover is critically endangered, the Little Tern endangered and the Pied Oystercatcher endangered. The three species are protected by the International Migratory Bird Agreement.

## 9. Community Expectations

In order to manage Lake Conjola effectively it is necessary to clearly identify the values that people with an interest in the lake consider important. With values identified it is then possible to develop future management objectives in line with community wants and expectations.

A review of available information and a community consultation session has outlined a number of key issues that need to be addressed and considered when adopting an Interim Entrance Management Policy. These key issues are described below.

### 9.1 Water Quality

Water quality resulting from increased levels of faecal coliforms is no longer an issue within the Lake. A reticulated sewerage system was implemented in 2008 to eliminate this issue. As well as this, upgrade measures have been put in place as part of the SCC *Estuary Health Monitoring Program* in order to maintain water quality within Conjola in line with current ANZECC guidelines for Fresh and Marine Water Quality.

### 9.2 Erosion and Sedimentation

Erosion and sedimentation has been identified as a management issue by the community. Through their estuary health monitoring program SCC has implemented actions designed to reduce the levels of erosion and monitor the level of sedimentation within Lake Conjola.

In 2002 funding was sought for management of the foreshore and riparian vegetation of Lake Conjola; in addition regular assessment is made by Council and consultants of areas experiencing bank erosion, shoreline stabilisation and actions are continually being developed for rectification of the Lake Conjola shoreline.

The extent of erosion and sedimentation will improve with infrastructure and increased community awareness. Erosion and sedimentation is often caused by clearing of vegetation, runoff from roads and urban areas; if the community is made aware of possible methods for managing erosion and sedimentation then the extent can be significantly reduced.

### 9.3 Wastewater and Sewage Overflows

In the past wastewater and sewage overflow has been a concern of the local Conjola community. The sewerage system was upgraded in 2008 and was designed with a minimum 8 hour detention time for emergency storage during power outages and pump problems.

An emergency response is in place for times where there is major interruption to the power supply or pump problems that could cause possible system failure. The first response is the utilisation of council tankers to clear built up sewage. Shoalhaven Water has a 20,000 litre wastewater tanker and two smaller tanks, as well as this council has a contract with a local wastewater tanker company who are able to provide tankers immediately for any problems encountered. If power is out city wide then tankers may be utilised from Unanderra and Wollongong. During extended power outages Council has six large mobile generators that are used during extended power outages to ensure pump station have the ability to continue operations.



During emergency situations the resources are available to ensure no overflows enter in the Lake. If sewage was to enter the Lake, the Department of Environment, Climate Change and Water would be notified through the EPA hotline and water sampling of the Lake would be conducted.

#### **9.4 Flooding**

The community in the past has raised concerns regarding the potential for inundation of low lying properties as a result of a closed entrance. Review of available information has indicated that the scenario likely to cause the most significant damage to low lying properties is not as a result of catchment flooding but due to a combination of both ocean inundation and catchment flooding corresponding with an open entrance.

In order to effectively manage this issue and satisfy the community whilst also considering what is best for estuary health, the interim entrance policy will account for both catchment flooding and ocean inundation. The options for management are described in section 10.

#### **9.5 Entrance Management and Opening Locations**

The management objective in relation to the Lake Conjola entrance is to achieve an opening regime with minimal human intervention which considers water quality, flooding and the ecological health of the Lake. The opening strategy outlined in section 10 takes into account these aspects.

In the past community members have voiced concerns in relation to the location of the entrance opening. It is recommended that the pilot channel be positioned as far north as is practicable for the following reasons:

- ▶ Opening the channel toward the southern end of the entrance can lead to significant erosion along the banks inside the entrance as was seen with the 1998 opening where the board walk collapsed;
- ▶ The general alignment of the shoals and the fact that the dune builds up to the south means it is most practical for the pilot channel to be located to the north in order to minimise the necessary length of the pilot channel;
- ▶ The wave shadow provided by Green Islands can assist in reducing the susceptibility of the entrance to shoal. If the channel is located further to the south if a storm event takes place after opening, the entrance will shoal more quickly than what might be the case if the entrance is located to the northern limit;
- ▶ If shorebirds are nesting the pilot channel should be located to the North to minimise disturbance; and,
- ▶ Having the pilot channel as far north as practicable will minimise disturbance to the southern dune which is acting as protection from storm surge inundation.

#### **9.6 Community Consultation Outcomes**

A community consultation session was held on 28<sup>th</sup> November 2011. During the consultation various community concerns were raised and discussed. Of the concerns raised the most prominent discussion were focused around the ideas of dredging the lake, opening the lake at a lower trigger level of 0.8 m AHD and opening the Lake to the south rather than the north. A summary of the community consultation is provided in Appendix B.



The community comments have been noted and discussed however based on the studies and research undertaken to date and the understanding of the coastal processes occurring at Lake Conjola the Interim Policy developed has maintained that the opening be undertaken at a trigger level of 1 m AHD. This trigger level has been based on an assessment of survey levels provided by WBM and has been chosen based on ensuring that habitable floor levels of properties are not inundated as a result of low level flood events. It should be noted that opening the entrance will not mitigate against the larger flood events.

## 10. Options for Management

This discussion paper has been produced based on findings from reviews undertaken to date relating to the Lake Conjola entrance. A concept opening policy for management of the entrance has been provided in order to allow comment, revision and ultimate endorsement by key stakeholders prior to implementation as an Interim Entrance Management Policy. This document and proposed policy has been reviewed and form part of the final Interim Entrance Management Policy.

It should be noted that entrance opening in some circumstances will not prevent flooding and may increase the risk of flooding as a result of storm surge. It should also be noted that in some circumstances it may not be possible to undertake the opening works however if possible the below procedures outline the method to be adopted.

### 10.1 Management Policy Objectives

The management strategy outlined below seeks to:

- ▶ Minimise interference with natural entrance opening processes and minimise associated impacts on ecological processes;
- ▶ Minimise risks to public safety associated with excessive inundation of foreshores and associated infrastructure;
- ▶ Satisfy local community values;
- ▶ Minimise risks to public health associated with excessive bacterial contamination of water;
- ▶ Determine the procedures to be initiated for entrance operations including entrance breakouts;
- ▶ Determine key responsibilities for management of the entrance; and
- ▶ Detail the procedures for monitoring of the Lake entrance.

The ultimate entrance management policy will take into account the entrance processes occurring and will develop strategies to improve entrance stability. Specifically, the entrance processes outlined in Table 4 can be managed effectively by ongoing involvement by SCC and the community through an overall entrance management strategy.

**Table 4 Ongoing Management Actions**

Process/Development	Issue	Management	Action & Timeframe
<b>Storm Washover</b>	The susceptibility of the entrance channel to close as a result of storm washover	Increase height of the dune on the southern side of the entrance  NB: dune to be of suitable height in order to stop wave overtopping otherwise has the potential to act as a sand source to infill the entrance channel	Dune Nourishment – Ongoing

Process/Development	Issue	Management	Action & Timeframe
<b>Wind Blown Sand</b>	Tendency for wind blown sand to contribute half the sand supply to the entrance shoals.	Ensure dunes are vegetated along Conjola Beach in order to minimise the impact of wind blown sand	Dune Vegetation – Ongoing
<b>Water Quality</b>	Potential for water quality to decline if effective management is not maintained	Community awareness, vegetation and bank stabilisation	Water quality monitoring, Vegetation, Bank Stabilisation - Ongoing
<b>Flooding</b>	Low lying land is susceptible to inundation	Development controls to include increased minimum floor levels to allow the entrance to return to a natural regime as possible  Flood Risk Management Plan will outline ongoing management requirements	Flood Risk Management Plan – Currently being developed  Flood DCP minimum floor levels updated – 2 years  Develop evacuation plan – 12 months
<b>Wastewater and Sewage Overflows</b>	Wastewater and sewage overflows into Lake Conjola	Ensure ongoing improvements are made to the sewerage system to adequately minimise the potential for wastewater and sewage overflows	Emergency measures are in place during times of power outage and pump problems to ensure overflow does not enter into the Lake
<b>Community Awareness</b>	Ill informed	Community awareness sessions, community signage, community newsletters, a Lake Conjola webpage and notice board	Provide newsletters to the local community with ongoing information on the state of the Lake and the processes occurring within the Lake – Ongoing  Develop a community noticeboard with snapshots of the processes occurring within Lake Conjola and the ongoing management objectives - Ongoing
<b>Development Consent and Lake Entrance Management</b>	Discrepancies between development approval and Lake entrance management	A wholistic approach in relation to development consent and management of the Lake entrance needs to be adopted that is in keeping with ensuring ongoing development takes place as well as ensuring the Lake is	Implement Flood Risk Management Plan's recommended development controls - 2 years

Process/Development	Issue	Management	Action & Timeframe
		restored to as natural a regime as is possible	
<b>Opening Protocol</b>	Resources and funding	<p>Ensure ongoing improvements are made to the protocols adopted for opening the entrance.</p> <p>Investigate the possibility for an environmental levy to allow the community to have more involvement in the opening of the entrance.</p> <p>Investigate possibility of further government funding.</p>	<p>Inform on site contractors of alternate methods for pilot channel excavation – Ongoing</p> <p>Investigate environmental levy to obtain increased funding for entrance opening procedures – 12 months</p> <p>Investigate government funding options – 12 months</p>

## 10.2 Policy Opening Procedures

### 10.2.1 Triggers

The following summarises the **proposed triggers** that would justify mechanical opening of the entrance:

- Lake water level (measured from MHL gauge at Conjola Caravan Park) at or exceeding 1.0 m AHD. At a level of 0.8 m AHD plant and equipment to be placed on standby. If moderate or heavy rainfall is ongoing or predicted and water reaches a level of 0.9 m AHD (measured from MHL gauge at Conjola Caravan Park) preparatory works should be undertaken to prepare the pilot channel for opening;
- OR
- If the Lake Level reaches and stabilises at a level between 0.8 m and 1.0 m AHD (measured from the MHL gauge at the Conjola Caravan Park) within three months prior to or at the time of the Christmas holidays and moderate or heavy rainfall is ongoing or predicted;
- OR
- Water quality declines to a point where levels are no longer compliant with ANZECC guidelines for Fresh and Marine Water Quality and water level is at or above 0.8 m AHD (measured from the MHL gauge at the Conjola Caravan Park) and moderate or heavy rainfall is ongoing or predicted;
- OR
- An emergency situation where Lake water levels are rising rapidly and a flood event is occurring or predicted. At a level above 1.1 m AHD works should be undertaken, if situation permits, to open the entrance in the shortest and quickest way possible.

### 10.2.2 Procedures

The following **proposed procedures** are to be followed during opening of the entrance (refer Appendix D of Policy for operational details):

- Opening April through to August inclusive (Non nesting season for threatened bird species):

- Relevant authorities and media to be informed of intent to open entrance
- Moderate or heavy rainfall is ongoing or predicted in the Lake Conjola Catchment area
- Low tide
- Small ocean swells
- Suitably qualified person to be on site to monitor shorebirds
- Access to be gained from Cunjarong Boat Ramp and remediated once works are complete
- Disposed spoil to be placed and shaped as nourishment on the entrance spit dune south of the entrance channel and in those areas experiencing erosion
- Revegetation to follow placement of spoil - If revegetation cannot be done sand to be placed north of the entrance channel
- Pilot channel sized to reflect width of entrance berm. As an example based on *1999 Entrance Study* if a pilot channel is approximately 200 m long then it needs to be no less than 10 m wide and have a bed at an RL 0.0 m AHD
- Pilot channel to be located as far north as is practicable as the northern foreshore has least exposure to wave energy
- Pilot channel excavation to start from the ocean and finish at the lake edge with plugs left in place at either end until ready to release Lake water
- Beach in immediate vicinity of entrance to be closed to the public
- Opening September through to March inclusive:
  - Relevant authorities and media to be informed of intent to open entrance
  - Moderate or heavy rainfall is ongoing or predicted in the Lake Conjola Catchment area
  - Low tide
  - Small ocean swells
  - Suitably qualified person to be on site to monitor shorebirds
  - Access to be gained from Cunjarong Boat Ramp and remediated once works are complete
  - Disposed spoil to be placed and shaped as nourishment on the northern shoreline of the entrance between Cunjarong and Green Island in order to avoid disturbance to nesting birds
  - Pilot channel sized to reflect width of entrance berm
  - Pilot channel to be located as far north as is practicable as the northern foreshore has the least exposure to wave energy
  - Pilot channel excavation to start from the ocean and finish at the lake edge with plugs left in place at either end until ready to release Lake water
  - Beach in immediate vicinity of entrance to be closed to the public
- Emergency opening:
  - Relevant authorities and media to be informed of intent to open entrance
  - Flood situation is occurring or predicted
  - Opening to be conducted in the shortest and quickest way possible
  - Opening only to be undertaken if safety is not compromised for all involved

- Access to be gained via the safest and quickest route available
- Disposed spoil to be placed north of pilot channel if achievable
- Pilot channel to be located, positioned and sized to ensure the safety of those involved is not compromised
- Beach in immediate vicinity of entrance to be closed to the public

## **10.3 Monitoring**

### **10.3.1 Water Level**

Water levels in Conjola Lake are monitored on a continuous basis by Manly Hydraulics Laboratory, refer:

[http://mhl.nsw.gov.au/htbin/map\\_data\\_display.com?SITE=CONJ](http://mhl.nsw.gov.au/htbin/map_data_display.com?SITE=CONJ)

In addition some property owners have established their own water level monitoring gauges. It is recommended that SCC's Natural Resource Manager monitor Lake water levels regularly, in particular after rain events. During an opening event details of water level at both the Lake Entrance and further upstream should be recorded as per the monitoring data sheet provided in Appendix C of the Policy.

### **10.3.2 Rainfall**

Rainfall forecasts should be regularly monitored when the Lake water levels reach approximately 0.8 m AHD. The Bureau of Meteorology website should be referred to on a regular basis, refer:

<http://www.bom.gov.au/jsp/watl/rainfall/pme.jsp>

If forecast rainfall values are predicted to raise the Lake water level above 0.9 m AHD equipment should be placed on standby for excavation of the pilot channel.

### **10.3.3 Water Quality**

It is recommended to continue with the water quality monitoring program in concurrence with monitoring of the entrance regime. When water quality levels exceed ANZECC guidelines appropriate signage should be put in place and investigations should be made into a potential opening of the entrance.

If the entrance is closed during holiday periods water quality monitoring is to be undertaken on a weekly basis. Results from testing should be updated regularly on the Shoalhaven City Council website, refer:

<http://www.shoalhaven.nsw.gov.au/soe/Region/Indicator%20homes/Surfacewaterqualitylakeconjola.htm>

In order to improve overall water quality within the catchment impervious suburban areas should be kept to a minimum, eroded banks should be stabilised, the buffer strip along the foreshore maintained and sewerage systems within the Lake Conjola catchment continually upgraded.

### **10.3.4 Entrance Opening Events**

During an opening event details should be recorded including whether it was an artificial or natural opening, water level and water level recording gauge, date, location of breach, details of the channel and details of spoil placement as per the monitoring data sheet in Appendix C of the Policy. It is also recommended to trial a number of different opening scenarios such as low tide opening /high tide opening and northern spit opening/southern spit opening and record the results.



After an opening event it is recommended to monitor shoreline erosion and vegetation loss and reinstate areas found to have experienced detrimental effects as a result of the opening. The entrance should be monitored and the timeframe between the opening and the commencement of shoaling should be recorded. Photographic records should be kept on file for future use in entrance management.



## 11. References

*Lake Conjola Entrance Study* Patterson Britton and Partners 1999

*Lake Conjola Entrance Management Plan* Manly Hydraulics Laboratory 2003

*Lake Conjola Entrance Management Dredging Works Review of Environmental Factors* Manly Hydraulics Laboratory 2003

*Lake Conjola Flood Study* BMT WBM 2007

*Lake Conjola Estuary Management Plan* 1998

*Burrill Lake – Interim Entrance Management Policy* Peter Spurway & Associates P/L 2008



Appendix A  
Historical Photographs and Media

1911-2007

## BURRILL LAKE.

### OPENING OF THE MOUTH.

MILTON, Wednesday.

A public meeting last night decided to approach the Government with a view to opening the mouth of Burrill Lake, which of late years has been blocked, and in consequence large areas of good farm land on the shores have been submerged and rendered practically useless. It was decided to open a subscription-list to raise funds locally, and then ask the Government to augment them, and carry out the work. Mr. Bloomfield, of the Harbours and Rivers Department, in response to a request from the Clyde Shire, inspected the place last week, and recommends blasting a channel through the bar of rock, which at present is the principal barrier. He estimates the cost at £200. Mr. Bloomfield also inspected Conjola Lake, which is similarly blocked. This being outside the municipality, the meeting last night did not cover it. The Clyde Shire, however, is agitating in regard to it.

With respect to the Burrill Lake, three land owners on the shore handed in their names for £55 between them. The general public is now being appealed to.



**COASTAL CONDITIONS LAST NIGHT.**

The following telegrams published at the G.P.O. at 8 o'clock last night indicate that the coastal conditions are becoming normal:—

- Tweed Heads, SE, fresh, cloudy, bar moderate.
- Ballina, SE, fresh, fine, sea smooth.
- Clarence Heads, S, light, cloudy, sea smooth.
- South Solitary, S, light, fine, sea smooth.
- Bellinger Heads, SE, moderate, fine, sea moderate.
- Nambucca Heads, E, fresh, fine, sea moderate.
- Beal Rocks, S, moderate, thick misty rain, sea moderate.
- Port Stephens, SE, light, raining, sea slight.
- Newcastle, SE, moderate, cloudy, sea smooth.
- Lake Macquarie Heads, NE, light, showery, sea moderate.
- Catherine Hill Bay, NE, light, showery, sea moderate.
- Barranjoey, SE, light, cloudy, sea slight.
- South Head, ESE, moderate, cloudy, sea moderate.
- Wollongong, E, light, thick, raining, sea slight.
- Kiama, SE, light, like rain, sea moderate.
- Crockhaven Heads, SW, light, thick misty showers, sea slight.
- Jervis Bay, SE, light, cloudy, moderate south-east swell.
- Ulladulla, S, light, showery, sea moderate.
- Batemans Bay, SE, light, cloudy, sea moderate.
- Moruya, NE, light, fine, sea slight.
- Eden, NE, fresh, cloudy, sea moderate.
- Green Cape, NE, fresh, cloudy, sea moderate.

The Melbourne Steamship Company's steamer Kapunda, which arrived at breakfast time yesterday, experienced rough weather all the way from Adelaide. The weather was particularly severe between Adelaide and Melbourne, but on the New South Wales coast the sea had moderated somewhat. Owing to her late arrival, and delay through rains, her departure for Melbourne this afternoon may be delayed. The same company's steamer Melbourne made a long passage up the coast from Melbourne. Although due at Catherine Hill Bay for loading Wallarah coal on Sunday afternoon, she did not reach that port until late last night.

The A.U.S.N. Company's steamer Wyandra, which arrived yesterday from Melbourne, escaped the worst conditions. Captain W. H. M'Lellan reports having had moderate winds, high south-east swell, and unsettled weather.

**ALSTONVILLE.**—Although the month of January opened dry, the rainfall to the present totals eight inches, most of which fell during the end of last week. The season throughout has been exceptionally favourable, and record results have been obtained.

**BLACKTOWN.**—An exceptionally heavy thunder-storm passed over here on Saturday afternoon, and within one hour all creeks were in high flood.

**BRANTON.**—Three inches of rain fell during this week.

**CLIFTON.**—The recent heavy weather did a great deal of damage to the Cliff-road, which is still blocked against heavy rainfalls. Large falls of rock

and rock completely blocked the road in several places. Yesterday afternoon several motor parties were greatly disappointed to find they could not pass along the Cliff-road on their way to Sydney, and were compelled to return via Bulli and the Pass to reach their destinations. A man residing in a humpy on the side of the Illawarra Range, near Clifton, retired to rest on Thursday night, and was awakened by finding his bed submerged by flood water. Debris washed up against the door made it impossible to open it from the inside. His humpy was soon carried away, and he with all his belongings went with it on the torrent. Finally he succeeded in getting a foothold, and reached safety on firmer ground.

**GUNNING.**—Recent cyclonic storms have done much damage to roads throughout the district.

**MILTON.**—The recent rainfall for Milton totalled nearly 16 inches. A few showers early in the month make the fall for January 17 inches so far. Considerable damage to the roads and culverts has resulted, but beyond this, not much loss has occurred. Conjola, Burrialla, and Tabourie lakes have broken out, and relieved the situation in regard to surrounding properties.

**PAMBULA.**—The flood waters subsided on Monday. Some of the paddocks on the flat are considerably damaged, while others are enriched with the river sediment. A total of 1358 points were registered to 9 a.m. on Monday.

**PEAR HILL.**—Almost six inches of rain has fallen here up till yesterday. There are appearances of a repetition of last January's rain, when 8in fell.

**RICHMOND.**—Unusual weather is being experienced here, showers continually falling. Nearly 10in have fallen here since Wednesday last, Castleragh and Agnes Banks being within the vicinity of 13in, whilst Comleroy-road, Kurrajong Heights, and Norwood recorded 1350, 1628, and 1125 points respectively. The rain will prove beneficial to the district as a whole.

**ROBERTSON.**—Steady rain set in again on Sunday, and continued all day. Light rain fell on Monday. Since Wednesday last 1462 points were registered.

**WOLLONGONG.**—There appears to be no abatement of the rain, which has fallen almost continually since Wednesday night. On Sunday night and on Monday heavy rain again fell. The total fall since the rain commenced, to 9 a.m. on Monday, was 1106 points.



## LAKE OPENED TO SEA.

MILTON, Thursday.

Conjola Lake, which was closed by heavy seas since last October for the first time in 29 years, has been reopened by volunteers, working with scoops loaned by the Clyde Shire Council. The back-water had been forced to a considerable distance over the flats. The opened channel, which is 40 yards wide and four feet deep, allows the water to rush to sea, and the land is being rapidly drained. It is anticipated that the first high tide will bring conditions back to normal.





COASTAL SURVEILLANCE 2001  
STANWELL PARK - BATEMANS BAY  
CONJOLA  
NSW4550 (M2264)

17-04-01  
193-205

RUN 6  
152.76 mm  
Approx. Scale  
1:12000

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08:57:16 17/04 0107646 NSW4550 R06 M2264 STANWL\_BATEMNL01 1:12000 ASD 535.2695 E150.4997 1880m <-051

FS100 1/ 340 F/4.0 FF--- EC----- SP- 041.05911 00% d1011.1 d5026 26.2V -66mb ER00 CAM5202

0 1 9 9



COASTAL SURVEILLANCE 2005  
STANWELL PARK - BATEMANS BAY  
CONJOLA  
NSW4893 (M2464)

01-02-05  
26-38

RUN 6  
152.76 mm  
Approx. Scale  
1:12 000

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FS100 1/500 F/4.0

FF----

EC-----

SP- V/H. 008800

00% d4015.5

05011

26.7V

-67mb ER00 CAM5202

00:45:11 01-02-05 26-38 152.76 1:12000 604 005.2602 E150.5000 1880M 4-052



09:01:29 23/03 0703246 NSW5016 R06 M2577 CS-STANWELL.PK\_BB 1:12000 604 535.2681 E150.5008 1857m <-051

COASTAL SURVEILLANCE 2007  
BATEMANS BAY - STANWELL PARK  
CONJOLA  
NSW5016 (M2577)

23-03-07  
58-70

RUN 6  
152.76 mm  
Approx. Scale  
1:12000

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FS100 1 / 400 f/4.0 FF---- EC---- SP- w/h. 04580 008 dt013.2 ds016 27.2v -66mb ER00 CAMS202





Appendix B  
Community Consultation Summary



CLIENTS | PEOPLE | PERFORMANCE

**Shoalhaven City Council**  
Report for Lake Conjola Interim  
Entrance Management Policy  
Community Consultation  
January 2012

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## Appendices

Appendix A Community Consultation Summary

# 1. Introduction

Shoalhaven City Council (SCC) is responsible for maintaining the entrance of Lake Conjola in line with NSW Government Guidelines, and considering the sometimes competing expectations of the Lake Conjola community. SCC is also responsible for ensuring that the entrance management policy adopted maintains the ecological diversity of the estuary, water quality and minimises any potential impact on lake assets as a result of catchment flooding or storm surge inundation.

GHD has been engaged by SCC to undertake a review of the Lake Conjola Entrance Management Plan prepared by Manly Hydraulics Laboratory (MHL) in 2003, and develop an Interim Entrance Management Policy in order to reflect current community values, scientific knowledge, strategic direction and technical understanding. This Interim Entrance Management Policy will provide updated direction to SCC in managing the Lake Conjola Entrance using new information gathered since the adoption of the existing Entrance Management Plan.

A Community Consultation session was held at 10 am on Monday 28<sup>th</sup> November, at the Lake Conjola Community Centre, Lake Conjola. This report provides a summary of that consultation session and subsequent responses received from the feedback form provided at the meeting as well as from email correspondence.

## 2. Community Consultation

### 2.1 Attendance

The public hearing was attended by approximately fifty three (53) Community Members of the Lake Conjola area.

Three (3) Council officers were in attendance: Isabelle Ghetti who chaired the consultation session, Ray Massie and Andrew Gibbes.

Two (2) National Parks and Wildlife Service staff were in attendance: Libby Shield and Jodie Dunn.

Two (2) NSW Maritime staff were in attendance: Warwick Scott and Mike Baldwin.

Two (2) staff members from GHD that were in attendance: Elizabeth Lockett and Anthony Galea.

The purpose and nature of the Community Consultation was outlined through a slide show to those attending the session. Participants were then invited to represent their views and questions on the subject matter of the consultation.

### 2.2 Community Questions

The questions raised during the consultation related to the following key areas:

- ▶ Entrance opening locations;
- ▶ Dredging of the entrance channel;
- ▶ Having a permanently open entrance;
- ▶ Water quality testing and concerns;
- ▶ Shorebirds;
- ▶ Opening water level; and,
- ▶ Sea level rise adaptation.

A summary of the questions and responses from the community session is provided in Appendix A

## 3. Feedback Form Responses

### 3.1 Provided Forms

GHD provided feedback forms to members of the community to fill in at the community consultation, or to be completed after the meeting and returned to GHD within two weeks of the consultation session.

Questions asked on these forms included:

- ▶ How did you hear about the community consultation session?
- ▶ Why did you come to the workshop today?
- ▶ Has the event been useful?
- ▶ Did you learn anything new about Lake Conjola today? If so what did you learn?
- ▶ Do you have any particular areas of interest/concerns about the Lake Conjola Entrance Plan?
- ▶ In terms of entrance management what would your ideal policy be for opening of the entrance keeping in mind the available funding at this point in time (eg water levels, opening location, frequency of opening)?
- ▶ Any other comments?

Seven (7) of the fifty (50) feedback forms distributed were returned.

### 3.2 Representations

The responses from the returned feedback forms contained the following comments and considerations:

- ▶ Suggestion of dredging the middle of the Lake was made in three (3) out of the seven (7) feedback forms;
- ▶ One resident suggested Council investigate innovative methods of funding sand removal;
- ▶ Two of the residents believed the 1m AHD trigger level adopted was too high and that a 0.8 m AHD trigger level should be considered;
- ▶ One resident outlined that they were concerned about the water quality of the Lake;
- ▶ Two residents wanted the Lake permanently open; and,
- ▶ One resident suggested opening to the south of the entrance.

## 4. Email Correspondence

### 4.1 Representations

A number of users and cabin owners from the Deepwater Resort provided email correspondence to GHD, Council and the local Member of Parliament voicing their concerns and considerations in relation to the management of the entrance of Lake Conjola. Eight (8) users and owners from Deepwater Resort were in regular email correspondence with GHD and raised the following considerations:

- ▶ Opening the lake at a level of 0.8 m AHD;
- ▶ Dredging the entrance channel; and,
- ▶ Keeping the entrance permanently open.

There was one (1) email response provided by a permanent resident of Lake Conjola who raised the following concerns/considerations:

- ▶ The water within the Lake be allowed to reach a level as high as possible without inundating permanent residents;
- ▶ Concern in relation to the short sightedness of community members;
- ▶ Concern in relation to the ongoing development taking place around the Lake foreshore which in time could place more pressure on the Lake ecosystem; and
- ▶ Ongoing measures are put in place to aim to restore the Lake to its natural regime.

## 5. Findings and Recommendations

### 5.1 Findings

Users and residents of Lake Conjola are concerned about the ongoing management of the Lake. Those users from Deepwater Resort would like to see the lake opened at a level of 0.8 m AHD and investigations made into Council funding permanent dredging of the Lake channel. A permanent resident is concerned about the short sightedness of users and would like to see the Lake restored to its natural regime.

### 5.2 Recommendations

Based on available survey information provided by the consultant undertaking the Flood Risk Management Plan for Lake Conjola it is recommended to maintain the opening trigger at a level of 1.0 m AHD.

Based on requirements put in place by the *Coastal Protection Act amended in 2010* it is recommended to try and restore the Lake to as natural a regime as possible and to gradually increase the trigger level for opening of the Lake.

It is also recommended that Council ensures ongoing community consultation in relation to management of the Lake and the entrance to ensure residents are kept informed and gain knowledge in relation to the Lake.

Appendix A  
Community Consultation Summary



## Lake Conjola Interim Entrance Management Community Workshop Summary

### ATTENDEES:

Isabelle Ghatti	Shoalhaven City Council (SCC)
Ray Massie	Shoalhaven City Council (SCC)
John Murtagh	OEH
Libby Shield	National Parks and Wildlife Service (NPWS)
Jodie Dunn	National Parks and Wildlife Service (NPWS)
Warwick Scott	NSW Maritime
Mike Baldwin	NSW Maritime
Andrew Gibbes	Shoalhaven City Council (water quality) (SCC)
Alan Lugg	Fisheries
Libby Lockett	GHD
Anthony Galea	GHD

Approximately fifty three (53) members of the local community

A community workshop was held on Monday 28<sup>th</sup> November to discuss with the Lake Conjola community the progress in the development of the Interim Entrance Management Plan for Lake Conjola. The main questions and comments raised by the local community are summarised below.

- Peter Hudson from north side of Conjola raised the question if modelling had incorporated sea level rise and climate change. He asked how it was being proposed to protect against storm surge, STP etc.
  - GHD responded with the fact that Shoalhaven Water had outlined that the STP had been designed to be above the 1 in 100 year flood level.
  - OEH outlined that the interim entrance management is looking at the short to medium term situation. The flood risk management plan is looking at the long term including sea level rise, storm surge and climate change as well as ways to mitigate the risks.
- Colin Ashford (Shorebird Volunteer) outlined that he believed the 2003 policy was 'environmental vandalism'. He asked the question of where the lake would be opened if it was necessary to open now.
  - GHD outlined that if the entrance was opened now it would be opened to the north however it wouldn't be expected to stay open long as there would not be enough water to effectively scour the entrance.
  - SCC outlined that Council would discuss with National Parks the requirements of where the opening should be located due to the possibility of nesting birds on the spit.
  - SCC outlined that the 1m trigger level was based on low level flooding. Council has been in discussions regarding this level (raise properties/levee) to allow entrance to be opened with higher water level and thus there might be a greater chance the Lake would stay open longer due to the better scouring.

- Darren Flanigan has been in the area for 13 years and believes that the tourism is declining due to the way in which the Lake Entrance is being managed. He outlined that it all seems to be about the lack of money. He asked why a dredge couldn't be used as he is of the opinion that with the right equipment and planning it would be a more effective and cost effective option. He outlined that the last time the channel was dredged the Lake stayed open for approximately 10 years. He is of the opinion that when the Lake is open there are far less issues.
  - SCC outlined that money is a constraint
  - GHD outlined that yes the Lake can be dredged however due to the northerly movement of sand it is expected to become blocked again in the not too distant future and as such dredging would be an ongoing operation.
  - SCC advised that the 1998 opening was successful as had big storm event during the entrance opening which effectively scoured the entrance channel.
  - Darren made a further comment that he believed the last attempted opening by Council was unsuccessful as the king tides were coming and they arrived with storm and damaged the entrance.
  - GHD outlined that the flood risk management plan was considering dredging as an option to mitigate against the 1 in 100 year flood event.
  - Further residence commented that the 1998 opening was undertaken on the southern side.
- Terry Lawrence Deepwater Resort resident asked what test of water quality Council carries out. He outlined that during the March event 'black water' came from Pattimores Lagoon. He outlined that some people were still on soak away septic systems. He asked what level opening was being considered as the water level is higher at the Deepwater Resort than at the entrance.
  - GHD outlined that within the Interim Policy, GHD advised that they would like Council to have another recording device upstream closer to the Caravan Park.
  - SCC outlined that water quality is monitored against ANZECC guidelines. The monitoring device tests temp, PH, turbidity, faecal coliform etc. The water quality monitoring has indicated that water quality has been improving over the years. If water quality was not safe Council would advise the community immediately.
  - National Park outlined that naturally Australia has high turbidity with leachate etc so would not be used to indicate if/when an opening was necessary.
- NPWS advised they believe people are blaming the birds for when and if the entrance is opened. They are of the opinion that it might actually be better for the birds when the Lake is open as the land is not flooded. They outlined that there are plenty of times when the shorebirds are not there that would be suitable for opening the entrance. The outlined that they believe it is necessary to manage the people as they seem to be scary the birds off, not the equipment.
- Michael outlined that with the net northerly movement of sand the entrance will always close. He outlined that 1.32m Lake does not go and at 2.8m Lake goes (breaches the berm). He outlined that he believes dredging should be an option as he believes that having the Lake open reduces the impact of flooding.
- One community member outlined that during the March flooding the Lake level rose extremely quickly. Within a day and a half the Caravan Park was under water. General consensus is to open



the Lake at 0.8m however a few of the community members agreed that a higher level was necessary.

- Some members of the community outlined that they would like to look at mining the sand from the entrance.
- One community member requested that future meeting be held in the late afternoon early evening so others could attend.

ENCL documents provided to Community:

- Interim Entrance Management Policy Discussion Paper (Appendix A to Interim Entrance Management Policy)
- ICOLL brochure

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