

**ADDENDUM**

**REVIEW OF ENVIRONMENTAL FACTORS**

**LAKE CONJOLA ENTRANCE MANUAL OPENING**

Note: This report is an addendum to a Review of Environmental Factors (REF) prepared Peter Spurway and Associates Pty Ltd in November 2013 for the entrance berm breaching works for Lake Conjola. The 2013 REF is attached as Appendix A. This addendum was necessary for the following reasons:

- Resolution by Shoalhaven City Council (SCC) to open the Lake below trigger levels prescribed in the Lake Conjola Entrance Management Plan.
- Requested by Crown Lands (NSW Department of Industries) prior to the issue of a short-term licence to undertake the opening.
- Changes to the proposed activity.
- Changes to legislation and the environment since 2013.

**Note: This addendum addresses only the changes since the 2013 REF and, as such, this addendum must be read inconjunct with the 2013 REF (Appendix A).**

**1. INTRODUCTION**

**1.1 Overview**

This report is an addendum to a Review of Environmental Factors (REF) prepared by Peter Spurway and Associates Pty Ltd, November 2013 (see Appendix A) and is to be read in conjunction with this REF. This addendum REF is to support a short-term licence application to construct a pilot channel and effect an opening of Lake Conjola at its current level, below the trigger level of 1.0m AHD for a planned opening in the Lake Conjola Interim Entrance Management Policy 2013 (the Policy).

Lake Conjola has been in a state of closure since April 2018, with elevated lake levels ranging from 0.75m-0.9m AHD. The elevated lake level over this prolonged period has caused much concern within the community. As a result of this and continued representations from community members and visitors which raised public health and safety concerns, Council resolved on 5 February 2019 (MIN19.51 see Appendix B) to seek a short-term licence from the NSW Government (Department of Industry - Crown Lands) to construct a pilot channel in the northern berm location and remove the sand plug within the pilot channel to effect an opening of the Lake below the current planned opening trigger level of 1.0m AHD set in the Policy. This licence application was refused. Lake levels have remained elevated and Council continued to receive representations





and resolved on 26 March 2019 (MIN 19.143 see Appendix C) to make further application to undertake a manual opening.

Council did construct a pilot channel on 21 December 2018 under the provisions of the Policy following heavy rain which saw the Lake rise to 0.95m AHD and further heavy rain predicted. This work was carried out with agreement from NSW Government Agencies due to the pending increase in population over the 2018/19 summer holiday period and Council shut-down between Christmas and New Year. The Lake closed again within 48 hours. Council carried out maintenance work on the pilot channel in early January, with agreement from NSW Government agencies, due to prediction of further heavy rain which was predicted to increase the lake height to 1.0m AHD and the significant holiday population within Lake Conjola and surrounds. However, the catchment did not receive the forecast rain and a decision was made by Council not to proceed with the Lake opening due to the increased risk of fish kill and rotting marine vegetation as heat wave conditions prevailed at the time.

Some of the issues identified by the community in their representations to Council include:

- submersion and failure of foreshore assets including seawalls, jetties, boat ramps and pathways
- saturated foreshore conditions resulting in erosion, ground slumping, die-back of foreshore vegetation, particularly trees, causing significant safety issues
- submersion of foreshore structures causing boating safety issues
- community stress related to the perception of heightened flood risk and reduced evacuation options as a result of existing elevated lake levels reducing the capacity of the Lake to endure significant rainfall events
- the “policy” status of the EMP has not been correctly recognised, in that whilst “policy” is adopted to give guidance to decision making, it cannot have regard to every possible scenario, and as such “trigger levels” may not always be the appropriate determinant
- the overarching objectives of the EMP need to be given significant weight in the management of the lake. Particularly relevant at this time are the objectives to:
  - minimise risk to public safety associated with excessive inundation of foreshores and associated infrastructure as a result of low-level flooding
  - minimise interference to the local ecological community
  - satisfy local community values

## 1.2 Overview

No change to 2013 REF.

### **1.3 Summary of Entrance Processes**

No change to 2013 REF.

### **1.4 Implications for Entrance Management**

NSW government policy encourages, in the long term, an 'as natural' regime as possible for estuary openings. Interference is limited to those conditions where flooding of existing low-lying assets is exacerbated by a closed or restricted entrance. The previous opening policy associated with a "managed natural entrance" for Lake Conjola required Council to maintain an open entrance at all times. This operated only until the installation of a sewage system and the completion of a flood study. The latest entrance regime limits manual openings to emergency intervention for flood risk management and / or planned openings at a slightly higher level if rainfall is anticipated.

The Lake Conjola entrance spit is a significant breeding area for shorebirds, including Little Terns and Pied Oystercatchers. Some of these birds are threatened species, protected under NSW and Commonwealth legislation, and others are protected under international agreements.

Note: The following is added to this sub-section of the 2013 via this Addendum

The short-term licence application seeks to alleviate the prolonged elevated Lake conditions to address public health and safety concerns raised by the community. Council is committed to a strategic review of the Policy as part of the development of a Coastal Management Program for Lake Conjola under the provisions of the *Coastal Management Act 2016*.

### **1.5 Proposed Intervention Regimes and Locations**

No change to 2013 REF.

#### **1.5.1 Detail of operating regimes**

Note: Section 1.5.1 of this Addendum replaces Section 1.5.1 of the 2013 REF

The proposed intervention below 1.0m AHD by way of a short-term licence is sought to alleviate the prolonged elevated lake conditions to address public health and safety concerns raised by the community.

#### **1.5.2 Evaluation of entrance berm breaching location**

Note: Section 1.5.2 of this Addendum replaces Section 1.5.2 of the 2013 REF.

The proposed opening channel will be constructed in either the approved northern or mid spit areas identified in the Policy using the access from the Cunjurong Point boat ramp (Options 2 and Option 3 as referenced in section 1.5.2 of the 2013 REF and shown on map titled 'Lake Conjola Entrance management Plan Operational Details Entrance Opening' contained within **Appendix C of the Policy** and also Appendix D of this Addendum REF).

### **1.6 Persistence of Entrance Intervention Works**

No change to 2013 REF

### **1.7 Effect on Flooding**

The Lake Conjola Floodplain Risk Management Study and Plan (BMT WBM 2012) shows that the state of the entrance does not impact on major flood peak heights at Conjola. However, there can be a need to breach a closed entrance to alleviate nuisance flooding generated by prolonged elevated lake levels when the entrance is closed. One of the objectives of the lake opening policy is to respond with entrance berm breaching prior to inundation of low lying parts of the village area. This in turn means the volume of sand to be excavated and the duration of excavation are important factors in an emergency (flood-related) scenario.

### **1.8 Excavated Sand Placement**

Note: Section 1.8 of this Addendum replaces Section 1.8 of the 2013 REF

The excavated sand will be spread on the northern side of the entrance in the approved location under the Policy. Spoil should be placed and shaped as nourishment between Cunjurong and Green Island as defined in section 1.5.2 of the Spurway REF and shown on map titled '*Lake Conjola Entrance Management Plan Operational Details Entrance Opening*' contained within Appendix C of the Policy and also Appendix D of this Addendum REF.



### **1.9 Alternatives**

No change to the 2013 REF.

## **2. RELEVANT LEGISLATION, REGULATIONS AND PERMIT REQUIREMENTS**

Note: Section 2 of this Addendum replaces Section 2 of the 2013 REF.

### **2.1 Environmental Planning and Assessment Act 1979**

Section 4.1 (Development that does not need consent) of the EP&A Act states that:

*“If an environmental planning instrument provides that specified development may be carried out without the need for development consent, a person may carry the development out, in accordance with the instrument, on land to which the provision applies.”*

In this regard clause 50 of the NSW *State Environmental Planning Policy (Infrastructure) 2007* (Infrastructure SEPP) states “development for the purpose of flood mitigation work may be carried out by or on behalf of a public authority without consent on any land”. “Flood Mitigation Work” is defined as “work designed and constructed for the express purpose of mitigating flood impacts. It involves changing the characteristics of flood behaviour to alter the level, location, volume, speed or timing of flood waters to mitigate flood impacts. Types of works may include excavation, construction or enlargement of any fill, wall or levee that will alter riverine flood behaviour, local overland flooding, or tidal action so as to mitigate flood impacts”. As the proposed work will be undertaken by a local authority (SCC) for the express purpose of flood mitigation work, the proposed work can be undertaken without development consent.

As the proposal does not require development consent, and as it constitutes an ‘activity’ for the purposes of Part 5 of the EP&A Act, being carried out by (or on behalf of) a public authority, environmental impact assessment under Part 5 of the EP&A Act is required. This addendum and associated 2013 REF provides this assessment.

### **2.2 Crown Land Management Act 2016**

Works would be undertaken on Crown Land. As such, SCC must obtain a licence (or other lawful authority) from the NSW Department of Industry – Crown Lands prior to the commencement of works.

### **2.3 State Environmental Planning Policy (Coastal Management) 2018**

The proposed activity would be undertaken in an area mapped for the purposes of this SEPP as “Coastal Use Area” and “Coastal Environment Area”. The provisions of the SEPP for these areas relate to development consent considerations. As the proposed activity does not require development consent, these provisions do not need addressing.

There are no Coastal Wetlands mapped in the vicinity of the works.

There is a littoral rainforest nearby (south of Ottawa Street, Figure 1) but this will not be impacted in anyway by the proposed works. Clause 11 of the SEPP, which relates to “land in proximity to coastal wetlands and littoral rainforest”, relates only to development consent considerations. As the proposed activity does not require development consent,

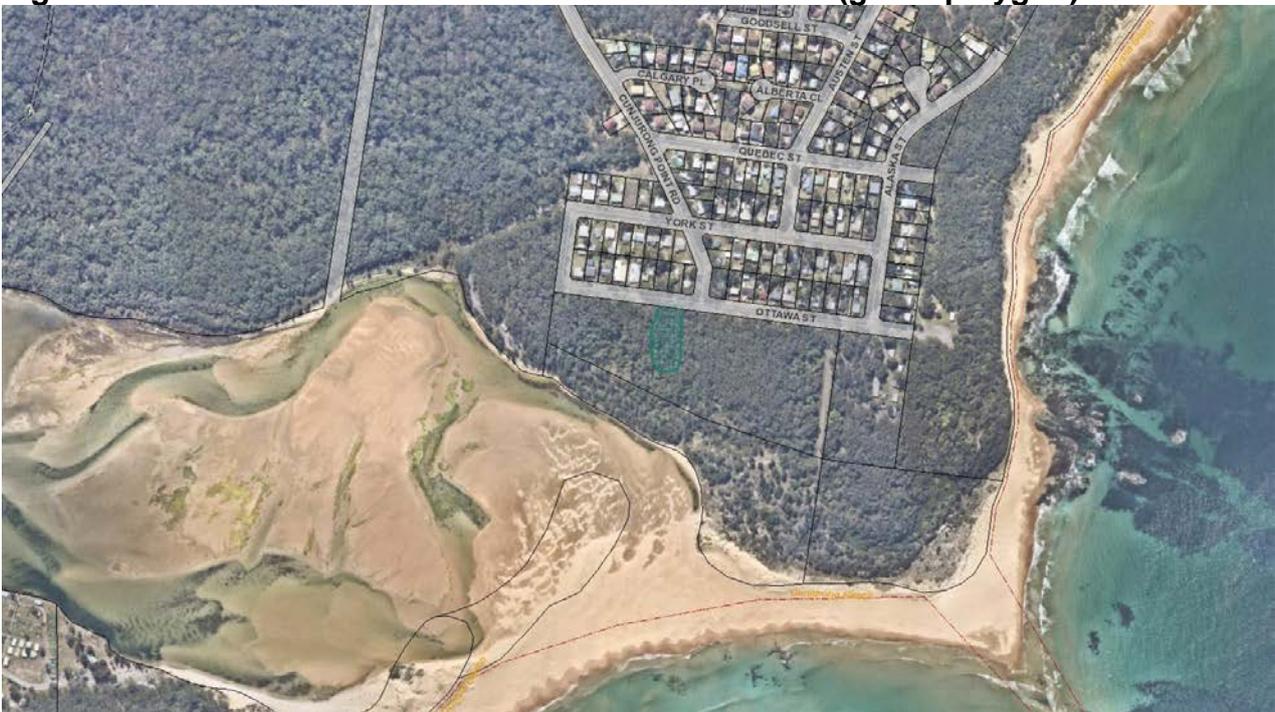
these provisions do not need addressing. Regardless, the proposed activity is not likely to significantly impact:

- the biophysical, hydrological or ecological integrity of the Ottawa Street littoral rainforest, and
- the quantity and quality of surface and ground water flows to and from the Ottawa Street littoral rainforest.

The proposed activity is not considered to be “coastal protection works” and therefore clause 19 does not apply and as it does not require development consent clauses 15 and 16 of the SEPP also do not need addressing.

No further consideration of this SEPP is required.

**Figure 1 Location the Ottawa Street Littoral Rainforest (green polygon)**



## **2.4 Fisheries Management Act 1994**

The proposed works would be considered dredging in water land which is regulated under Part 7 of the *Fisheries Management Act 1994*. Section 200 of the Act prescribes circumstances where a local government can carry out dredging, *i.e.*:

- Under the authority of a permit (“Fisheries Permit”), or
- Work authorised under the Crown Land Management Act 2016, or
- Work authorised by a relevant public authority (other than a local government authority).

As the proposed activity would be authorised by licence under the *Crown Land Management Act 2016*, a separate Fisheries Permit is not required. It is understood that Crown Lands consults the NSW Department of Primary Industries (NSW Fisheries) prior to issuing the licence. It is understood that this consultation has occurred.

## 2.5 Other

The proposed activity is permissible under other relevant environmental legislation (Table 1 below).

**Table 1 Summary of legislation and permissibility**

<b>NSW State Legislation</b>	
<b><i>Environmental Planning and Assessment Act 1979 (EP&amp;A Act)</i></b>	
Permissible <input checked="" type="checkbox"/>	Not permissible <input type="checkbox"/>
Justification: The Infrastructure SEPP provides for this work to be undertaken without development consent. In circumstances where development consent is not required, the environmental assessment provisions outlined in Part 5 of the Act are required to be complied with. This addendum and associated 2013 REF fulfils this requirement.	
<b><i>Shoalhaven Local Environmental Plan 2014 (SLEP)</i></b>	
Permissible <input checked="" type="checkbox"/>	Not permissible <input type="checkbox"/>
Justification: Under the SLEP the proposed activity may have required development consent. The provisions of SEPP Infrastructure, however prevail over the SLEP where there is an inconsistency by virtue of Section 3.28 of the EP&A Act. Consequently development consent is not required. In circumstances where development consent is not required, the environmental assessment provisions outlined in Part 5 of the Act are required to be complied with. This addendum and associate 2013 REF fulfils this requirement.	
<b><i>Protection of the Environment Operations Act 1997</i></b>	
Permissible <input checked="" type="checkbox"/>	Not permissible <input type="checkbox"/>
Justification: The proposed activity does not constitute scheduled development work or scheduled activities as listed in Schedule 1 of the Act. The proposed activity therefore does not require an environmental protection licence.	
<b><i>National Parks and Wildlife Act 1974</i></b>	
Permissible <input checked="" type="checkbox"/>	Not permissible <input type="checkbox"/>
Justification:	

- The proposed activity would not be carried out on land reserved or acquired under the Act.
- The Due Diligence Code of Practice (DECCW 2010) was followed for the proposed activity (refer to Section 4.5). As there are no recorded sites, and the area affected by the proposed activity is unlikely to contain Aboriginal objects, the Due Diligence Code of Practice requires no further assessment and an AHIP is not required (refer to Section 4.5) .

**Biodiversity Conservation Act 2016**

Permissible  Not permissible

**Justification:**

- The proposed development is unlikely to have a significant impact on species and communities listed in the schedules of the Act (refer to subsequent of this REF).
- The proposed development is not within an area declared to be of “outstanding biodiversity value” as defined in the Act.
- The proposed development is unlikely to have a significant impact on threatened species and/or threatened ecological communities listed in the schedules of the Act. Therefore there is no requirement to ‘opt in’ to the Biodiversity Offset Scheme.
- There are no *serious and irreversible impacts on biodiversity values* present at the site of the proposed activity.

The proposed activity therefore is not deemed to be *likely to significantly affect threatened species* and entry into the Biodiversity Offset Scheme and preparation of a Biodiversity Development Assessment Report (BDAR) is not required.

It is also a defence to a prosecution for an offence under Part 2 of the Act (harming animals, picking plants, damaging the habitat of threatened species or ecological communities *etc*) if the work was essential for the carrying out of an activity by a determining authority within the meaning of Part 5 of the EP&A Act after compliance with that Part. The activity is considered permissible as this REF has been prepared and determined in accordance with the EP&A Act.

**Local Land Services Act 2013**

Permissible  Not permissible

**Justification:**

Any clearing of vegetation would be of a kind that is authorised under Section 60O(b)(ii) of the *Local Land Services Amendment Act 2016* (“*an activity carried out by a determining authority within the meaning of Part 5 of the Act after compliance with that Part.*”). No separate authorisation under the Act is required.

**Water Management Act 2000**

Permissible  Not permissible

<p>Justification:</p> <ul style="list-style-type: none"> <li>Local councils are exempt from s.91E(1) of the Act in relation to all controlled activities that they carry out in, on or under waterfront land (by virtue of clause 41 of the <i>Water Management (General) Regulation 2011</i>).</li> <li>The proposal would not interfere with the aquifer and therefore an interference licence is not required (s.91F).</li> </ul>
<b>Commonwealth Legislation</b>
<b>Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EP&amp;BC Act)</b>
Permissible <input checked="" type="checkbox"/> Not permissible <input type="checkbox"/>
<p>Justification:</p> <p>The proposed activity would not be undertaken on Commonwealth land and no Matters of National Environmental Significance are likely to be significantly impacted by the proposed activity. The proposed activity is therefore not a controlled action and does not require commonwealth referral.</p>
<b>Commonwealth <i>Native Title Act 1994</i></b>
Permissible <input checked="" type="checkbox"/> Not permissible <input type="checkbox"/>
<p>Justification:</p> <p>As the proposal is a “one-off” event, it is asserted that Native Title would not be affected by the proposed activity. Notification / request for comment is not required.</p>

### **3. DESCRIPTION OF THE EXISTING ENVIRONMENT**

#### **3.1 General Characteristics**

No change to the 2013 REF.

#### **3.2 Acid Sulphate Soils**

No change to the 2013 REF.

#### **3.3 Hydrology**

No change to the 2013 REF.

#### **3.4 Water Quality**

The Water Quality Rating for Lake Conjola from April 2018 to date was rated as "Good" to "Excellent" and on three (3) occasions rated as "Fair" following rain. The full set of water quality monitoring results from the seven (7) sites and catchment monitoring Council has undertaken since Lake closure can be found on Council's Aquadata portal at <https://www.shoalhaven.nsw.gov.au/Environment/Aqua-Data> . The water quality monitoring ratings can be found at <https://www.shoalhaven.nsw.gov.au/Environment/Coastline-and-waterways/Beachwatch> . Faecal Coliform and enterococci levels remain generally below the water quality guideline level for swimming except following heavy rainfall events, and nutrients were generally below guideline levels on most occasions.

Water quality monitoring shows water quality decline occurs immediately after rainfall. This is typical of a waterway with a catchment containing areas of urban development.

The quality of the lake water changes when there is strong tidal flushing to refresh the lake basins. An opening event would temporarily provide flushing. However the extent of improvement depends on the tidal flushing efficiency. This in turn is dependent on the duration of the opening.

Modeling by Patterson Britton (1999)<sup>1</sup> has suggested that if the entrance is heavily shoaled, some 80-100% flushing occurs downstream of Chinamans Island. Berringer Lake is flushed less than 10% and the western half of Lake Conjola is not flushed at all. Under fully open entrance conditions, the whole lake would flush with at least 30 to 40 days of tidal action.

Lake Conjola is healthy whether open or closed. The implications are that the lake is a healthy ecosystem operating within its natural range of variability.

#### **3.5 Wetlands**

No changes to the 2013 REF.

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<sup>1</sup> Refer to refer to reference list in 2013 REF.

### 3.6 Flora

#### 3.6.1 Vegetation, endangered ecological communities and Protected Marine Vegetation

While the reference to the NSW *Threatened Species Conservation Act 1995* is no longer current (superseded by the NSW *Biodiversity Conservation Act 2016*), the vegetation, endangered ecological communities and protected marine vegetation occurring adjacent to the site and surrounding areas remain as described in the 2013 REF.

Specific to the proposed activity that is the subject of this Addendum REF are the following two areas:

##### 1. Channel and spoil placement areas

The proposed channel and spoil placement areas of works comprise low dunes and sand-flats containing no to very little vegetation (Figures 2 and 3 below). The dunes to the north of the proposed spoil placement area contain Spinifex (*Spinifex sericeus*) and the exotic Marram Grass (*Ammophila arenaria*).

**Figure 2 Proposed opening location looking north-west to Lake Conjola**



**Figure 3 Proposed spoil placement area**



**Figure 4 Looking west across proposed opening area to nesting shorebird habitat**



## **2. Access route from Cunjurong Boat Ramp**

The access route from Cunjurong Point skirting the Lake's edge around Lot 7022 DP 1031073, comprises flat rock shelves, rocky foreshore and sand flats, containing scattered herbs, grasses and sedges including *Paspalum vaginatum*, *Spinifex sericeus*, *Cyperus laevigatus*, *Rhagodia candolleana*, *Ficinia nodosa*, and *Juncus krausii* (Figures 5, 6, and 7 below).

**Figure 5 Access route - rock shelf**



**Figure 6 Access route – rocky foreshore**



**Figure 7 Access route – sand flat adjacent to dunes**



### **3.6.2 Threatened flora species**

Two threatened flora species listed under the NSW *Biodiversity Act 2016* (BC Act) are recorded as occurring within 5km of the site of proposed works, these being:

- *Cryptostylis hunteriana* (Leafless Tongue Orchid)
- *Rhodamnia rubescens* (Scrub Turpentine)

The 2013 REF also notes that *Wilsonia backhousei* (Narrow-leafed Wilsonia) has been recorded north of Manyana.

Vegetation and habitat assessment was undertaken by Council Environmental Officers on 28 May 2019 between 11:45AM and 2:45PM. No *Wilsonia backhousei* or *Rhodamnia rubescens*, nor any suitable habitat for either of these species was detected. While the survey undertaken was outside the detectable (flowering) period for *Cryptostylis hunteriana*, no suitable habitat for this species occurs within or immediately adjacent to the site.

In addition to the endangered ecological communities (EECs) addressed within the 2013 REF as being in close proximity to the site or otherwise potentially impacted by the proposed opening of the lake (*Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions* and *Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions*), a third NSW BC Act listed EEC,

*Bangalay Sand Forest in the Sydney Basin and South East Corner Bioregions*, is mapped as occurring adjacent to the site. The presence of Bangalay Sand Forest EEC was confirmed during recent vegetation assessment.

### 3.7 Fauna

Search of NSW Office of Environment & Heritage threatened fauna records (ATLAS NSW Wildlife) within 5km radius of the site returned records for 46 different fauna species listed under the BC Act (27 bird species, 1 amphibian species, 12 mammal species (non-microbat), 5 microchiropteran bat species and 1 reptile species).

Of these recorded species, the potential for occurrence on site or the potential for impact to habitat was considered likely for six shorebird species and one frog species:

- Black Bittern
- Eastern Curlew
- Hooded Plover
- Lesser Sand Plover
- Little Tern
- Pied Oystercatcher
- Sooty Oystercatcher
- Green and Golden Bell Frog

The 2013 REF addressed each of the species with the exception of Black Bittern and Eastern Curlew.

#### **4. POTENTIAL ENVIRONMENTAL IMPACTS**

##### **4.1 Direct and Indirect Effects**

No changes to the 2013 REF.

##### **4.2 Water Level Impacts**

Note: Section 4.2 of this Addendum adds to Section 4.2 of the 2013 REF

For the purposes of this REF and in the absence of any substantive evidence to the contrary, it is assumed that the intervention levels of 1.0 to 1.2m AHD lie at the lower end of the natural breakout range. It is assumed however that a single opening will have minimal impact, representing an insignificant departure from the lake behaviour since intervention at similar levels since at least the 1930s. This assumption is the basis for the analysis and judgments made in the 2013 REF.

Water level impacts are unknown. However, since it is not the intention of this proposal to open the Lake below 1.0m AHD on multiple occasions over the long-term, water level impacts are likely to be negligible as the Lake level is not expected to recede lower than if the Lake was opened at or above 1.0m AHD. However, should the proposal proceed, the ecological communities around the Lake should be monitored and the Lake entrance surveyed to assess impact to inform any future intervention proposals below the trigger levels in the adopted Policy and preparation of a Lake Conjola Coastal Management Program (CMP).

##### **4.3 Water Quality Impacts**

No changes to the 2013 REF.

##### **4.4 Threatened and Migratory Species Impact Assessment**

###### *Direct and indirect impacts to vegetation and other habitat as a result of the proposal*

No vegetation removal or disturbance will occur as a result of the excavation works.

Machinery used for works will access the site via the Cunjurong Point Boat Ramp and skirt the lake along the foreshore edge. This area contains scattered, small herbs, grasses and sedges that may be impacted by the ingress and egress of machinery and vehicles. This vegetation does not constitute any threatened ecological community or represent any important habitat. No impact to the adjoining treed or dune vegetation is expected to occur.

Indirect impacts to shore fringing vegetation including Coastal Saltmarsh and Swamp Oak Floodplain Forest vegetation communities may result from changes to the lake water level and associated changes to groundwater and salinity. It is expected that in a one-off opening of the lake entrance that impacts would be minimal and not long-term, as the changed soil and water conditions would be temporary and transition toward existing

conditions over time, within the resilience capacity of these vegetation communities and within the natural fluctuations of which they are tolerant. Ongoing management involving future mechanical openings of the entrance must however consider the cumulative effects of these impacts and the potential for significant impacts to endangered ecological communities in addition to habitat for threatened species. Monitoring should be undertaken to inform future management considerations, which includes (but is not limited to) mapping and integrity assessment of vegetation around Lake Conjola including endangered ecological communities, and mapping of threatened and migratory shorebird nesting and foraging habitat.

Threatened and migratory species – potential impacts

Threatened and migratory species from database searches (NSW ATLAS of Wildlife records) are listed below in Table 2 (p.30) along with a likelihood of occurrence evaluation.

The likelihood of occurrence evaluation considered that the potential for occurrence on site, the potential for impact to habitat, or the potential for indirect impacts was considered likely for the following NSW *Biodiversity Conservation Act 2016* (BC Act) listed species:

- Black Bittern
- Hooded Plover
- Lesser Sand Plover
- Little Tern
- Pied Oystercatcher
- Sooty Oystercatcher
- Green and Golden Bell Frog

Further assessment of the risk of impact associated with the proposed activity to each of these species is required via a Test of Significance in accordance with the criteria under Section 7.3 of the NSW *Biodiversity Conservation Act 2016* (BC Act).

The 2013 REF assessed the potential for significant impact to Green and Golden Bell-Frog, Hooded Plover, Lesser Sand Plover, Little Tern, Pied Oystercatcher and Sooty Oystercatcher in addition to the endangered ecological communities *Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions* and *Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions*, in accordance with the former NSW *Environmental Planning & Assessment Act 1999* (EP&A Act), Section 5A Assessment of Significance criteria.

The EP&A Act Assessment of Significance criteria relevant to evaluating the risk of significant impact to threatened species and ecological communities as listed above, are equivalent to those relevant within the current BC Act Test of Significance.

Each of the Assessments of Significance undertaken within the 2013 REF has been reviewed within the context of the current addendum REF, and each is considered to

remain relevant and adequate in assessing the potential for significant impact to these threatened species and endangered ecological communities.

A BC Act Test of Significance follows for Black Bittern, Eastern Curlew and *Bangalay Sand Forest in the Sydney Basin and South East Corner Bioregions* endangered ecological community which were not addressed by the 2013 REF.

As a precaution, a general assessment of potential impacts to shorebirds – foraging and nesting has also been included.

### **Threatened species impact assessment (NSW)**

Section 1.7 of the EP&A Act 1979 applies the provisions of Part 7 of the NSW *Biodiversity Conservation Act 2016* and Part 7A of the NSW *Fisheries Management Act 1994* that relate to the operation of the Act in connection with the terrestrial and aquatic environment. Each are addressed below.

#### ***Part 7 Biodiversity Conservation Act 2016***

An assessment of the potential for NSW threatened flora and fauna species occurring on-site or otherwise being impacted by the proposal was undertaken.

The following species and endangered ecological communities are known to occur on-site or are considered to have some potential to occur on-site or be otherwise impacted by the proposal, and therefore required further assessment under Part 7 of the *NSW Biodiversity Conservation Act 2016*:

- Black Bittern
- *Bangalay Sand Forest in the Sydney Basin and South East Corner Bioregions* endangered ecological community

Section 7.3 of the Act provides a five-part ‘test of significance’ to determine whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats. Each Part is addressed below:

***Part 1: In the case of a threatened species, where the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is to be placed at risk of extinction.***

#### **Black Bittern**

Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves.

Feeds on frogs, reptiles, fish and invertebrates, including snails, dragonflies, shrimps and crayfish, with most feeding done at dusk and at night.

During the day, roosts in trees or on the ground amongst dense reeds. When disturbed, freezes in a characteristic bittern posture (stretched tall, bill pointing up, so that shape and streaked pattern blend with upright stems of reeds), or will fly up to a branch or flush for cover where it will freeze again.

Generally solitary, but occurs in pairs during the breeding season, from December to March.

Like other bitterns, but unlike most herons, nesting is solitary. Nests, built in spring are located on a branch overhanging water and consist of a bed of sticks and reeds on a base of larger sticks. Between three and five eggs are laid and both parents incubate and rear the young.

The potential for any impact to Black Bittern is considered unlikely due to the following factors:

- Favoured foraging and roosting habitat for this species occurs outside the site, while habitat within or immediately adjacent to the site is sub-optimal.
- No breeding habitat exists for Black Bittern (nests on branches overhanging the water) and the proposed activity would take place outside the breeding period (Spring).

#### Shorebirds – foraging and nesting (general)

- Works are temporary in nature and would occur in June, outside the nesting periods for locally occurring threatened shorebirds (generally Nov-Feb) and outside important foraging periods for migratory birds (generally Sep-Mar).
- These species are highly mobile and transient and unlikely to visit or remain on site during machinery operation.
- A Council Environmental Officer or other suitably qualified person would undertake pre-clearance surveys prior to works commencing each day and prior to machinery access and egress from site. If any of these species are detected in the vicinity of the works or machinery access/egress, works and/or machinery movement will stop immediately and not resume until the bird has vacated the site of its own accord. In the event that a nest or nesting birds are detected, works will cease and mitigation measures will be adapted in consultation with the NPWS Shorebird Recovery Coordinator, to minimise risk of disturbance to the birds and ensure their protection.

#### ***Part 2 In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:***

***(a) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or***

***(b) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.***

### Bangalay Sand Forest

Bangalay Sand Forest is the name given to the ecological community associated with coastal sand plains of marine or Aeolian origin. It occurs on deep, freely draining to damp sandy soils on flat to moderate slopes within a few kilometres of the sea and at altitudes below 100 metres. The community is characterised by an assemblage of species specified in the Scientific Committee's determination (NSW Scientific Committee 2011), typically with a relatively dense or open tree canopy dominated by Bangalay (*Eucalyptus botryoides*) and Coast Banksia (*Banksia integrifolia*), an understorey of mesophyllous or sclerophyllous small trees and shrubs, and a variable groundcover dominated by sedges, grasses or ferns.

Bangalay Sand Forest EEC does not occur within the site but does occur adjacent to the access route which skirts the lake from Cunjurong Boat Ramp.

The potential impact to Bangalay Sand Forest EEC as a result of the proposal is not considered significant for the following reasons:

- No vegetation removal will be required to allow for vehicle and machinery ingress and egress.
- Staff and contractors will be made aware of the presence of endangered ecological communities along this area and their responsibility to ensure that there is no entry into this vegetation and that this vegetation is not impacted during movement of machines and vehicles.

In consideration of the above assessment, the proposed activity is unlikely to lead the vegetation community within the reserve to the risk of extinction. As a result, a species impact statement for this Part for this community is not required.

### ***Part 3 In relation to the habitat of a threatened species or ecological community:***

***(a) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and***

***(b) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and***

***(c) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.***

Refer to responses in Part 1 and Part 2 above. A species impact statement is not required for this part.

**Part 4 Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).**

No “areas of outstanding biodiversity values” have been declared in the City of Shoalhaven.

**Part 5 Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.**

There are no key threatening process listed under the NSW *Biodiversity Conservation Act 2016* considered relevant to the proposed activity.

The proposed activity is therefore considered not likely to result in the operation of, or significantly increase the impact of any key threatening process and a species impact statement is not required for this part.

**Part 7A Fisheries Management Act 1994**

The proposed works involve excavation of non-vegetated sand-dunes and sand-flats.

Within the waterway area on site, only shallow sand-flat areas containing no marine vegetation will be impacted.

No marine vegetation or threatened marine fauna will be directly impacted by the proposal.

**Part 1 In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is to be placed at risk of extinction.**

There are no threatened species likely to inhabit Lake Conjola.

Several saltwater species listed in the schedules of the Act are known to have occurred on the south coast of NSW:

- Grey Nurse Shark *Carcharias taurus* and Blind Slug *Smeagol hilaris* are listed as Critically Endangered.
- Southern Bluefin Tuna *Thunnus maccoyii* and Scalloped Hammerhead Shark

*Sphyrna lewini* are listed as Endangered.

- Great White Shark *Carcharodon carcharia* and Black Rockcod *Epinephalus daemeli* are listed as Vulnerable.
- Green Sawfish *Pristis zijsron* is listed as Presumed Extinct.

Populations of these species have primarily been reduced by over-harvesting and habitat degradation.

### **Grey Nurse Shark**

Grey Nurse Sharks are found predominantly in inshore coastal waters. They have been recorded at various depths, but mainly found in waters between 15 and 40 metres deep. Grey Nurse Sharks gather at a number of key sites along the coast of NSW and southern Queensland. These sites have gravel or sand filled gutters, rocky reefs or caves, and are called aggregation sites. Lake Conjola and the proposed opening area is not a known aggregation site and doesn't provide suitable habitat for aggregation. As such, the species is unlikely to occur there and the proposed activity would have no effect on the life cycle of the species.

In the unlikely event that a Grey Nurse Shark was present in the vicinity at the time of Lake opening, it would be expected to swim away in response to the disturbance with little consequence to its lifecycle.

### **Blind Slug**

This is a pulmonate (with lung) slug. It has only been collected from a small isolated location at Merry Beach, south of Ulladulla. The species lives in gravel and cobble filled rocky crevices and beaches at Merry Beach. The proposed activity would therefore have no effect on the lifecycle of this species.

### **Southern Bluefin Tuna**

The Southern Bluefin Tuna are pelagic fish occurring in the oceanic waters normally on the seaward side of the continental shelf. The proposed activity would therefore have no effect on the lifecycle of this species.

### **Scalloped Hammerhead Shark**

The Scalloped Hammerhead Shark is a coastal pelagic species with a circumglobal distribution in warm temperate and tropical coastal areas. They are known to form large migratory schools and in Australia tend to move as far south as Sydney during the warmer months. The proposed actions therefore would have no effect on the lifecycle of this species.

### **Great White Sharks**

Great White Sharks are normally found in inshore waters around rocky reefs and islands and often near seal colonies. They have been recorded at varying depths down to 1,200 metres. In the unlikely event that a Great White Shark was present in the time of Lake opening, it would be expected to swim away in response to the disturbance with little consequence to its lifecycle.

### **Black Rockcod**

Black Rockcod live in relatively shallow rocky reefs where they are usually found in caves, ledges, gutters and beneath bommies (DoPI 2015). Small juveniles are often found in coastal rocky pools, and larger juveniles around rocky shores in estuaries (DoPI

2015). The site of the proposed activity does not currently provide any habitat for all these life stages, nor would it provide habitat.

### **Green Sawfish**

Green Sawfish (presumed extinct in NSW) are bottom dwelling rays commonly found in near-coastal environments including estuaries, river mouths, embankments and along sandy and muddy beaches. It has been recorded in Jervis Bay, but the last confirmed sighting of the species in NSW was in 1972 from the Clarence River at Yamba.

Although the site of the proposed activity does provide suitable habitat, in the unlikely event that a Green Sawfish was present at the time of driving in the piles, it would be expected to be able to swim away in response to the disturbance with little consequent disruption to its life cycle. The proposed air berth is therefore not considered likely to place a viable local population of Green Sawfish at risk of extinction.

***Part 2 In the case of an endangered population, whether the proposed development or activity is likely to have an adverse effect on the lifecycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.***

The endangered populations listed under the Act are:

- *Ambassis agassizii* Steindachner Agassiz's glassfish, olive perchlet, western New South Wales population
- *Craterocephalus amniculus* Darling River Hardyhead, Hunter River population
- *Gadopsis marmoratus* river blackfish, Snowy River population
- *Tandanus tandanus* freshwater catfish, eel tailed catfish, Murray-Darling Basin population
- *Posidonia australis* seagrass, Port Hacking, Botany Bay, Sydney Harbour, Pittwater, Brisbane Waters and Lake Macquarie populations

These areas would be unaffected by the proposed lake opening.

***Part 3 In the case of an endangered ecological community or critically endangered ecological community whether the proposed development or activity:***

- I. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or***
- II. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.***

The endangered ecological communities listed under the Act are:

- Aquatic ecological community in the natural drainage system of the lower Murray River catchment

- Aquatic ecological community in the natural drainage system of the lowland catchment of the Darling River
- Aquatic ecological community in the natural drainage system of the lowland catchment of the Lachlan River
- Aquatic ecological community in the catchment of the Snowy River in NSW

These areas would be unaffected by the proposed opening.

**Part 4 In relation to the habitat of a threatened species or ecological community:**

***I. The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and***

***II. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and***

***III. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.***

N/A – The area affected by the activity does not provide habitat for threatened species, populations or ecological communities (refer responses to Part 1 through Part 3 above)

**Part 5 Whether the proposed development or activity is likely to have an adverse effect on any critical habitat (either directly or indirectly),**

The only critical habitat currently on the register is “*Critical Habitat of Grey Nurse Shark*” with listed and mapped areas of:

- 
- Bass Point (Shellharbour)
  - Big and Little Seal Rocks
  - Fish Rock and Green Island (South West Rocks)
  - Julian Rocks (Byron Bay)
  - Little Broughton Island (Port Stephens)
  - Magic Point (Maroubra)
  - Montague Island (Narooma)
  - The Pinnacle (Forster)
  - Tollgate Islands (Batemans Bay)

These areas would be unaffected by the proposed works in Currumbene Creek.

**Part 6 Whether the proposed development or activity is consistent with a Priorities Action Statement**

Of the species listed in Part 1 above, Priority Action Statements (PAS) have been prepared for Grey Nurse Sharks, Blind Slug, Scalloped Hammerhead, Southern Bluefin Tuna, Black Rockcod, and Great White Shark. As demonstrated in Part 1 above, the proposed activity would have no effect on these species. Similarly the proposed activity are unlikely to be inconsistent with respective PASs.

**Part 7      *Whether the proposed development constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process***

Key Threatening Process	Assessment
Degradation of native riparian vegetation along NSW water courses	Negligible – only scattered, small herbs, grasses and sedges along the foreshore access route will experience minor impact during ingress and egress of machinery and vehicles.
Hook and line fishing in areas important for the survival on threatened fish species	Not applicable – proposal does not comprise or facilitate hook and line fishing.
Human-caused climate change	Not applicable – the proposal does not contribute to human-cause climate change.
Installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams	Not applicable – the proposal does not involve the installation or operation of instream structures.
Introduction of fish to waters within a river catchment outside their range	Not applicable – the proposal does not involve releasing fish.
Introduction of non-indigenous fish and marine vegetation to the coastal waters of NSW	Not applicable – the proposal does not involve the introduction of non-indigenous fish.
Removal of large woody debris from NSW rivers and streams	Not applicable – the proposal does not involve the removal of woody debris.
The current shark meshing program in NSW waters	Not applicable – the proposal does not involve shark meshing.

**Threatened species impact assessment (Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act))**

An EPBC Protected Matters Report was generated on 10 May 2019. An EPBC Protected Matters Report provides general guidance on matters of national significance and other matters protected by the EPBC Act in the area selected. Of those threatened species and endangered ecological communities reported as likely occurring or having habitat within the area of the report, the following were considered to have potential habitat on the site and requiring further assessment:

- Eastern Curlew (Critically Endangered)
- Bar-tailed Godwit (Vulnerable)

- Green & Golden Bell Frog (Vulnerable)
- Hooded Plover (Vulnerable)
- Caspian Tern (Migratory)
- Common Sandpiper (Migratory)
- Ruddy Turnstone (Migratory)
- Little Tern (Migratory)
- Lesser Sand Plover (Migratory)
- *Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community* (Endangered)

Other species including marine species and migratory birds may occur occasionally within the vicinity of the proposed activity but would not be affected by the proposal.

The EPBC Significant Impact Criteria are as follows:

<b>Critically endangered and endangered species - Significant impact criteria</b>	
Species to consider: <b>Eastern Curlew</b>	
<b>Criteria</b>	<b>Assessment</b>
lead to a long-term decrease in the size of a population	The proposed activity will not directly impact the Eastern Curlew, will not affect or disrupt breeding and will not impact on breeding or foraging habitat
reduce the area of occupancy of the species	No
fragment an existing population into two or more populations	No
adversely affect habitat critical to the survival of a species	No important habitat will be impacted
disrupt the breeding cycle of a population	Works will be undertaken outside breeding period and will not affect breeding habitat
modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	No important habitat will be impacted
result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	No invasive species will be introduced
introduce disease that may cause the species to decline	No disease will be introduced
interfere with the recovery of the species	No

<b>Vulnerable species - Significant impact criteria</b>	
Species to consider: <b>Bar-tailed Godwit</b> <b>Hooded Plover</b> <b>Green &amp; Golden Bell Frog</b>	
<b>Criteria</b>	<b>Assessment</b>
lead to a long-term decrease in the size of an important population of a species	The proposed activity will not directly impact the Bar-tailed Godwit, Hooded Plover or Green &

	Golden Bell Frog, will not affect or disrupt breeding and will not impact on breeding or foraging habitat
reduce the area of occupancy of an important population	No
fragment an existing important population into two or more populations	No
adversely affect habitat critical to the survival of a species	No important habitat will be impacted
disrupt the breeding cycle of an important population	Works will be undertaken outside breeding period for nesting shorebirds and will not affect breeding habitat. Works will be undertaken outside breeding and dispersal periods for Green & Golden Bell Frog.
modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	No important habitat will be impacted. Any disruption to habitat for Green & Golden Bell Frog as a result of changing lake levels will occur outside of breeding and dispersal period while frogs are over-wintering, will be short-term and not affect habitat in the long-term
result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	No invasive species will be introduced
introduce disease that may cause the species to decline	No disease will be introduced
interfere substantially with the recovery of the species	No

<b>Critically endangered and endangered ecological communities - Significant impact criteria</b>	
Communities to consider: <b>Coastal Swamp Oak (<i>Casuarina glauca</i>) Forest of New South Wales and South East Queensland ecological community</b>	
<b>Criteria</b>	<b>Assessment</b>
reduce the extent of an ecological community	No Coastal Swamp Oak Forest will be directly impacted by the proposed works. Site management will ensure that no entry, direct damage or indirect impacts will occur through machinery and vehicle movement and maintenance.
fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines adversely affect habitat critical to the survival of an ecological community	No
modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological	No
community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns	No
cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example	No

through regular burning or flora or fauna harvesting	
cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: assisting invasive species, that are harmful to the listed ecological community, to become established, or causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community	No
interfere with the recovery of an ecological community	No

Additional consideration was given to the four principal threats determined by DEWHA (2009) to be most relevant to judgements on significance of impact to migratory shorebirds. These include:

- habitat loss
- habitat degradation
- disturbance, and
- direct mortality.

Degradation of shorebird habitat has a similar effect on populations as direct habitat loss. Many migratory shorebirds have specialised feeding techniques, making them susceptible to slight changes to prey sources and their foraging environments. Habitat degradation is associated with activities such as invasion of intertidal mudflats by exotic species. For example, invasion of exotic rice grass (*Spartina anglica*) is thought to have led to the loss of both roosting and foraging habitats for migratory shorebirds in America (Stralberg et al, 2004). Similar impacts from this species have been observed in parts of Australia (Minton and Whitelaw, 2000).

Other examples of activities that may cause degradation to shorebird habitats include water pollution and changes to the water regime; loss of marine or estuarine vegetation which helps stabilise mudflats and provides organic matter to support the invertebrates on which migratory shorebirds feed; expansion of mangroves; artificial changes to hydrological regimes that affect the productivity of the feeding environment; and exposure of acid sulphate soils.

Habitat degradation may also be caused by impacts which are indirect, or not directly associated with a particular activity. For example, nutrient runoff from a construction or development site may compromise the quality of water at a wetland downstream of the development.

The proposal does not involve or contribute to habitat loss or habitat degradation.

Potential disturbance will be involved, however the works are temporary in nature and would occur in June/July, outside the nesting periods for locally occurring threatened

shorebirds (generally Nov-Feb) and outside important foraging periods for migratory birds (generally Sep-Mar).

These species are highly mobile and transient and unlikely to visit or remain on site during machinery operation.

Direct mortality to threatened and migratory shorebirds will be avoided through the timing of works in addition to mitigation measures involving monitoring and stop-work protocols.

Works will occur on the northern end of the spit, avoiding existing favoured nesting areas of Little Tern occurring over the central and southern spit.

A Council Environmental Officer or other suitably qualified person would undertake pre-clearance surveys prior to works commencing each day and prior to machinery access and egress from site. If any of these species are detected in the vicinity of the works or machinery access/egress, works and/or machinery movement will stop immediately and not resume until the bird has vacated the site of its own accord. In the event that a nest or nesting birds are detected, works will cease and mitigation measures will be adapted in consultation with the NPWS Shorebird Recovery Coordinator, to minimise risk of disturbance to the birds and ensure their protection.

#### *Conclusion of EPBC Significant Impact Assessment*

The proposal is therefore unlikely to have an adverse effect on a vulnerable, endangered, critically endangered or migratory species or its habitat, nor on the extent or integrity of an endangered ecological community such that its local occurrence is likely to be placed at risk of extinction. Further assessment and referral to the Commonwealth is therefore not required.

**Table 2 Likelihood of occurrence**

The table of likelihood of occurrence evaluates the likelihood of threatened species to occur on the subject site. This list is derived from previously recorded species within a 5km radius (taken from Office of Environment and Heritage (OEH) Wildlife Atlas) around the subject site. Ecology information has been obtained from the Threatened Species Profiles on the NSW OEH website ([www.threatenedspecies.environment.nsw.gov.au](http://www.threatenedspecies.environment.nsw.gov.au)).

**Likelihood of occurrence in study area**

1. Unlikely – Species, population or ecological community is not likely to occur. Lack of previous recent (<25 years) records and suitable potential habitat limited or not available in the study area.
2. Likely – Species, population or ecological community could occur and study area is likely to provide suitable habitat. Previous records in the locality and/or suitable potential habitat in the study area.
3. Present – Species, population or ecological community was recorded during the field investigations.

**Possibility of impact**

1. Unlikely – The proposal would be unlikely to impact this species or its habitats. No EP&A Act 7-Part Test or EPBC Act significance assessment is necessary for this species.
2. Likely – The proposal could impact this species, population or ecological community or its habitats. An EP&A Act 7-Part Test and/or EPBC Act significance assessment is required for this species, population or ecological community.

<i>Endangered Ecological Community name</i>	<i>Status</i>	<i>Likelihood of presence within areas impacted by the activity</i>
Bangalay Sand Forest of the Sydney Basin and South East Corner Bioregions	Endangered - NSW BC Act	This EEC occurs adjacent to the access route along the north-eastern lake edge. Requires NSW BC Act s7.3 Test of Significance.

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Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions	Endangered - <i>NSW BC Act</i>  Vulnerable - Commonwealth <i>EPBC Act</i>	Occurs near the site (within 150m) but site surveys confirmed that this EEC does not occur in close proximity such that it is at risk of being impacted by the proposal.
Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion	Endangered - <i>NSW BC Act</i>  Critically Endangered - Commonwealth <i>EPBC Act</i>	Does not occur on-site and is not mapped as occurring in close proximity to the site (nearest records approx. 1.9km from the site).
Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	Endangered - <i>NSW BC Act</i>  Critically Endangered - Commonwealth <i>EPBC Act</i>	Does not occur on-site and is not mapped as occurring in close proximity to the site (nearest records approx. 1km from the site).
Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions	Endangered - <i>NSW BC Act</i>  Endangered - Commonwealth <i>EPBC Act</i>	This EEC occurs adjacent to the access route along the north-eastern lake edge. Requires NSW BC Act s7.3 Test of Significance.
Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	Endangered - <i>NSW BC Act</i>	Occurs in the surrounding area (approx. 300m from site), but site surveys confirmed that this EEC does not occur in close proximity such that it is at risk of being impacted by the proposal.

<i>Species name</i>	<i>Status</i>	<i>Habitat requirements (www.environment.nsw.gov.au)</i>	<i>Likelihood of presence within areas impacted by the activity</i>
<b>FLORA</b>			
Leafless tongue Orchid <i>Cryptostylis hunteriana</i>	<i>Vulnerable EPBC Act Vulnerable NSW BC Act</i>	Occurs in a wide variety of habitats from moist sandy soil to dense heathland, sedgeland and verges of fire trails. The larger populations typically occur in woodland dominated by Scribbly Gum ( <i>Eucalyptus sclerophylla</i> ), Silvertop Ash ( <i>E. sieberi</i> ), Red Bloodwood ( <i>Corymbia gummifera</i> ) and Black Sheoak ( <i>Allocasuarina littoralis</i> ); appears to prefer open areas in the understorey of this community and is often found in association with the Large Tongue Orchid ( <i>C. subulata</i> ) and the Tartan Tongue Orchid ( <i>C. erecta</i> ).	No. No suitable habitat present within the site.
Narrow-leafed Wilsonia <i>Wilsonia backhousei</i>	Vulnerable NSW BC Act	This is a species of the margins of salt marshes and lakes.	No. No suitable habitat present within the site. Vegetation survey did not detect the species.
Scrub Turpentine <i>Rhodamnia rubescens</i>	Critically Endangered NSW BC Act	Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils.	No – no habitat present
<b>AMPHIBIANS</b>			

Green and Golden Bell Frog <i>Litoria aurea</i>	Vulnerable <i>EPBC Act</i> Endangered <i>NSW BC Act</i>	Heath, woodland and open dry sclerophyll forest on a variety of soil types except clay based. Whilst in non-breeding habitat it burrows below the soil surface or in the leaf litter. Breeding frogs will call from open spaces, under vegetation or rocks or from within burrows in the creek bank. Egg masses are laid in burrows or under vegetation in small pools. After rains, tadpoles are washed into larger pools where they complete their development in ponds or ponded areas of the creekline. Tadpole development ranges from Breeding habitat of this species is generally soaks or pools within first or second order streams. They are also commonly recorded from 'hanging swamp' seepage lines and where small pools form from the collected water.	Unlikely to occur within works areas. No suitable habitat present within the site. Possibly occurring within areas affected by the lake's opening. Requires NSW BC Act s7.3 Test of Significance.
<b>REPTILES</b>			
Green Turtle <i>Chelonia mydas</i>	Vulnerable <i>EPBC Act</i> Vulnerable <i>NSW BC Act</i>	Ocean-dwelling species spending most of its life at sea. Eggs are laid in holes dug in beaches throughout their range.	Possibly occurring transiently in nearby ocean areas but unlikely to be affected.
<b>MICROCHIROPTERAN BATS</b>			
Eastern False Pipistrelle <i>Falsistrellus tasmaniensis</i>	Vulnerable <i>NSW BC Act</i>	Prefers moist habitat that contains trees greater than 20 m high with a dense understorey. They are fast flyers. Roosts in hollow trunks of eucalyptus trees, in colonies of 3 – 80. Also may roost in caves and old wooden buildings. This species changes roost every night. Roosts on consecutive nights are usually less than 750 m apart. This species	Unlikely. No suitable habitat present within the site.

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		<p>has a home range of up to 136 ha (Churchill, S 2008, Australian Bats, Jacana Books, Crows Nest, NSW).</p> <p>Although they prefer habitat with a dense understorey, they prefer to forage along flyways to avoid the thick understorey. They prefer continuous forest and avoid remnant vegetation. However, they have been recorded in open forests (Churchill, S 2008, Australian Bats, Jacana Books, Crows Nest, NSW).</p>	
<p>Eastern Bentwing-bat <i>Miniopterus orianae oceanensis</i></p>	Vulnerable <i>EPBC Act</i>	<p>Specific caves are known maternity sites with other caves being primary roosting habitat outside breeding period. Also uses derelict mines, storm-water tunnels, buildings and other man-made structures. Hunts in forested areas, catching moths and other flying insects above the tree tops.</p>	Unlikely. No suitable habitat present within the site.
<p>Eastern Freetail-Bat <i>Micronomus norfolkensis</i></p>	Vulnerable <i>EPBC Act</i>	<p>Small tree hollows/fissures in bark for roosting in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range.</p>	Unlikely. No suitable habitat present within the site.
<p>Large-footed Myotis (Southern Myotis) <i>Myotis macropus</i></p>	Vulnerable <i>NSW BC Act</i>	<p>This species is predominantly roosts in caves, however, is known to roost in trees and man-made structures close to water. Roosts are generally located close to water, where the bats forage in small groups of three or four. They have a strong association with streams and permanent waterways in areas that are vegetated rather than cleared (Churchill, S 2008, Australian Bats, Jacana Books, Crows Nest, NSW)</p>	Unlikely. No suitable habitat present within the site.

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		They feed on small fish, prawns and aquatic macroinvertebrates. They have a preference towards large still pools, rather than flowing streams. They will also forage an aerial insects flying over water. They use their large feet to capture prey items (Churchill, S 2008, Australian Bats, Jacana Books, Crows Nest, NSW).	
Greater Broad-nosed Bat <i>Scoteanax ruepellii</i>	Vulnerable NSW BC Act	Found mainly in gullies and river systems that drain the Great Dividing Range, it utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, below 500m, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings. Forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3 - 6 m	Unlikely to occur. No suitable habitat present within the site.
Southern Myotis <i>Myotis macropus</i>	Vulnerable NSW BC Act	This species is predominantly roosts in caves, however, is known to roost in trees and man-made structures close to water. Roosts are generally located close to water, where the bats forage in small groups of three or four. They have a strong association with streams and permanent waterways in areas that are vegetated rather than cleared (Churchill, S 2008, Australian Bats, Jacana Books, Crows Nest, NSW) They feed on small fish, prawns and aquatic macroinvertebrates. They have a preference towards large still pools, rather than flowing streams. They will also forage an aerial insects	Unlikely to occur. No suitable habitat present within the site.

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		<p>flying over water. They use their large feet to capture prey items (Churchill 2008).</p>	
<b>BIRDS</b>			
<p>Arctic Jaeger <i>Stercorarius parasiticus</i></p>	<p>Migratory EPBC Act</p>	<p>An inhabitant of oceans, coastal regions, boreal forest, grassland and tundra, the arctic jaeger shows a great ability to live in windy, wet climates as well as extremely dry and cold ones. The arctic jaeger breeds both on islands and on mainland coasts, and outside of the breeding season is found mostly at sea.</p>	<p>Possibly occurring transiently but unlikely to be affected.</p>
<p>Barking Owl <i>Ninox connivens</i></p>	<p>Vulnerable NSW BC Act</p>	<p>Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g. western NSW) due to the higher density of prey on these fertile soils. Roost in shaded portions of tree canopies, including tall midstorey trees with dense foliage such as Acacia and Casuarina species. During nesting season, the male perches in a nearby tree overlooking the hollow entrance. Requires very large permanent territories in most habitats due to sparse prey densities. Monogamous pairs hunt over as much as 6000</p>	<p>Unlikely to occur. No suitable habitat present within the site.</p>

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		<p>hectares, with 2000 hectares being more typical in NSW habitats.</p> <p>Two or three eggs are laid in hollows of large, old trees. Living eucalypts are preferred though dead trees are also used. Nest sites are used repeatedly over years by a pair, but they may switch sites if disturbed by predators (e.g. goannas).</p>	
<p>Bar-tailed Godwit <i>Limosa lapponica</i></p>	<p>Migratory EPBC Act</p>	<p>The Bar-tailed Godwit is found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. It is found often around beds of seagrass and, sometimes, in nearby saltmarsh. It has been sighted in coastal sewage farms and saltworks, saltlakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats. It is rarely found on inland wetlands or in areas of short grass, such as farmland, paddocks and airstrips, although it is commonly recorded in paddocks at some locations overseas.</p> <p>Forages near the edge of water or in shallow water, mainly in tidal estuaries and harbours. They appear not to forage at high tide and prefer exposed sandy substrates on intertidal flats, banks and beaches. They also prefer soft mud; often with beds of eelgrass <i>Zostera</i> or other seagrasses. Occasionally they have been known to forage among mangroves, or on coral reefs or rock platforms among rubble, crevices and holes. They rarely forage in grassy or vegetated areas. On Heron Island they have been seen feeding on insect larvae among the roots of <i>Casuarina</i>. Roosts on sandy beaches, sandbars, spits and also in near-coastal saltmarsh. In some</p>	<p>Possibly occurring</p>

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		conditions, waders may choose roost sites where a damp substrate lowers the local temperature.	
Black Bittern <i>Ixobrychus flavicollis</i>	Vulnerable <i>NSW BC Act</i>	Terrestrial and estuarine wetlands generally in areas of permanent water and dense vegetation that may comprise grassland, woodland forest rainforest and mangroves. Roosts in trees or on ground amongst dense reeds, nests in branches overhanging water	Possibly occurring
Black-browed Albatross <i>Thalassarche melanophris</i>	Vulnerable <i>NSW BC Act</i>  Vulnerable <i>EPBC Act</i>	Inhabits Antarctic, subantarctic, subtropical marine and coastal waters over upwellings and boundaries of currents. Spends most of its time at sea, breeding on small isolated islands. This species feeds on fish, crustaceans, offal and squid and often forages in flocks with other seabirds. Nests annually on a mound of soil and vegetation, on the cliffs or steep slopes of vegetated Antarctic and subantarctic islands.	Possibly occurring transiently but unlikely to be affected.
Brown Treecreeper (eastern subspecies) <i>Climacteris picumnus victoriae</i>	<i>NSW BC Act</i> Vulnerable	Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and River Red Gum ( <i>Eucalyptus camaldulensis</i> ) Forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses; usually not found in woodlands with a dense shrub layer; fallen timber is an important habitat component for foraging; also recorded, though less commonly, in similar woodland habitats on the coastal ranges and plains. Hollows in standing dead or live trees and tree stumps are essential for nesting.	Unlikely to occur – no suitable habitat present on site

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<p>Caspian Tern <i>Hydroprogne caspia</i></p>	<p>Migratory EPBC Act</p>	<p>Occur along the Australian coastline, and also occur inland along major rivers, especially in the Murray-Darling and Lake Eyre drainage basins, preferring wetlands with clear water to allow easy prey detection.</p>	<p>Possibly occurring</p>
<p>Common Sandpiper <i>Actitis hypoleucos</i></p>	<p>Migratory EPBC Act</p>	<p>The species utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins or rocky shores and rarely on mudflats. The Common Sandpiper has been recorded in estuaries and deltas of streams, as well as on banks farther upstream; around lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties. The muddy margins utilised by the species are often narrow, and may be steep. The species is often associated with mangroves, and sometimes found in areas of mud littered with rocks or snags. Generally the species forages in shallow water and on bare soft mud at the edges of wetlands; often where obstacles project from substrate, e.g. rocks or mangrove roots. Birds sometimes venture into grassy areas adjoining wetlands. Roost sites are typically on rocks or in roots or branches of vegetation, especially mangroves. The species is known to perch on posts, jetties, moored boats and other artificial structures, and to sometimes rest on mud or 'loaf' on rocks.</p>	<p>Possibly occurring</p>
<p>Eastern Curlew <i>Numenius madagascariensis</i></p>	<p>Critically Endangered EPBC Act</p>	<p>Most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass. Occasionally, the species occurs on ocean beaches (often near estuaries), and coral reefs,</p>	<p>Possibly occurring.</p>

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		<p>rock platforms, or rocky islets. The birds are often recorded among saltmarsh and on mudflats fringed by mangroves, and sometimes use the mangroves. The birds are also found in saltworks and sewage farms (Marchant &amp; Higgins 1993). The numbers of Eastern Curlew recorded during one study were correlated with wetland areas. Mainly forages on soft sheltered intertidal sandflats or mudflats, open and without vegetation or covered with seagrass, often near mangroves, on saltflats and in saltmarsh, rockpools and among rubble on coral reefs, and on ocean beaches near the tideline. The birds are rarely seen on near-coastal lakes and in grassy areas.</p> <p>Roosts on sandy spits and islets, especially on dry beach sand near the high-water mark, and among coastal vegetation including low saltmarsh or mangroves. It occasionally roosts on reef-flats, in the shallow water of lagoons and other near-coastal wetlands. Eastern Curlews are also recorded roosting in trees and on the upright stakes of oyster-racks. At Roebuck Bay, Western Australia, birds fly from their feeding areas on the tidal flats to roost 5 km inland on a claypan. In some conditions, waders may choose roost sites where a damp substrate lowers the local temperature. This may have important conservation implications where these sites are heavily disturbed beaches. It may be possible to create artificial roosting sites to replace those destroyed by development. Eastern Curlews typically roost in large flocks, separate from other waders.</p>	
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Eastern Ground Parrot <i>Pezoporus wallicus wallicus</i>	Vulnerable NSW BC Act	The Eastern Ground Parrot occurs in near coastal low heathlands and sedgelands, generally below one metre in height and very dense (up to 90% projected foliage cover). These habitats provide a high abundance and diversity of food, adequate cover and suitable roosting and nesting opportunities for the Ground Parrot, which spends most of its time on or near the ground. When flushed, birds fly strongly and rapidly for up to several hundred metres, at a metre or less above the ground (OEH 2013)	Unlikely to occur. No suitable habitat present on site.
Eastern Osprey <i>Pandion cristatus</i>	NSW BC Act Vulnerable	Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water. Breed from July to September in NSW. Nests are made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea.	Possible – but not likely to be affected by the proposed activity as no vegetation removal is proposed. The species are transient and far ranging. It is possible that the species would fly over the site from time to time or to rest briefly. The proposed activity is unlikely to impact the species as the area does not provide important or useful habitat for the species. The species use of the site (flying over or resting) would not be affected by the proposal.
Eastern Reef Egret <i>Egretta sacra</i>	Migratory EPBC Act	The Eastern Reef Egret lives on beaches, rocky shores, tidal rivers and inlets, mangroves, and exposed coral reefs.	Possibly occurring transiently but unlikely to be affected.
Fork-tailed Swift <i>Apus pacificus</i>	Migratory EPBC Act	Occurring over inland plains but sometimes above foothills or in coastal areas. They often occur over cliffs and beaches and also over islands and sometimes well out to sea. They also occur over settled areas, including towns, urban areas and cities. They mostly occur over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh. They are also found at treeless grassland and sandplains covered with spinifex,	Possible – but not likely to be affected by the proposed activity as no vegetation removal is proposed. The species are transient and far ranging. It is possible that the species would fly over the site from time to time or to rest briefly. The proposed activity is unlikely to impact the species as the area does not provide important or useful habitat for the species. The species use of the site (flying over or resting) would not be affected by the proposal.

		open farmland and inland and coastal sand dunes.	
Gang-gang Cockatoo <i>Callocephalon fimbriatum</i>	<i>Vulnerable NSW BC Act</i>	Tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, may occur at lower altitudes in drier more open eucalypt forests and woodlands, and often found in urban areas. preferring more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas. Favours old growth attributes for nesting and roosting	Unlikely to occur. No suitable habitat present on site.
Gibson's Albatross <i>Diomedea gibsoni</i>	Vulnerable NSW BC Act Vulnerable EPBC Act	This species is known only to breed on the Adams, Disappointment and Auckland Islands in the subantarctic Auckland Island group. Breeds biennially in colonies among grass tussocks on isolated subantarctic islands, using the wind to travel great distances both during and between breeding seasons. This species regularly occurs off the NSW coast from Green Cape to Newcastle. Although representing a small proportion on its total foraging area, potential forage in NSW waters during the winter is nonetheless considered significant for the species. Forage for Gibson's Albatross is extremely patchy, both spatially and temporally, and individuals traverse great distances in search of food. This species feeds pelagically on squid, fish and crustaceans.	Possibly occurring transiently but unlikely to be affected.
Glossy Black-cockatoo <i>Calyptorhynchus lathami</i>	<i>Vulnerable NSW BC Act</i>	The GBC inhabits open forest and woodlands of the coast where stands of she-oak occur. In the Jervis Bay region they feed almost exclusively on the seeds of the black she-oak <i>Allocasuarina littoralis</i> , shredding the cones with their bill	Unlikely to occur. No suitable habitat present on site.

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<p>Hooded Plover <i>Thinornis rubricollis</i></p>	<p>NSW BC Act: Critically Endangered  EPBC Act: Vulnerable</p>	<p>In south-eastern Australia Hooded Plovers prefer sandy ocean beaches, especially those that are broad and flat, with a wide wave-wash zone for feeding, much beachcast seaweed, and backed by sparsely vegetated sand-dunes for shelter and nesting. Occasionally Hooded Plovers are found on tidal bays and estuaries, rock platforms and rocky or sand-covered reefs near sandy beaches, and small beaches in lines of cliffs. They regularly use near-coastal saline and freshwater lakes and lagoons, often with saltmarsh. Hooded Plovers forage in sand at all levels of the zone of wave wash during low and mid-tide or among seaweed at high-tide, and occasionally in dune blowouts after rain. At night they favour the upper zones of beaches for roosting. When on rocks they forage in crevices in the wave-wash or spray zone, avoiding elevated rocky areas and boulder fields. In coastal lagoons they forage in damp or dry substrates and in shallow water, depending on the season and water levels. In eastern Australia, Hooded Plovers usually breed from August to March on sandy ocean beaches strewn with beachcast seaweed, in a narrow strip between the high-water mark and the base of the fore-dunes. They often nest within 6 m of the fore-dune, mostly within 5 m of the high-water mark, but occasionally among or behind dunes.</p>	<p>Possibly occurring. Requires NSW BC Act s7.3 Test of Significance.</p>
<p>Lesser Sand-plover <i>Charadrius mongolus</i></p>	<p>NSW BC Act: Vulnerable  Migratory EPBC Act</p>	<p>In non-breeding grounds in Australia, this species usually occurs in coastal littoral and estuarine environments. It inhabits large intertidal sandflats or mudflats in sheltered bays, harbours and estuaries, and occasionally sandy ocean beaches, coral reefs, wave-cut rock platforms</p>	<p>Possibly occurring. Requires NSW BC Act s7.3 Test of Significance.</p>

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		<p>and rocky outcrops. It also sometime occurs in short saltmarsh or among mangroves.</p> <p>The species feeds mostly on extensive, freshly-exposed areas of intertidal sandflats and mudflats in estuaries or beaches, or in shallow ponds in saltworks.</p> <p>hey roost near foraging areas, on beaches, banks, spits and banks of sand or shells and occasionally on rocky spits, islets or reefs.</p> <p>The species does not breed in Australia.</p>	
<p>Little Eagle <i>Hieraaetus morphnoides</i></p>	<p>Vulnerable NSW BC Act</p>	<p>Occupies open eucalypt forest, woodland or open woodland. She-oak or acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter</p>	<p>Possible – but not likely to be affected by the proposed activity as no vegetation removal is proposed. The species are transient and far ranging. It is possible that the species would fly over the site from time to time or to rest briefly. The proposed activity is unlikely to impact the species as the area does not provide important or useful habitat for the species. The species use of the site (flying over or resting) would not be affected by the proposal.</p>
<p>Little Lorikeet <i>Glossopsitta pusilla</i></p>	<p>Vulnerable NSW BC ACT</p>	<p>Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophora, Melaleuca and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity.</p> <p>Isolated flowering trees in open country, e.g. paddocks, roadside remnants and urban trees also help sustain viable populations of the species</p> <p>Roosts in treetops, often distant from feeding areas.</p> <p>Nests in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of smooth-barked Eucalypts. Entrance is</p>	<p>Unlikely to occur. No suitable habitat present on site.</p>

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		small (3 cm) and usually high above the ground (2–15 m). These nest sites are often used repeatedly for decades, suggesting that preferred sites are limited. Riparian trees often chosen, including species like <i>Allocasuarina</i>	
Little Tern <i>Sternula albifrons</i>	Endangered NSW BC Act	Mostly exclusively coastal, preferring sheltered environments; however may occur several kilometres from the sea in harbours, inlets and rivers (with occasional offshore islands or coral cay records). Nests in small, scattered colonies in low dunes or on sandy beaches just above the high tide mark near estuary mouths or adjacent to coastal lakes and islands. Nests in a scrape in the sand, which may be lined with shell grit, seaweed or small pebbles.	Possibly occurring. Requires NSW BC Act s7.3 Test of Significance.
Masked Owl – <i>Tyto novaehollandiae</i>	Vulnerable NSW BC Act	Dry eucalypt forests and woodlands from sea level to 1100 m. Inhabits forest but often hunts along the edges of forests, including roadsides. The typical diet consists of tree-dwelling and ground mammals, especially rats. Pairs have a large home-range of 500 to 1000 hectares. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting requires old growth elements-hollow bearing tree resources for nesting and prey source	Unlikely to occur. No suitable habitat present on site.
Pied Oystercatcher <i>Haematopus longirostris</i>	Endangered NSW BC Act	Favours intertidal flats of inlets and bays, open beaches and sandbanks. Forages on exposed sand, mud and rock at low tide, for molluscs, worms, crabs and small fish. Nests mostly on coastal or estuarine beaches although occasionally they use saltmarsh or grassy areas. Nests are shallow scrapes in sand above the	Possibly occurring. Requires NSW BC Act s7.3 Test of Significance.

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		high tide mark, often amongst seaweed, shells and small stones.	
Pink Robin <i>Petroica rodinogaster</i>	Vulnerable NSW BC Act	Inhabits rainforest and tall, open eucalypt forest particularly in densely vegetated gullies	Unlikely to occur. No suitable habitat present on site.
Powerful Owl <i>Ninox strenua</i>	Vulnerable NSW BC Act	Coastal Woodland, Dry Sclerophyll Forest, wet sclerophyll forest and rainforest- Can occur in fragmented landscapes Roosts in dense vegetation comprising species such as Turpentine <i>Syncarpia glomulifera</i> , Black She-oak <i>Allocasuarina littoralis</i> , Blackwood <i>Acacia melanoxylon</i> , Rough-barked Apple <i>Angophora floribunda</i> , Cherry Ballart <i>Exocarpus cupressiformis</i> and a number of eucalypt species. requires old growth elements-hollow bearing tree resources for nesting and prey resource. Nests in large tree hollows in large eucalypts that are at least 150yrs old. Often in riparian areas. Large home range	Unlikely to occur. No suitable habitat present on site.
Regent Honeyeater <i>Anthochaera phrygia</i>	Critically endangered EPBC Act Critically endangered NSW BC Act	Temperate woodlands and open forests- and drier coastal woodlands in some years (flowering coastal woodlands and forests including box-ironbark woodland, and riparian forests-that exhibit large numbers of mature trees, high canopy cover and abundance of mistletoes) Key eucalypt species include Mugga Ironbark, Yellow Box, Blakely's Red Gum, White Box and Swamp Mahogany. Also utilises: <i>Eucalyptus microcarpa</i> , <i>E. punctata</i> , <i>E. polyanthemos</i> , <i>E. moluccana</i> , <i>Corymbia robusta</i> , <i>E. crebra</i> , <i>E. caleyi</i> , <i>C. maculata</i> , <i>E. mckieana</i> , <i>E. macrorhyncha</i> , <i>E. laevopinea</i> , and <i>Angophora floribunda</i> . Nectar	Unlikely to occur. No suitable habitat present on site.

		and fruit from the mistletoes <i>Amyema miquelii</i> , <i>A. pendula</i> and <i>A. cambagei</i> are also eaten during the breeding season.	
Ruddy Turnstone <i>Arenaria interpres</i>	Migratory EPBC Act	<p>In Australasia, the Ruddy Turnstone is mainly found on coastal regions with exposed rock coast lines or coral reefs. It also lives near platforms and shelves, often with shallow tidal pools and rocky, shingle or gravel beaches. It can, however, be found on sand, coral or shell beaches, shoals, cays and dry ridges of sand or coral. It has occasionally been sighted in estuaries, harbours, bays and coastal lagoons, among low saltmarsh or on exposed beds of seagrass, around sewage ponds and on mudflats. In southern Australia the Ruddy Turnstone prefers rockier coastlines and is less numerous on large embayments with extensive mudflats.</p> <p>The Ruddy Turnstone mainly forages between lower supralittoral and lower littoral zones of foreshores, from strand-line to wave-zone. They often forage among banks of stranded seaweed or other tide-wrack. They are also known to forage on exposed rocky platforms, coral reefs and mudflats. In the south-east Gulf of Carpentaria they feed only on mangrove mudflats, especially those near shingle beaches. Sometimes they feed around coastal lagoons and sewage treatment ponds, occasionally among low vegetation in saltmarsh, on exposed beds of seagrass, or among dunes on coral cays. The have sometimes been known to forage in grassy areas above the tideline, in short pasture, or in ploughed paddocks.</p>	Possibly occurring.

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		The Ruddy Turnstone roosts on beaches, above the tideline, among rocks, shells, beachcast seaweed or other debris. They have also been observed roosting on rocky islets among grassy tussocks, and on mudflats and sandflats. They sometimes fly around, or land on, ships at sea	
Short-tailed Shearwater <i>Ardenna tenuirostris</i>	Migratory EPBC Act	Coastal, oceanic.	Possibly occurring transiently but unlikely to be affected.
Shy Albatross <i>Thalassarche cauta</i>	NSW BC Act Vulnerable EPBC Act Vulnerable	This pelagic or ocean-going species inhabits subantarctic and subtropical marine waters, spending the majority of its time at sea. While at sea, it soars on strong winds and when calm, individuals may rest on the ocean, in groups during the breeding season or as individuals at other times. Occasionally the species occurs in continental shelf waters, in bays and harbours. The species feeds on fish, crustaceans, offal and squid and may forage in mixed-species flocks. Food may be caught by seizing prey from the water's surface while swimming, by landing on top of prey, diving for prey beneath the water and by scavenging behind fishing vessels. Known breeding locations include Albatross Island off Tasmania, Auckland Island, Bounty Island and The Snares, off New Zealand, where nesting colonies of 6-500 nests occur and may contain other species such as the Australian Gannet. Located on sheltered sides of islands, on cliffs and ledges, in crevices and slopes, nests are used annually and consist of a mound of mud, bones, plant matter and rocks.	Possibly occurring transiently but unlikely to be affected.

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Sooty Owl <i>Tyto tenebricosa</i>	Vulnerable NSW BC Act	Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests	Unlikely to occur. No suitable habitat present on site.
Sooty Oystercatcher <i>Haematopus fuliginosus</i>	Vulnerable NSW BC Act	Shore bird – breeds in sand or coral scrapes on offshore islands	Possibly occurring. Requires NSW BC Act s7.3 Test of Significance.
Square-Tailed Kite <i>Lophoictinia isura</i>	Vulnerable NSW BC Act	Summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March. Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses large hunting ranges of more than 100km <sup>2</sup> Nest within large hollow bearing trees generally within 200m of riparian areas.	Unlikely to occur. No suitable habitat present on site.
Swift Parrot <i>Lathamus discolor</i>	Endangered EPBC Act Endangered NSW BC Act	Migrates to the Australian south-east mainland between March and October. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany ( <i>Eucalyptus robusta</i> ), Spotted Gum ( <i>Corymbia maculata</i> ), Red Bloodwood ( <i>C. gummifera</i> ), Mugga Ironbark ( <i>E. sideroxylon</i> ), and White Box ( <i>E. albens</i> ). Commonly used lerp infested trees include Inland Grey Box <i>E. microcarpa</i> , Grey Box <i>E. moluccana</i> and Blackbutt <i>E. pilularis</i> . Return to some foraging sites on a cyclic basis depending on food availability. Following winter they return to Tasmania where they breed from September to January, nesting in old trees with hollows and	Unlikely to occur. No suitable habitat present on site.

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		feeding in forests dominated by Tasmanian Blue Gum Eucalyptus globulus.	
Varied Sittella <i>Daphoenositta chrysoptera</i>	Vulnerable <i>NSW BC Act</i>	Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland	Unlikely to occur. No suitable habitat present on site.
Wedge-tailed Shearwater <i>Ardenna pacificus</i>	Migratory <i>EPBC Act</i>	A pelagic, marine bird known from tropical and subtropical waters. The species tolerates a range of surface-temperatures and salinities, but is most abundant where temperatures are greater than 21 °C and salinity is greater than 34.6 %. In tropical zones the species may feed over cool nutrient-rich waters. The species has been recorded in offshore waters of eastern Victoria and southern NSW, mostly over continental slope with sea-surface temperatures of 13.9–24.4 °C and usually off the continental shelf in north-west Australia.	Possibly occurring transiently but unlikely to be affected.
White-bellied Sea-Eagle <i>Haliaeetus leucogaster</i>	<i>NSW BC Act</i> Vulnerable  Migratory <i>EPBC Act</i>	Found in coastal habitats (especially those close to the sea-shore) and around terrestrial wetlands in tropical and temperate regions of mainland Australia and its offshore islands. The habitats occupied by the sea-eagle are characterized by the presence of large areas of open water (larger rivers, swamps, lakes, the sea). Birds have been recorded in (or flying over) a variety of terrestrial habitats. The species is mostly recorded in coastal lowlands, but can occupy habitats up to 1400 m above sea level on the Northern Tablelands of NSW and up to 800 m above sea level in Tasmania and South Australia. Birds have been recorded at or in the vicinity of freshwater swamps, lakes, reservoirs, billabongs,	Possible – but not likely to be affected by the proposed activity as no vegetation removal is proposed. The species are transient and far ranging. It is possible that the species would fly over the site from time to time or to rest briefly. The proposed activity is unlikely to impact the species as the area does not provide important or useful habitat for the species. The species use of the site (flying over or resting) would not be affected by the proposal.

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		<p>saltmarsh and sewage ponds. They also occur at sites near the sea or sea-shore, such as around bays and inlets, beaches, reefs, lagoons, estuaries and mangroves. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, forest (including rainforest) and even urban areas. Breeding has been recorded on the coast, at inland sites, and on offshore islands. Breeding territories are located close to water, and mainly in tall open forest or woodland, although nests are sometimes located in other habitats such as dense forest (including rainforest), closed scrub or in remnant trees on cleared land.</p> <p>Forages over large expanses of open water; this is particularly true of birds that occur in coastal environments close to the sea-shore, where they forage over in-shore waters. However, the White-bellied Sea-Eagle will also forage over open terrestrial habitats (such as grasslands). Birds may move to and congregate in favorable sites during drought or food shortage.</p>	
<p>White-tailed Tropicbird <i>Phaethon lepturus</i></p>	<p>Migratory EPBC Act</p>	<p>Occupies marine habitats in tropical waters with sea-surface temperatures of more than 22°C. The tropicbird breeds on islands and atolls, where it nests in a variety of habitats including on bare sandy ground, in closed-canopy rainforest, on rocky cliffs and in quarries.</p> <p>Nests in <i>Pisonia</i> trees amongst <i>Pisonia</i>-coconut vegetation, and on sandy ground.</p> <p>Most commonly associated with marine habitats in tropical waters with sea-surface temperatures of more than 22°C (Marchant &amp; Higgins 1990). Marine habitat preferences are poorly known. The species feeds over warm waters of low</p>	<p>Possibly occurring transiently but unlikely to be affected.</p>

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		salinity. Probably pelagic, as they are rarely found inshore or beachcast. The only variation in habitat used by the White-tailed Tropicbird throughout its range is its occurrence in subtropical waters off New South Wales or, on rare occasions, Victoria.	
White-throated Needletail <i>Hirundapus caudacutus</i>	Migratory <i>EPBC Act</i>	Almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground. Because they are aerial, it has been stated that conventional habitat descriptions are inapplicable, but there are, nevertheless, certain preferences exhibited by the species. Although they occur over most types of habitat, they are probably recorded most often above wooded areas, including open forest and rainforest, and may also fly between trees or in clearings, below the canopy, but they are less commonly recorded flying above woodland. They also commonly occur over heathland, but less often over treeless areas, such as grassland or swamps. When flying above farmland, they are more often recorded above partly cleared pasture, plantations or remnant vegetation at the edge of paddocks. In coastal areas, they are sometimes seen flying over sandy beaches or mudflats, and often around coastal cliffs and other areas with prominent updraughts, such as ridges and sand-dunes. They are sometimes recorded above islands well out to sea.	Possible – but not likely to be affected by the proposed activity as no vegetation removal is proposed. The species are transient and far ranging. It is possible that the species would fly over the site from time to time or to rest briefly. The proposed activity is unlikely to impact the species as the area does not provide important or useful habitat for the species. The species use of the site (flying over or resting) would not be affected by the proposal.
<b>MAMMALS</b>			
Australian Fur-seal <i>Arctocephalus pusillus doriferus</i>	Vulnerable <i>NSW BC Act</i>	Prefers rocky parts of islands with flat, open terrain. They occupy flatter areas than do New Zealand Fur-seals where they occur together.	Unlikely to occur or be otherwise impacted – no suitable habitat present on site.

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Greater Glider <i>Petauroides Volans</i>	Vulnerable EPBC Act	Feeds exclusively on eucalypt leaves, buds, flowers and mistletoe. Shelter during the day in tree hollows and will use up to 18 hollows in their home range. Occupy a relatively small home range with an average size of 1 to 3 ha. Give birth to a single young in late autumn or early winter which remains in the pouch for approximately 4 months and is independent at 9 months of age. Usually solitary, though mated pairs and offspring will share a den during the breeding season and until the young are independent. Can glide up to a horizontal distance of 100m including changes of direction of as much as 90 degrees. Very loyal to their territory.	Unlikely to occur or be otherwise impacted – no suitable habitat present on site.
Grey-headed Flying-fox <i>Pteropus poliocephalus</i>	Vulnerable EPBC Act Vulnerable NSW BC Act	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy.	Unlikely to occur or be otherwise impacted – no suitable habitat present on site.
Humpback Whale <i>Megaptera novaeangliae</i>	Vulnerable EPBC Act Vulnerable NSW BC Act	The population of Australia's east coast migrates from summer cold-water feeding grounds in Subantarctic waters to warm-water winter breeding grounds in the central Great Barrier Reef. They are regularly observed in NSW waters in June and July, on northward migration and October and November, on southward migration	Unlikely to occur or be otherwise impacted – no suitable habitat present on site.
Koala <i>Phascolarctos cinereus</i>	Vulnerable NSW BC Act	Eucalypt woodland and forest Home range sizes vary with quality of habitat ranging from less than two ha to several hundred ha. Preferred tree species on the south coast are <i>Eucalyptus</i>	Unlikely to occur or be otherwise impacted – no suitable habitat present on site.

		<i>amplifolia</i> , <i>E.viminalis</i> , & <i>E.tereticornis</i> but numerous other species also known food trees.	
Long-nosed Potoroo <i>Potorous tridactylus</i>	Vulnerable EPBC Act Vulnerable NSW BC Act	Inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. A sandy loam soil is also a common feature. The fruit-bodies of hypogeous (underground-fruiting) fungi are a large component of the diet of the Long-nosed Potoroo. They also eat roots, tubers, insects and their larvae and other soft-bodied animals in the soil. Often digs small holes in the ground in a similar way to bandicoots. Mainly nocturnal, hiding by day in dense vegetation - however, during the winter months animals may forage during daylight hours. Individuals are mainly solitary, non-territorial and have home range sizes ranging between 2-5 ha.	Unlikely to occur or be otherwise impacted – no suitable habitat present on site.
Southern Brown Bandicoot (eastern) <i>Isodon obesulus obesulus</i>	Endangered EPBC Act Endangered NSW BC Act	Southern Brown Bandicoots are largely crepuscular (active mainly after dusk and/or before dawn). They are generally only found in heath or open forest with a heathy understorey on sandy or friable soils. They feed on a variety of ground-dwelling invertebrates and the fruit-bodies of hypogeous (underground-fruiting) fungi. Their searches for food often create distinctive conical holes in the soil. Males have a home range of approximately 5-20 hectares whilst females forage over smaller areas of about 2-3 hectares. Nest during the day in a shallow	Unlikely to occur or be otherwise impacted – no suitable habitat present on site.

		depression in the ground covered by leaf litter, grass or other plant material. Nests may be located under Grass trees <i>Xanthorrhoea</i> spp., blackberry bushes and other shrubs, or in rabbit burrows. The upper surface of the nest may be mixed with earth to waterproof the inside of the nest.	
Southern Right Whale <i>Eubalaena australis</i>	Endangered EPBC Act Endangered NSW BC Act	Migrate between summer feeding grounds in Antarctica and winter breeding grounds around the coasts of southern Australia, New Zealand, South Africa and South America. They feed in the open ocean in summer. They move inshore in winter for calving and mating. Calving females and females with young usually remain very close to the coast, particularly in the 5-10 m watermark. They feed on krill and copepods by filtering water through their baleen (plates of keratin that hang inside their upper-jaw). It appears Southern Right Whales may not feed at all in Australian waters	Unlikely to occur or be otherwise impacted – no suitable habitat present on site.
Sperm Whale <i>Physeter macrocephalus</i>	Vulnerable NSW BC Act	Concentrations of Sperm Whales tend to occur where the seabed rises steeply from a greater depth, beyond the continental shelf. It is likely they feed on squid, octopus and fish. They are able to dive to depths of 2500m and have been recorded eating Giant Squid up to 10m in length.	Unlikely to occur or be otherwise impacted – no suitable habitat present on site.
Spotted-tailed Quoll <i>Dasyurus maculatus</i>	Endangered EPBC Act Vulnerable NSW BC Act	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock outcrops and rocky-cliff faces as den sites. Mostly nocturnal, although will hunt during the day; spends most of the time on the ground, although also an excellent climber and	Unlikely to occur or be otherwise impacted – no suitable habitat present on site.

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		will hunt possums and gliders in tree hollows and prey on roosting birds. Use communal 'latrine sites', often on flat rocks among boulder fields, rocky cliff-faces or along rocky stream beds or banks. Such sites may be visited by multiple individuals and can be recognised by the accumulation of the sometimes characteristic 'twisty-shaped' faeces deposited by animals. Females occupy home ranges up to about 750 hectares and males up to 3500 hectares. Are known to traverse their home ranges along densely vegetated creeklines.	
Squirrel Glider <i>Petaurus norfolcensis</i>	NSW BC Act Vulnerable	Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia midstorey. Live in family groups of a single adult male one or more adult females and offspring. Require abundant tree hollows for refuge and nest sites. Diet varies seasonally and consists of Acacia gum, eucalypt sap, nectar, honeydew and manna, with invertebrates and pollen providing protein.	Unlikely to occur or be otherwise impacted – no suitable habitat present on site.
Yellow-bellied Glider - <i>Petaurus Australis</i>	Vulnerable NSW BC Act	Forest with old growth elements. Large Eucalypt Hollows for denning- Inhabits mature or old growth Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia mid storey. Feed primarily on plant and insect exudates, including nectar, sap, honeydew and manna with pollen and insects providing protein. Extract sap by incising (or biting into) the trunks and branches of favoured food	Unlikely to occur or be otherwise impacted – no suitable habitat present on site.

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		trees, often leaving a distinctive 'V'-shaped scar. Very mobile and occupy large home ranges between 20 to 85 ha to encompass dispersed and seasonally variable food resources.	
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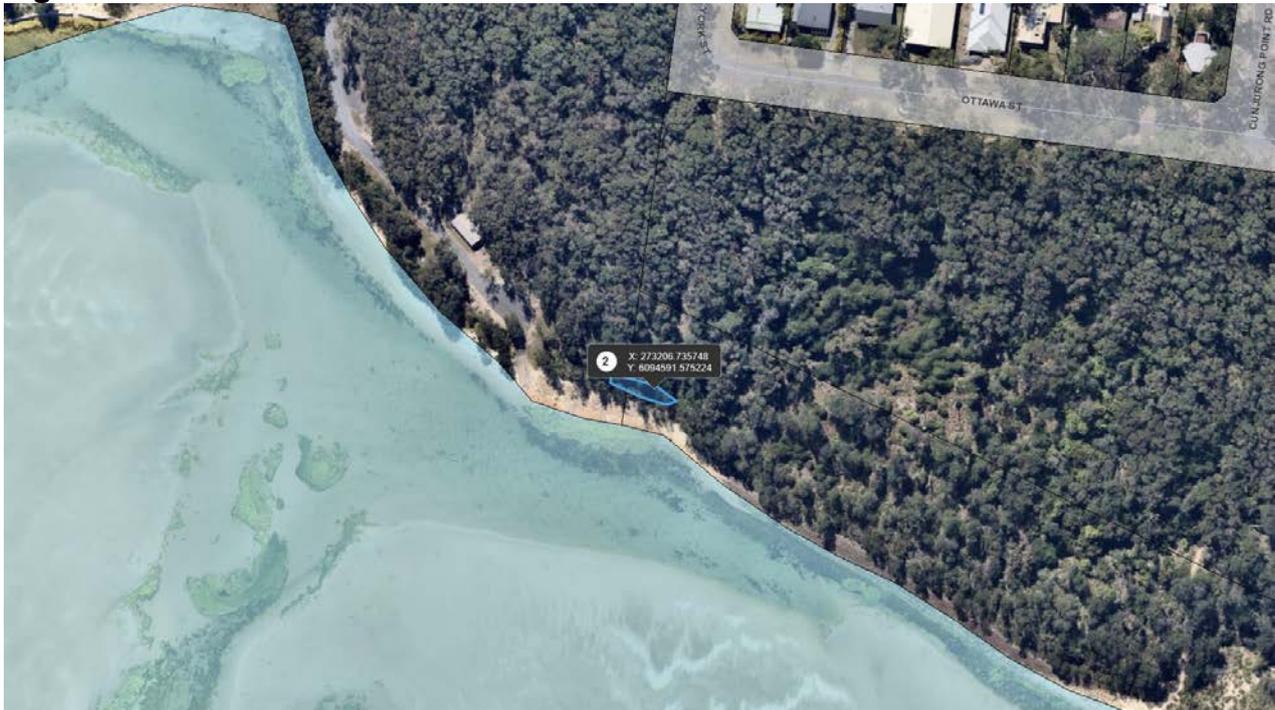
#### **4.5 Archaeology**

Note: Section 4.4 of this Addendum replaces Section 4.4 of the 2013 REF entirely

Under Section 86 of the NSW *National Parks and Wildlife Act 1974* (NPW Act) it is an offence to disturb, damage, destroy any Aboriginal object without an Aboriginal Heritage Impact Permit (AHIP). The Act, however, provides that if a person who exercises 'due diligence' in determining that their actions will not harm Aboriginal objects has a defence against prosecution if they later unknowingly harm and object without an AHIP (Section 87(2) of the Act). To effect this, the NSW Department of Environment, Climate Change and Water have prepared the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (hereafter referred to as the 'Due Diligence Guidelines') to assist individuals and organisations to exercise due diligence when carrying out activities that may harm Aboriginal objects and to determine whether they should apply for an AHIP.

In accordance with Step 1 of the Due Diligence Guidelines (DECCW 2010), a search on the Aboriginal Heritage Information Management System (AHIMS) indicated that there are no aboriginal sites within the vicinity of the proposed activity (see report below). However, since this database search was conducted on the 28<sup>th</sup> May 2019, a shell midden on the shores of Lake Conjola was detected and recorded. The extent of surface exposure of the midden is shown in Figure 2 (below). The actual extent of the midden below the surface is likely to be larger than that shown. Regardless, the works can easily avoid the midden as it is on the vegetated dune which vehicles and equipment would be prevented from accessing/impacting.

**Figure 8 location of midden**



Step 2 of the Due Diligence Code of Practice requires consideration of whether Aboriginal objects are likely to be in the area of the proposed activity in regard to certain landscape features. The proposed activity would be conducted within landscape features which may have a higher likelihood to contain Aboriginal artefacts, i.e., “*within 200 metres of waters*”. The Due Diligence Guidelines require further analysis if a proposal is on these lands and these lands are not regarded as ‘disturbed’. Disturbed land or land that has been disturbed by previous activity is defined by the Due Diligence Guidelines as:

*“Land is disturbed if it has been the subject of a human activity that has changed the land’s surface, being changes that remain clear and observable. Examples include ploughing, construction of rural infrastructure (such as dams and fences), construction of roads, trails and tracks (including fire trails and tracks and walking tracks), clearing vegetation, construction of buildings and the erection of other structures, construction or installation of utilities and other similar services (such as above or below ground electrical infrastructure, water or sewerage pipelines, stormwater drainage and other similar infrastructure) and construction of earthworks.”*

The site of the proposed activity is considered “disturbed land” as it been subject to constant disturbance through natural and dynamic watercourse and coastal processes. No further assessment as it is reasonable to conclude that there is a low probability of objects occurring in area and as there are no impacts to a recorded/know Aboriginal heritage site an AHIP is not required for the works.

As previously mentioned in the 2013 REF, anecdotal evidence suggests that previous manual openings have led to erosion of dunes which subsequently exposed significant Aboriginal heritage sites including ancestral skeletal remains on the southern shore of the lake (below the Conjola boardwalk). It is understood that in this circumstance the opening was on the south side of the lake entrance area. The opening within the north and mid spit areas is not expected to cause such erosion and damage to unrecorded Aboriginal heritage sites is not anticipated. Post-opening monitoring is however recommended.

Shoalhaven City Council  
PO Box 42 Bridge Rd  
Nowra New South Wales 2541  
Attention: Jeff Bryant

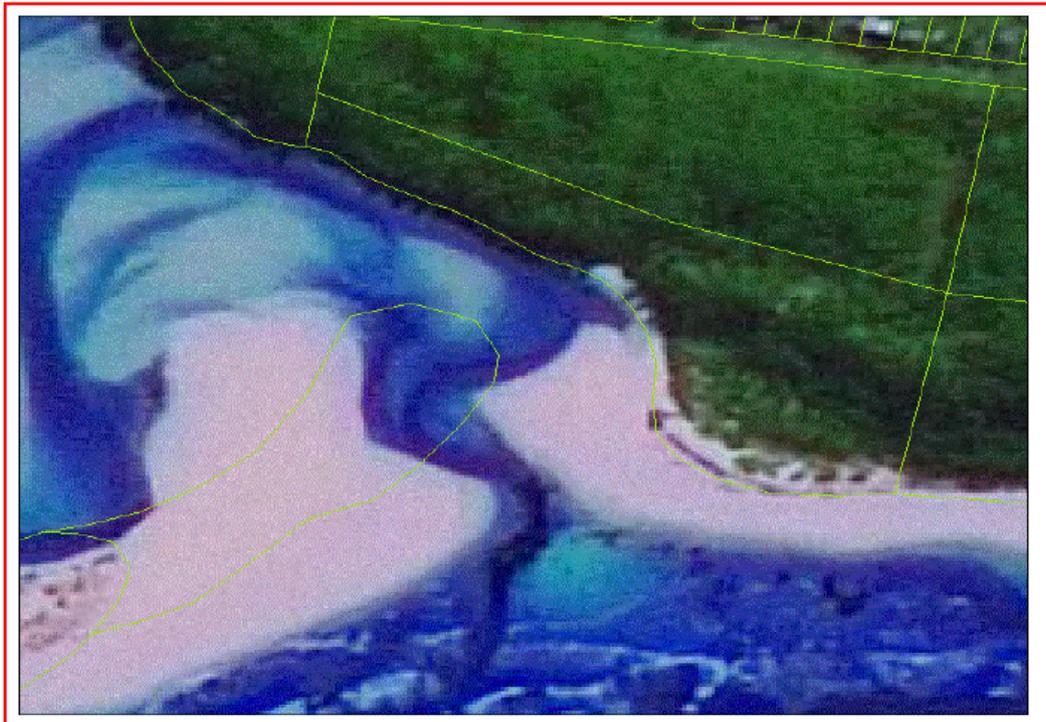
Date: 28 May 2019

Email: jeff.bryant@shoalhaven.nsw.gov.au

Dear Sir or Madam:

AHIMS Web Service search for the following area at Datum :GDA, Zone : 56, Eastings : 273150 - 273497, Northings : 6094178 - 6094634 with a Buffer of 50 meters, conducted by Jeff Bryant on 28 May 2019.

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.



A search of the Office of the Environment and Heritage AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

<b>0</b>	<b>Aboriginal sites are recorded in or near the above location.</b>
<b>0</b>	<b>Aboriginal places have been declared in or near the above location. *</b>

**5. CHECKLIST – MATTERS OF CONSIDERATION**

Note: Although many of the assessment responses are similar, Section 5 of this Addendum replaces Section 5 of the 2013 REF entirely.

This section was specifically requested by NSW Department of Industry prior to the release of the licence.

Clause 228(2) of the *Environmental Planning and Assessment Regulation 2000* lists the factors to be taken into account when consideration is being given to the likely impact of an activity on the environment under Part 5 of the EP&A Act. The following assessment deals with each of the factors in relation to the proposed activity.

**Table 3 Clause 228 (EP&A Regulation) matters**

DOES THE PROPOSAL:	ASSESSMENT	REASON
a) <b>Have any environmental impact on a community?</b>	Positive	<p>The proposed manual opening is being driven by the Lake Conjola community due to prolonged nuisance flooding of the lower areas of the township.</p> <p style="background-color: yellow;">The proposal may alleviate some of this nuisance flooding.</p> <p>The proposed activity would not have any impact on other community services and infrastructure such as power, water, waste, management, educational, medical or social services.</p>
b) <b>Cause any transformation of a locality?</b>	Negligible	<p>The locality will remain a beach and a coastal foreshore reserve with and associated ICOLL at a location where the lake may open in natural situations.</p> <p>The lowering of the lake and the changes around the foreshore would also be within the natural range.</p>
c) <b>Have any environmental impact on the ecosystem of the locality?</b>	Low adverse	<p>Possible impacts have been addressed in Section 4 of this Addendum and the 2013 REF.</p> <p>No vegetation or significant/important aquatic habitat would be removed.</p>

DOES THE PROPOSAL:	ASSESSMENT	REASON
		<p>No food resources critical to the survival of a particular species would be removed.</p> <p>Aquatic ecosystems are not likely to be significantly affected by the proposed activity and there is not likely to be any long-term or long-lasting impact through the input of sediment and nutrient into the ecosystem.</p> <p>Protected vegetation and fauna are unlikely to be significantly affected by the proposed activity.</p> <p>The slight lowering of the lake and the changes around the foreshore would also be within the natural range.</p>
<p>d) <b>Cause a diminution of the aesthetic, recreational, scientific or other environmental quality or value of a locality?</b></p>	Positive	<p>There is not likely to be any reduction in the aesthetic quality or value of the locality as a result of the proposed activity.</p> <p>Intervention in the natural breakout process diminishes slightly the scientific value of the system since an element of 'naturalness' has been modified. However ecological processes will continue to operate and the locality could still be suitably used for a wide range of scientific purposes.</p>
<p>e) <b>Have any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific, or social</b></p>	Negligible	<p>The proposed activity does not affect a site listed on the State Heritage List or a site listed in the heritage schedules of the SLEP 2014. Underground 'relics' (as defined in the NSW Heritage Act) are also not anticipated.</p>

DOES THE PROPOSAL:	ASSESSMENT	REASON
<p><b>significance or other special value for present or future generations?</b></p>		<p>The site is not within an Aboriginal Place declared under the <i>National Parks and Wildlife Act 1974</i>.</p> <p>The proposed activity does not affect a site listed on the State Heritage List or a site listed in the heritage schedules of the SLEP 2014. Underground ‘relics’ (as defined in the NSW Heritage Act) are also not anticipated.</p> <p>A known Aboriginal archaeological site occurs adjacent to the access route from Cunjurong Boat Ramp and will be protected from impact through avoidance and site management. Due diligence will be followed during excavation activities including monitoring. The possible impacts have been discussed in detail under Section 4.5.</p> <p>Lake Conjola has significant aesthetic and social significance to local and holidaying communities. The process and consequences of entrance berm breaching do not impact adversely on these values.</p> <p>Impacts on the aboriginal midden on the lake foreshore can be easily avoided by restricting vehicle, plant and equipment movement.</p>
<p>f) <b>Have any impact on the habitat of protected fauna (within the meaning of the Biodiversity Conservation Act 2016)?</b></p>	<p>Negligible</p>	<p>The Test of Significance provided in Section 4.4, with reference to Appendix 1 of the 2013 REF, concludes that the proposed activity would not have a significant impact upon threatened fauna.</p> <p>No direct impact to vegetation will occur as result of the proposed activity.</p>

DOES THE PROPOSAL:	ASSESSMENT	REASON
		<p>No impact to important nesting or foraging habitat will occur as a result of the proposed activity.</p> <p>Pre-sand dredging surveys would be undertaken to ascertain the presence of nesting birds. The sand nourishment activities may be postponed until breeding has finished particularly if threatened species are present.</p> <p>The possible impacts have been discussed in detail under Section 4.</p>
<p>g) <b>Cause any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air?</b></p>	<p>Low adverse</p>	<p>The Test of Significance provided in Section 4.4, with reference to Appendix 1 of the 2013 REF, concludes that the proposed activity would not have a significant impact upon threatened fauna.</p> <p>Pre-clearing surveys would be undertaken to minimise risk of disturbance, mortality or other impacts to threatened or migratory shorebirds within proximity to excavation works and machinery and vehicle access/egress.</p> <p>Works will be undertaken outside the nesting and important foraging periods for threatened and migratory shorebirds.</p> <p>Disturbance and risk of mortality to threatened fauna (particularly shorebirds) will be minimised.</p> <p>The possible impacts have been discussed in detail under Section 4. Refer also to the conclusions and recommendations in Section 6.</p>

DOES THE PROPOSAL:	ASSESSMENT	REASON
<p>h) <b>Have any long term effects on the environment?</b></p>	<p>Low adverse</p>	<p>It is considered that indirect impacts associated with changes to the lake level (including effects of altered soil and water characteristics on fringing shore-line vegetation) will be temporary, minor and within the resilience capacity of relevant ecosystems.</p> <p>The excavation works would be relatively short term and the noise generated will occur during normal working hours. There are no sensitive receivers in the vicinity of the proposed works.</p> <p>The proposed activity would not use hazardous substances or use or generate chemicals which may build up residues in the environment.</p> <p>The possible impacts have been discussed in detail under Section 4.0. Refer also to the conclusions and recommendations in Section 6.</p>
<p>i) <b>Cause any degradation of the quality of the environment?</b></p>	<p>Low adverse</p>	<p>The quality of the lake environment will be slightly degraded by virtue of the fact that a natural process is being interfered with.</p> <p>The recommended environmental safeguards (Section 6) would minimise impacts and risks to the quality of the environment.</p> <p>The proposal would not intentionally introduce noxious weeds, vermin, or feral animals into the area or contaminate the soil.</p>

DOES THE PROPOSAL:	ASSESSMENT	REASON
		The possible impacts have been discussed in detail under Section 4.
j) <b>Cause any risk to the safety of the environment?</b>	Unknown	<p>The proposed activity would not involve hazardous wastes and would not lead to increased bushfire or landslip risks.</p> <p>It is not known whether the works would adversely affect flood or tidal regimes, or exacerbate flooding risks.</p>
k) <b>Cause any reduction in the range of beneficial uses of the environment?</b>	Positive / Low adverse	<p>The site and affected areas are used for lake, beach and ocean related recreation opportunities as well as access to them.</p> <p style="background-color: yellow;">It is anticipated that the proposed activities would benefit users of Lake Conjola in low-lying flood-prone areas by improving access and amenity.</p> <p>Use of the ocean will not be adversely effected, save for potential short-term turbidity.</p> <p>Beach access will be temporarily unavailable in the vicinity of the channel and walking between Conjola Beach and Cunjurong Beach inhibited.</p>
l) <b>Cause any pollution of the environment?</b>	Low adverse	<p>The proposal would involve an increase in noise during the construction phase due to the use of machinery. However this would not affect any sensitive receivers such as schools, childcare centres and hospitals.</p> <p>It is unlikely that the activity (including the environmental impact mitigation measures) would result in water or air</p>

DOES THE PROPOSAL:	ASSESSMENT	REASON
		<p>pollution, spillages, dust, odours, vibration or radiation.</p> <p>The proposal does not involve the use, storage or transportation of hazardous substances or the use or generation of chemicals which may build up residues in the environment.</p>
m) <b>Have any environmental problems associated with the disposal of waste?</b>	Negligible	<p>Sand spoil will be applied as nourishment to existing non-vegetated dunes.</p> <p>There would be no trackable waste, hazardous waste, liquid waste, or restricted solid waste as described in the NSW <i>Protection of the Environment Operations Act 1997</i>.</p>
n) <b>Cause any increased demands on resources (natural or otherwise) which are, or are likely to become, in short supply?</b>	Negligible	<p>The amount of resources that would be used are not considered significant and would not increase demands on current resources such that they would become in short supply.</p>
o) <b>Have any cumulative environmental effect with other existing or likely future activities?</b>	Negligible	<p>The assessed impacts of the proposal are not likely to interact.</p> <p>Indirect impacts to shore fringing vegetation including Coastal Saltmarsh and Swamp Oak Floodplain Forest vegetation communities may result from changes to the lake water level and associated changes to groundwater and salinity. It is expected that in a one-off opening of the lake entrance that impacts would be minimal and not long-term, as the changed soil and water conditions would be temporary and</p>

DOES THE PROPOSAL:	ASSESSMENT	REASON
		<p>transition toward existing conditions over time, within the resilience capacity of these vegetation communities and within the natural fluctuations of which they are tolerant. Ongoing management involving future mechanical openings of the entrance must however consider the cumulative effects of these impacts and the potential for significant impacts to endangered ecological communities in addition to habitat for threatened species. Monitoring should be undertaken to inform future management considerations, which includes (but is not limited to) mapping and integrity assessment of vegetation around Lake Conjola including endangered ecological communities, and mapping of threatened and migratory shorebird nesting and foraging habitat.</p>
<p>p) <b>Any impact on coastal processes and coastal hazards, including those under projected climate change conditions</b></p>	<p>Low adverse to Negligible</p>	<p>There is a minor risk associated with oceanic storm surge occurring while the lake entrance is open, resulting in erosion of the sand spits and flooding of low-lying areas around the lake. Previous lake openings have been short-lived. Forecast of storm surges is considered reliable for two-week periods. It is anticipated that if undertaken when no potential oceanic storm surge is forecast, the risk of inundation and erosion from such an event is minimal.</p> <p>This one off opening is unlikely to have any significant impact on coastal processes and coastal hazards,</p>

DOES THE PROPOSAL:	ASSESSMENT	REASON
		<p>including those under projected climate change conditions. However, according to the 2013 REF, continued interventions below 1.0m AHD could have increase the likelihood of shoaling of the entrance. The berm will be surveyed before and after intervention to monitor changes.</p>

## 6. CONCLUSION AND RECOMMENDATIONS

Note: Section 6 of this Addendum replaces Section 6 of the 2013 REF entirely.

It is concluded that the proposed manual lake opening in the mid and northern spit areas is unlikely to cause a significant impact on the local environment, provided that the mitigation measures described below are adopted and implemented:

### General

- A short-term licence shall be obtained from the NSW Department of Primary Industry for works within Crown Land.
- Works are to be scheduled in consideration of forecasted weather condition to avoid the potential for storm surges into the Lake.
- Prior to works occurring, all operators of plant and vehicles shall be briefed on the following recommendations to reduce environmental impacts.

### Access

- Access shall be via the Cunjurong Point boat ramp (off York Street) only and skirting the Lake's edge around Lot 7022 DP 1031073.
- Any damage to the boat ramp and road approaches shall be immediately repaired.
- All vehicle movements shall be restricted to non-vegetated areas.

### Sand Spoil Disposal

- Dredged/excavated sand shall not be deposited on the vegetated dunes.

### Shorebirds

- All works will be undertaken outside of important foraging and nesting periods for threatened shorebirds, including the Little Tern (September through to March inclusive).
- Works shall not impact on threatened shorebird nesting areas. A general minimum buffer of 20 metres will apply to the nesting area.
- A Council Environmental Officer or other suitably qualified person shall undertake pre-works surveys prior to works commencing each day and prior to machinery access and egress from site. If any protected species are detected in the vicinity of the works or machinery access/egress, works and/or machinery movement will stop immediately and not resume until the bird has vacated the site of its own accord. In the event that a nest or nesting birds are detected, works will cease and mitigation measures will be adapted in consultation with the NPWS Shorebird Recovery Coordinator, to minimise risk of disturbance to the birds and ensure their protection.

**Fish**

- Fisheries Officers from the NSW Department of Primary Industries shall be informed of the timing of lake opening and permitted to be present if they request.
- A visual inspection of the waterway (ocean and lake in the vicinity of the opening) for dead or distressed fish (including fish gasping at the water surface) shall be undertaken periodically whilst the Lake is opened.

**Pollution**

- Emergency spill kits shall be kept on-site at all times with procedures to contain and collect any leakage or spillage of fuels, oils and greases from plant and equipment.
- To avoid the risk of pollution from machinery, refuelling shall generally be done off site, however if refuelling on site is required, due care shall be taken to avoid spilling fuel and a tray shall be used to catch any accidentally spilt fuel.
- No major equipment maintenance works shall be undertaken on-site.
- Prior to use at the site and/ or entry into the waterway, machinery is to be appropriately cleaned, degreased and serviced.

**Archaeology**

- All contractors / SCC staff employed in the project shall be made aware of the presence of the midden on the northern lake shore and told to avoid disturbance with all plant movements to occur on the adjacent rock shelf
- Monitoring of the dunes shall occur to document any indirect impact the opening may have on recorded and unrecorded Aboriginal heritage sites (e.g. additional scouring).

**Ecological Monitoring**

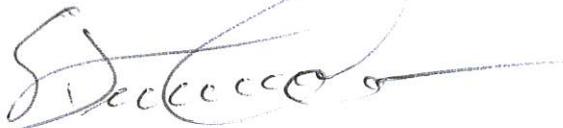
- Ecological monitoring shall be undertaken to inform future management considerations for Lake Conjola, which includes (but is not limited to) mapping and integrity assessment of vegetation around Lake Conjola (including endangered ecological communities) and mapping of threatened and migratory shorebird nesting and foraging habitat. This will facilitate appropriate consideration of the cumulative effects of impacts associated with mechanical openings of the entrance and the potential for significant impacts to endangered ecological communities in addition to habitat for threatened species.

**DETERMINATION**

This Review of Environmental Factors has assessed the likely environmental impacts, in the context of Part 5 of the *Environmental Planning and Assessment Act 1979*, of a proposal by Shoalhaven City Council for the manual opening of Lake Conjola.

Shoalhaven City Council has considered the potential environmental effects of the proposal and the effectiveness and feasibility of measures for reducing or preventing detrimental effects. It is determined that:

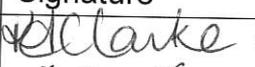
1. The proposed safeguards identified in the report (Section 6) shall be adopted and implemented.
2. It is unlikely that there will be any significant environmental impact as a result of the proposed work and an Environmental Impact Statement is not required for the proposed works.
3. The proposed activity is not likely to significantly affect threatened species or ecological communities, or their habitats and entry into the Biodiversity Offset Scheme is not required.
4. The proposed activity is not a 'controlled action' for the purposes of the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* and referral to the Commonwealth Environment Minister is not required.



Stephen Dunshea  
(acting) General Manager  
Shoalhaven City Council

Date: 6/6/2019

**Document Review**

	Name	Signature	Date
Author	Geoff Young/Kelie		6-6-19
	Clarke/Jeff Bryant/Ali		6.6.19
	Sevenler		6.6.19
Reviewer	Phil Costello		6.6.19.

## 7. REFERENCES

BMT WBM Pty Ltd 2013 *Lake Conjola Floodplain Risk Management Study and Plan*. Report prepared for Shoalhaven City Council.

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**APPENDIX A: 2013 Review of Environmental Factors (Spurway and Associates)**



# **REVIEW OF ENVIRONMENTAL FACTORS**

## **LAKE CONJOLA ENTRANCE MANAGEMENT**

**FINAL**

**November 2013**

**Prepared by**

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# REVIEW OF ENVIRONMENTAL FACTORS LAKE CONJOLA ENTRANCE MANAGEMENT

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# REVIEW OF ENVIRONMENTAL FACTORS LAKE CONJOLA ENTRANCE MANAGEMENT

## 1.0 Introduction

### 1.1 Overview

Peter Spurway and Associates Pt Ltd has been commissioned by Shoalhaven City Council to conduct a review of environmental factors for entrance berm breaching works for Lake Conjola. Three options for opening locations, South, North and Middle, were recommended by Council for consideration.

The present review has been instigated to identify key issues for discussion in the selection of locations for works associated with both emergency and planned manual entrance berm breaching at the Lake Conjola entrance. The likely persistence of effects associated with the proposed entrance management works are to be addressed. Other issues to be addressed include:

- Impact of overwash on the likely duration of opening for each site
- Impact of post-works channel meandering on stability of the entrance channel
- Effect on flooding
- Sand volumes for selected locations and cost implications
- Timing - whether flood emergency response or planned intervention
- Shorebird breeding season impact on works location
- Excavated sand placement

During the preparation of draft reports, washover deposits from heavy coastal wave action in June 2012 have extended into the inlet and the entrance subsequently closed.

This document reflects Council's adopted position with regards to location and timing of opening works. It has a dual function of providing commentary on all opening options that were assessed. Note that an earlier entrance management plan (GHD January 2012: Draft Interim Lake Conjola Entrance Policy) has been replaced by GHD August 2013: Interim Lake Conjola Entrance Policy which has been adopted by Council on 24 September 2013.

### 1.2 Background to Lake Conjola

Lake Conjola is a medium sized barrier estuary located 210 kilometres south of Sydney on the NSW South Coast. It has a water body area of approximately 4.3 km<sup>2</sup> and a catchment area of 145 km<sup>2</sup>. While the lake body is comparatively deep with a maximum depth of 10 metres, a shallow reach some 3 kilometres long forms the lower section of the estuary adjacent to the entrance. The lake tide is in the order of 20% of the ocean tide when the entrance is open.

The entrance is usually located at the northern end of the embayment, adjacent to the northern headland and is afforded some protection from waves from the north east by Green Island. It is exposed to the more common waves from the south east and is at the northern end of a littoral drift stream along Conjola Beach.

### **1.3 Summary of Entrance Processes**

The main processes affecting entrance condition are wave action, tidal flows, river flows and littoral drift of sediment along the beach towards the inlet. Major entrance restricting processes are short-term and appear to be associated with storm waves. Wave overtopping of the entrance spit during periods of high storm wave activity is responsible for the injection of marine sediment to the entrance area, restricting the tidal flow in the channel and choking the tide entering the estuary.

The process of littoral drift along the beach is associated with the mainly SE waves and is therefore from south to north. This process varies in strength with wave energy and actual direction but has the inevitable effect of deflecting any entrance towards the northern headland over time. The 1999 Conjola Entrance Study calculated an average annual accumulation of sand through littoral drift of the order 50,000 m<sup>3</sup>.

High flows from the catchment have the effect of assisting ebb flows and providing extra scour in the entrance area. During periods when rainfall events are frequent, the entrance may gradually expand as the net effects of flow from the river/estuary dominate entrance forming processes. When the entrance is scoured to a reasonable size the tidal flows will be strong enough to maintain the opening for a considerable period but the lesser tidal flow through a smaller entrance will not be self-sustaining and the entrance will move towards closure.

### **1.4 Implications for Entrance Management**

NSW government policy encourages, in the long term, an 'as natural' regime as possible for estuary openings. Interference is limited to those conditions where flooding of existing low-lying assets is exacerbated by a closed or restricted entrance. The previous opening policy associated with a "managed natural entrance" for Lake Conjola required Council to maintain an open entrance at all times. This operated only until the installation of a sewage system and the completion of a flood study. The latest entrance regime limits manual openings to emergency intervention for flood risk management and / or planned openings at a slightly higher level if rainfall is anticipated.

The Lake Conjola entrance spit is a significant breeding area for shorebirds, including Little Terns and Pied Oystercatchers. Some of these birds are threatened species, protected under NSW and Commonwealth legislation, and others are protected under international agreements.

### **1.5 Proposed Intervention Regimes and Locations**

Following preliminary community consultation during November 2011 the Draft Interim Lake Conjola Entrance Policy (GHD January 2012) introduced three options for manual breaching of the entrance berm:

- Planned opening @ 1.0m AHD lake level
- Low level pre-holiday opening at a level between 0.8 and 1.0 m AHD
- Emergency intervention @ 1.2m AHD

A discussion paper made available to the community (PSA September 2012) and a public meeting in September 2012 explored entrance berm breaching locations.

Government policy is to allow estuarine entrances to open and close naturally as far as possible, within the constraints of managing flooding to public and private infrastructure. Accordingly in its consideration of opening regimes at its meeting of 18<sup>th</sup> December 2012, the Lake Conjola Community workshop determined that both the low level pre-holiday intervention previously proposed in GHD 2012 at a level of 0.8m AHD, and any intervention governed by water quality considerations, were not appropriate. Consequently the pre-holiday opening option has not been considered in this document.

### **1.5.1 Detail of operating regimes**

The adopted operating regimes for Lake Conjola outlined in GHD (August 2013) are as follows. Water levels refer to those recorded at the MHL gauge at Conjola Caravan Park.

#### 1. Planned intervention @ 1.0 AHD

If moderate or heavy rainfall is predicted and water reaches a level of 0.8 m AHD, plant and equipment are to be placed on standby. Preparatory works should be undertaken to prepare a pilot channel if the level reaches 0.9m AHD and rainfall is ongoing or predicted. Intervention is to commence when the lake water level is at or exceeding 1.0 m AHD.

#### 2. Emergency intervention @ 1.2m AHD

An emergency situation is where the lake water levels are rising rapidly and a flood event is occurring or predicted. At a level above 1.2m AHD, works should be undertaken, if the situation permits, to open the entrance in the shortest and quickest way possible.

### **1.5.2 Evaluation of entrance berm breaching locations**

The three options for locations of manual entrance berm breaching are the result of a combination of community requests and suggestions from consultants in various reports. These options are shown on Figure 1-1 and discussed below with reference to the processes operating at each location.

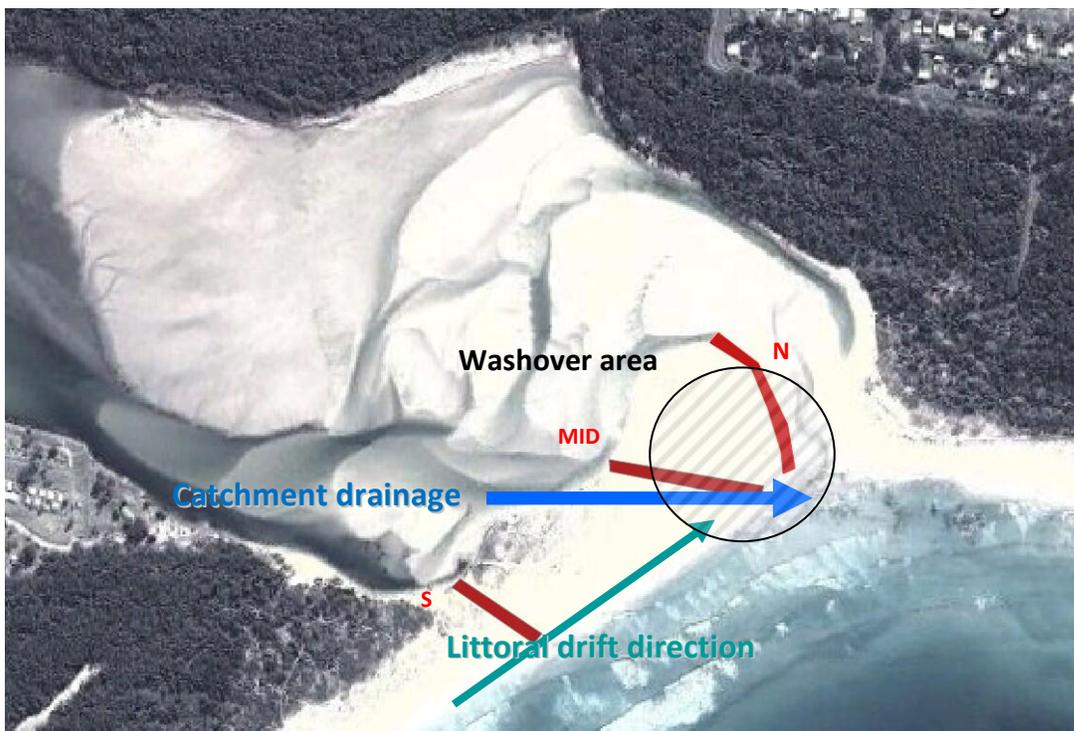
#### **Option 1 - South Location**

This is an option promoted by some members of the community in response to the fact that the 1998 southern opening preceded a lengthy period during which the Lake was open. GHD (2011) reported a community desire to trial an opening location to the south of the existing opening location. This, however, did not refer to the mid-dune location but mid-spit to mimic the natural flood opening location. The southern opening would require the removal of an estimated 10,115 m<sup>3</sup> of sand. The time required to excavate this volume – up to 10 days based on past works schedules – is excessive.

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 and major dune reconstruction was required. The movement of a southern entrance northwards would also erode all residual dune deposits to the north of the opening, exposing a broad area to wave overwash and increasing the supply of marine sand to the body of the inlet. There is no evidence that a natural southern entrance has ever existed.

Parts of the local community have claimed that historically a southern opening lasts longer due to its more favourable location. The opening statistics have been examined in Appendix 3.

Recommendation: It is recommended that the Southern mid-dune location be rejected.



(September 2011 aerial photograph)

**Figure 1-1 Approximate locations of entrance berm breaching options**

### **Option 2 – Mid-spit Location**

The mid-spit entrance berm breaching location (see Figure 1-1) has a discharge point just to the south of the northern entrance but the pilot channel cuts through the washover deposits and mimics the alignment of a natural high-volume flood discharge channel shown as a blue arrow in Figure 1-1. This option would provide a longer pilot channel with higher associated excavation costs than for the Northern location (4,283 m<sup>3</sup> in June 2012, although subsequent washover

deposits expanded the area and this may now be a conservative estimate). It could also likely impact on shorebird nesting sites, particularly if channel migration towards a northern configuration followed the initial excavation.

The actual location of the excavated channel may vary with sand elevation across the spit, as determined by survey. An amended option involving one or a series of east-west pilot channels (Figure 1-2) could be cut across shoals at the back of the beach to reduce the ebb channel length. This option aims to improve the ebb flow by reducing friction losses. The seaward end of the mid-spit breach through the berm would be located close to that of the northern location in this case. Shorebird breeding impacts in breeding season would also be likely.



**Figure 1-2 Modified mid-spit option showing pilot channels**

Recommendation : This option is recommended for any intervention outside the shorebird nesting season.

### **Option 3 - Northern Location**

The general alignment of sand shoals means it is often most practical for the pilot channel to be located to the north in order to minimise the necessary length of the channel (estimated volume of sand 2,960 m<sup>3</sup> in June 2012). The wave shadow provided by Green Island would assist in reducing the susceptibility of the entrance to subsequent shoaling.

If shorebirds are nesting the pilot northern channel location would be essential to minimise disturbance to nesting sites.

Recommendation: This option is suitable for all interventions.

## **1.6 Persistence of Entrance Intervention Works**

It should be noted that the entrance restrictions in the past have all been coupled to coastal storms, usually when rainfall associated with the storm has been low. All suggested locations would be subject to effects by washover processes (or beach berm deposits and dune erosion in the case of the southern location). However, it is likely that a more northerly discharge location to the coast may be less susceptible to washover than further south along the beach where the wave attack is more concentrated. Certainly, Green Island would be more effective in shadowing a northern entrance from NE waves than more southerly locations.

Therefore the longevity of a northern intervention is expected to be greater than the other options. However while a large volume of sand is choking the entrance in 2012 and 2013, coupled with relatively low intervention levels, the longevity of any intervention is not assured.

## **1.7 Effect on Flooding**

The Draft Lake Conjola Floodplain Risk Management Study and Plan (WBM 2012) shows that the state of the entrance does not impact on major flood peak heights at Conjola. However, there can be a need to breach a closed entrance to alleviate nuisance flooding generated by prolonged elevated lake levels when the entrance is closed. One of the objectives of the lake opening policy is to respond with entrance berm breaching prior to inundation of low lying parts of the village area. This in turn means the volume of sand to be excavated and the duration of excavation are important factors in an emergency (flood-related) scenario.

## **1.8 Excavated Sand Placement**

Excavated sand could be spread between a number of locations dependant on avoiding disturbance to nesting shorebirds. In April through to August (non nesting season for threatened bird species) sand would be placed south of the entrance. This sand would widen the toe of the dune on the lake side

The alternative location for spoil disposal in shorebird nesting season (September through to March inclusive) is the northern side of the entrance. Spoil should be placed and shaped as nourishment between Cunjarong and Green Island. This location would also be used outside of the nesting season if dune nourishment were impractical.

Additionally, sand may be used in those areas around the lake entrance experiencing erosion when feasible. Minor volumes could be used to restore any areas that had been eroded around the lake shoreline walking track from the boatramp to the spit if disturbance to nesting shorebirds could be avoided. Care should be taken not to dispose of sand in areas that would freely add sand to the entrance channel under tidal action.

These areas should be selected as according to the scale of sand removal and the timing relative to shorebird breeding season. Note that in an emergency intervention, sand would likely be spread to the north of the opening and more local to the entrance.

## **1.9 Alternatives**

Ultimately there are no viable alternatives to artificial opening of the lake. Not interfering and allowing nature to take its course so that water levels rise until a natural breakout takes place would occasionally result in road, dwelling and caravan park inundation, pavement or vehicle damage and inherent safety and health issues.

The Lake Conjola Floodplain Risk Management Study and Plan provides guidance on management of major flood risk. New developments and redevelopments now occur in compliance with flood related development controls. The plan recommends improvements to flood warnings and developing evacuation procedures. It is therefore expected that, with time, there will be an opportunity to review (increase) the intervention trigger levels.

## 2.0 Relevant Legislation, Regulations and Permit Requirements

### 2.1 Approvals

The following Acts have to be considered prior to entrance berm breaching at the lake entrance:

- Environmental Planning and Assessment Act 1979
- Crown Lands Act 1989
- National Parks and Wildlife Act 1974
- Water Management Act 2000
- Threatened Species Conservation Act 1995
- Environment Protection and Biodiversity Conservation Act 1999
- Fisheries Management Act 1994 and Fisheries Management Amendment Act 1997

#### **Environmental Planning and Assessment Act 1979**

Clause 35 of the Environmental Planning and Assessment (EP&A) Act Model Provisions has been adopted under Shoalhaven City Council's Local Environment Plan. This allows council to assess the impact of flood mitigation works under Part 5 of the EP&A Act.

A determining authority, in this case Shoalhaven City Council, must satisfy the provisions of Section 111 of the Act in determining whether the proposed activity is likely to have a significant effect on the environment. This is generally referred to as a Review of Environmental Factors (REF), and its conclusions may take the following form:

- The proposal is not likely to have a significant effect on the environment and the determining authority can then give approval (if other requirements under other legislation and policy is satisfied).
- The proposal is likely to have a significant effect on the environment and therefore
  - the preparation of an Environmental Impact Statement (EIS) should be undertaken to enable a more detailed assessment before a decision is made, or
  - modifications to reduce any likely significant effect are in order; or
  - a decision not to proceed is made.

A determining authority means the public authority (for example, Council) by or on whose behalf the activity is to be carried out, or any Minister or public authority whose approval is required to enable the activity to be carried out. Therefore, SCC is a determining authority. The Department of Lands is also a determining authority by virtue of the requirement for a licence under Division 4 of the Crown Lands Act (see below). NSW Fisheries would only be a determining authority if marine vegetation is to be directly affected. National Parks would be a determining authority if there were any impacts upon threatened species or Aboriginal archaeological sites and a license to harm or destroy was required.

### **Crown Lands Act 1989**

Whilst SCC has care and control of the entrance area above mean high water mark, excavation will be below this level and will therefore affect Crown Land. As such, Department of Lands will be requested to issue a licence to SCC to carry out excavation across the beach at Lake Conjola entrance in accordance with the conditions outlined in the Policy.

### **Water Management Act 2000**

This Act provides for the protection of "Waterfront Land", which includes the bed and bank of any river, lake or estuary and all land within 40 metres of the highest bank of the river, lake or estuary.

As described in the following clauses in the Act, Council is exempt from the requirement to obtain a Controlled Activity Permit under this statute, which includes the Water Management (General) Regulation 2004.

The Water Management (General) Regulation 2004 states:

#### *39A Exemption from requirement for controlled activity approval*

*(1) Public authorities (other than Landcom) and local councils are exempt from section 91E (1) of the Act (see below) in relation to all controlled activities that they carry out in, on or under waterfront land.*

#### *91E Carrying out controlled activity without, or otherwise than as authorised by, a controlled activity approval*

*(1) A person:*

*(a) who carries out a controlled activity in, on or under waterfront land, and*

*(b) who does not hold a controlled activity approval for that activity, is guilty of an offence*

### **National Parks and Wildlife Act 1974**

Under this act a licence is required if the lake entrance berm breaching works will impact on protected wildlife (other than threatened species). There are no such impacts identified.

Under this act, it is an offence to knowingly destroy an Aboriginal site, relic or artifact. Since none are known to exist or are likely to exist within the entrance barrier this Act will not have effect.

There are no Conservation Agreements prepared under this Act for the area. There are no Plans of Management under the Act that are relevant.

### **Threatened Species Conservation Act 1995**

The Threatened Species Conservation Act 1995 (TSC Act) specifies seven factors which must be considered by decision-makers regarding the effect of a proposed development or activity on threatened species, populations or ecological communities, or their habitats (DECC 2007). These factors form part of the threatened species assessment process under the Environmental Planning and Assessment Act 1979 (EP&A Act) and are formally named the Assessment of Significance (informally known as the 'Seven-part Test') (DECC 2007).

Consent authorities have a statutory obligation, under Part 4 of the EP&A Act, to consider whether a proposal is likely to significantly affect threatened species, populations or ecological communities, or their habitats by applying the Seven-part Test. If the determination is made that there is likely to be a significant effect then either;

- A Species Impact Statement (SIS) must be prepared and the concurrence of the Director-General of the Department of Environment, Climate Change and Water (DECCW) obtained prior to the consent authority making a determination, or
- The proposal may be modified such that a significant effect on threatened species, populations or ecological communities, or their habitats is unlikely (DEC 2004).

This report applies the Seven-part Test to threatened entities which may potentially be impacted by the proposal in order to determine the significance of the potential impact.

### **Environment Protection & Biodiversity Conservation Act 1999**

The Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) enables the Australian Government to join with the states and territories in providing a national scheme of environment and heritage protection and biodiversity conservation.

Under the EPBC Act, actions that have, or are likely to have a significant impact on a matter of National Environmental Significance (NES) require approval from the Australian Government Minister for the Environment, Heritage and the Arts (DEWHA 2009).

The seven matters of NES that are protected under the EPBC Act are:

- World heritage properties
- National heritage places
- Wetlands of international importance
- Listed threatened species and ecological communities
- Migratory species protection under international agreements
- Commonwealth marine areas
- Nuclear actions including uranium mines.

This report provides an assessment of relevant NES matters to ascertain where the proposed activity will require referral to the Commonwealth.

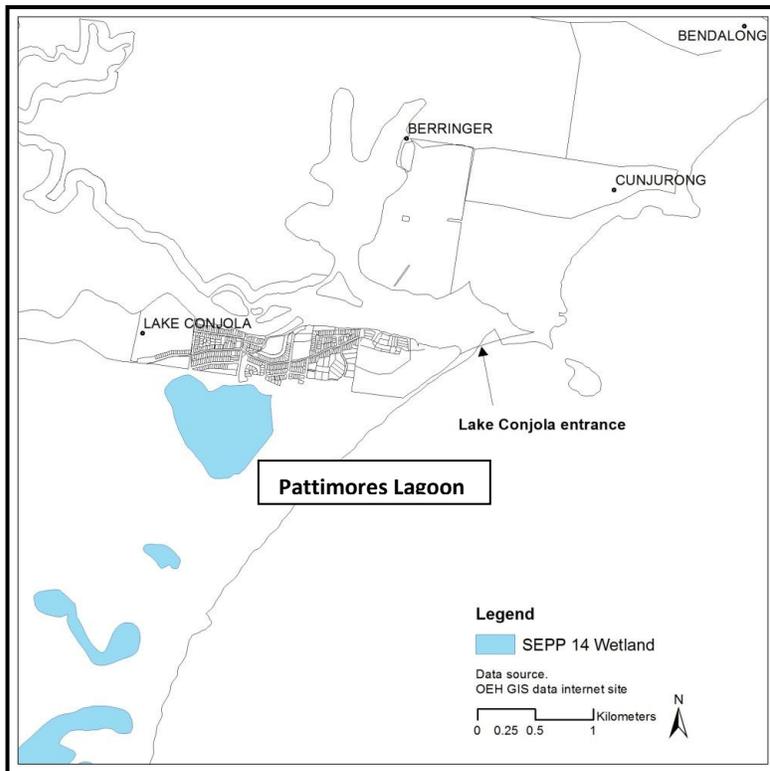
### **Fisheries Management Act 1994 and Fisheries Management Amendment Act 1997**

This Act requires an assessment of whether threatened species of fish and marine vegetation, populations or ecological communities are likely to be affected by the activity. If a significant effect on threatened species is likely, a species impact statement must be completed and concurrence of or consultation with NSW Fisheries is required.

## 2.2 Environmental Planning Instruments

### State Environmental Planning Policy No 14 Coastal Wetlands

There are no SEPP 14 wetlands fringing Lake Conjola itself, as shown in the map below. Pattimores Lagoon is a SEPP 14 wetland linked to the Conjola entrance channel. Vegetation around the lagoon has adapted to highly variable inundation frequencies and durations (Clarke 2012). The impacts of lake openings on this wetland are discussed under Section 3.5.



**Figure 2-1 SEPP 14 Wetland Mapping at Lake Conjola Entrance**

The policy states:

“In respect of land to which this policy applies, a person shall not:

- (a) clear that land,
- (b) construct a levee on that land,
- (c) drain that land, or
- (d) fill that land,

except with the consent of the council and the concurrence of the Director.”

As no direct or indirect negative impacts on SEPP 14 wetlands are proposed that fall within the above limitations, the requirements of this SEPP are not triggered.

### SEPP 71 Coastal Protection

This policy aims for improved state, regional and local planning and encourages management decisions to better protect the coast. It gives the Minister for Planning the consent authority role for specified developments or State Significant Developments. Proposals for development in sensitive coastal locations fall under SEPP 71. SEPP 71 has no impact on the proposed lake opening activity.

### Draft Shoalhaven Local Environmental Plan

Under the Draft Shoalhaven LEP the lake foreshore areas adjacent to and immediately north and south of the entrance are zoned RE1 Public Recreation. The entrance area and the sand spit are both proposed to be zoned W2 Recreational Waterways.

The entrance area is Crown land (see **Figure 2-2**).

### Draft Environmental Planning Instruments on Exhibition

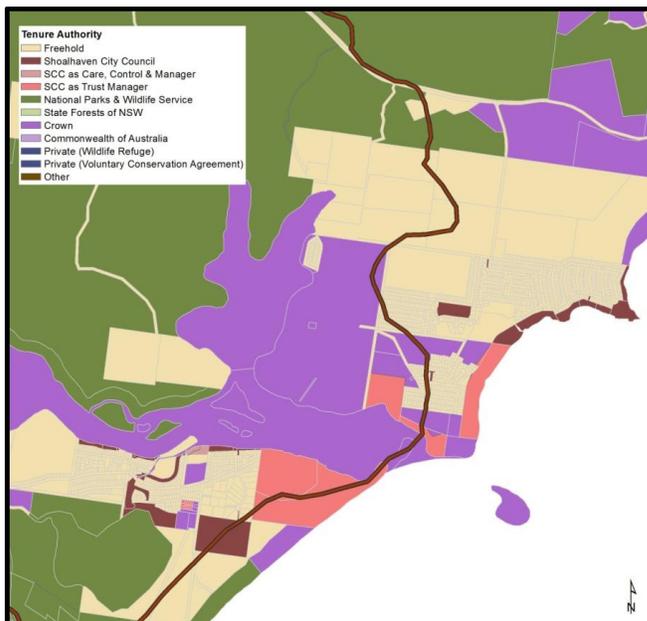
There are no Draft Environmental Planning Instruments on Exhibition that impact on this assessment.

### Draft State Environmental Planning Policies submitted to the Minister

No draft SEPPs are of relevance to this assessment.

### Development Control Plans

No DCPs are relevant to this assessment.



**Figure 2-2 Land Tenure**

## **3.0 Description of the Existing Environment**

### **3.1 General Characteristics**

The Lake Conjola entrance is characterised by an expanse of unvegetated sand (with a sparsely vegetated beach dune at its southern end). The substrate in the entrance area is completely dominated by unconsolidated and unsorted sand with varying amounts of broken shell and drying algae, such as kelp, which has been washed ashore.

### **3.2 Acid Sulphate Soils**

In NSW, potential acid sulfate soils (ASS) have been mapped in every estuary and embayment along the coastline. The impacts of acid drainage can be substantial and may include fish kills, release of heavy metals from contaminated sediment, human and animal health impacts, adverse impacts on soil structure and damage to built structures such as bridges.

Acid sulphate soils are those that have been formed in low energy, depositional environments over the last 6000 years. Mapping suggests a high probability of finding acid sulphate deposits at shallow depth in the immediate catchment areas adjacent to the upper estuary. However, the entrance to Lake Conjola is a highly dynamic area, consisting predominantly of marine sands. Acid sulphate soils are unlikely to occur in the area where entrance berm breaching works would be carried out. Furthermore, excavation depths will be within the levels created by natural opening events and historic lake opening activities have had no impacts consistent with those caused by disturbance to ASS.

### **3.3 Hydrology**

The frequency and duration of entrance opening is a determinant of the hydraulic character of the lake (that is, the frequency and magnitude of water level fluctuations and quality changes). When the entrance is open, water levels are relatively stable, varying across the tidal range (for Lake Conjola they are very attenuated by the shallow entrance channel).

Water levels vary to a much greater extent over a time scale of months in response to the combined impacts of rainfall, catchment runoff and evaporation. In the extreme, the water level could potentially rise up to two metres above mean sea level during severe floods.

### **3.4 Water Quality**

The Water Quality Rating for Lake Conjola for the reporting period 2010/11 was rated as "Good" to "Excellent". Faecal Coliform levels remain well below the water quality guideline level for swimming, and nutrients were generally below guideline levels on most occasions. The improvement to water quality is notable with the installation of reticulated sewerage to the village.

Water quality monitoring shows water quality decline occurs immediately after rainfall. This is typical of a waterway with a catchment containing areas of urban development.

The quality of the lake water changes when there is strong tidal flushing to refresh the lake basins. An opening event would temporarily provide flushing. However the extent of improvement depends on the tidal flushing efficiency. This in turn is dependent on the duration of the opening.

Modeling by Patterson Britton (1999) has suggested that if the entrance is heavily shoaled, some 80-100% flushing occurs downstream of Chinamans Island. Berringer Lake is flushed less than 10% and the western half of Lake Conjola is not flushed at all. Under fully open entrance conditions, the whole lake would flush with at least 30 to 40 days of tidal action.

Lake Conjola is healthy whether open or closed. The implications are that the lake is a healthy ecosystem operating within its natural range of variability.

### 3.5 Wetlands

There are no SEPP 14 wetlands on the fringes of Lake Conjola itself. Pattimores Lagoon is a SEPP 14 wetland linked to the Conjola entrance channel via artificial canals and a weir at about 0.45m AHD. The canals were constructed sporadically over the period 1964-1984 (Clarke 2012). Pattimores Lagoon now experiences highly variable salinities and tidal environments. The lagoon's tidal environment is primarily controlled by water level and tide heights, both of which are highly influenced by the entrance condition of Lake Conjola.

Clarke (2012) identifies three states of connectivity for the lagoon:

- No connection during periods of low water levels and small to no tides - often experienced during partially shoaled entrance conditions.
- Complete connection during periods of high water levels in Lake Conjola and Pattimores Lagoon. This period is primarily experienced during highly shoaled entrance conditions and accompanied by very small or no tides.
- Partial connection during periods when mean water levels in Lake Conjola are low but tides are high enough to overtop the weir. During this period higher tides spill over the weir but due to low water levels in Pattimores Lagoon water often cannot flow back out during low tides, causing the lagoon to gradually fill with water. This is mostly experienced during open entrance conditions.

The majority of vegetation around the lagoon has adapted to these highly variable inundation frequencies and durations (Clarke 2012). The main vegetation types recorded by Clarke around the lagoon fringes were *Juncus*, *Baumea articulata*, *Phragmites australis*, *Meleleuca* and *Casuarinas*, with Eucalypts beyond the limits of influence of lagoon flooding. Notably Clarke recorded a larger number of mangroves around the lagoon, implying a colonisation since the late 1980's.

Clarke concluded, with reference to whether returning Pattimores Lagoon to its natural regime was possible, that although it is a variable and complex system, it is thought to be behaving relatively similarly to the historic lagoon system.

The behaviour of Lake Conjola under this policy is expected to be similar to the behaviour under the past 50 or so years. If any impacts there would be less open periods and more partially or highly shoaled entrance conditions. The current range of behaviour of Pattimores Lagoon would

not be expected to change. However the relative durations of the three lagoon states may alter to favour the first two states of connectivity - 'no connection' or 'complete connection'.

These two states produce very different lagoon saline conditions and water levels at the extremes of behaviour.

### 3.6 Flora

#### 3.6.1 Vegetation, endangered ecological communities and Protected Marine Vegetation.

This section describes vegetation communities associated with the lake (as per Tozer *et al.* 2006), along with any endangered ecological communities or Protected Marine Vegetation they represent. Discussion covers both the Threatened Species Conservation Act (1995) and the Fisheries Management Act (1994). These are listed below in Table 3-1 and mapped in Figure 3-1 (see also site photographs in

Table 3-2).

**Table 3-1 Vegetation communities and their relationship to EEC and/or PMV.**

Community	Habitat/extent	EEC and/or PMV
Beach Strand Grassland (Gr1 e62) (Photograph 1)	Occurs on foredunes at the southern and northern ends of the entrance, with (native) grass dominated vegetation.  The remainder of the sandy entrance barrier is a highly dynamic habitat and is, therefore, unvegetated.	No
Coastal Fore-dune Scrub (DSF e61). (Photograph 1)	Occurs on the fore-dune within the lake (i.e. lower dune slopes in the vicinity of the lookout platform).	No
Floodplain Swamp Forest (FOW p105) (Photographs 2, 3)	On flats, above high tide mark, influenced by brackish groundwater. Dominated by Swamp Oak ( <i>Casuarina glauca</i> ).  Scattered throughout lake margin, but major occurrences cleared or modified by farming and urbanisation on flats.	Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions (EEC)
Estuarine Fringe Forest (FOW p106) (Photograph 2)	Similar habitat to previous, but occupies increasingly saline environments, indicated by its increased dominance of halophytic taxa. Usually more sparse upper/mid storey of <i>C. glauca</i> and <i>Myoporum australis</i> , with understorey containing salt tolerant sedges and forbs	
Estuarine Creekflat Scrub (FOW p107) (Photograph 2)	Similar habitat to previous two, but is found at sites that are likely to have marginally lower soil salinity. Dominated by Swamp Paperbark ( <i>Melaleuca ericifolia</i> ), often with <i>C. glauca</i> .	
Estuarine Saltmarsh (SL p509)	Restricted to upper limit of the inter-tidal zone on estuarine mudflats, replaces by the previous three communities at higher	Coastal Saltmarsh (EEC and PMV)

Community	Habitat/extent	EEC and/or PMV
(Photograph 2)	elevation/decreased salinity. Only minor occurrence in study area due to steep banks in most areas (and likely clearing and modification of habitat for urbanisation.	
SL e69 Seagrass Meadows ( <i>Ruppia</i> ) and SL e70 Seagrass Meadows ( <i>Zostera</i> ).  (Photograph 4)	Unconsolidated sediments of the lake bed in saline to brackish water where flows are low enough to allow seagrass establishment. Based on the aerial photograph shown in Table 3-1, minor, scatted patches of seagrass occur upstream of the lake entrance, with larger patches further upstream.  Note: the highly invasive exotic seagrass species <i>Caulerpa taxifolia</i> (see 3.5) was previously know from Lake Conjola. However, the high rainfall period and low salinity of the past two years has seen its decline (Clarke 2012, Ray Massie pers. comm.).	
(Estuarine Mangrove Forest)	Minor area mapped by Tozer <i>et al.</i> (2006) about 2km upstream of lake entrance. However, unlikely to occur on Lake Conjola based on the following: requires daily tidal inundation; no mangroves sited around the lake itself during the current study; and unlikely that Tozer mapping was ground-truthed.	PMV

**Table 3-2 Site photographs of vegetation/ecological communities**

	<p>Photograph 1: Facing east, from near viewing platform, showing Beach Strand Grassland to the left and Coastal Foredune Scrub to the right.</p>
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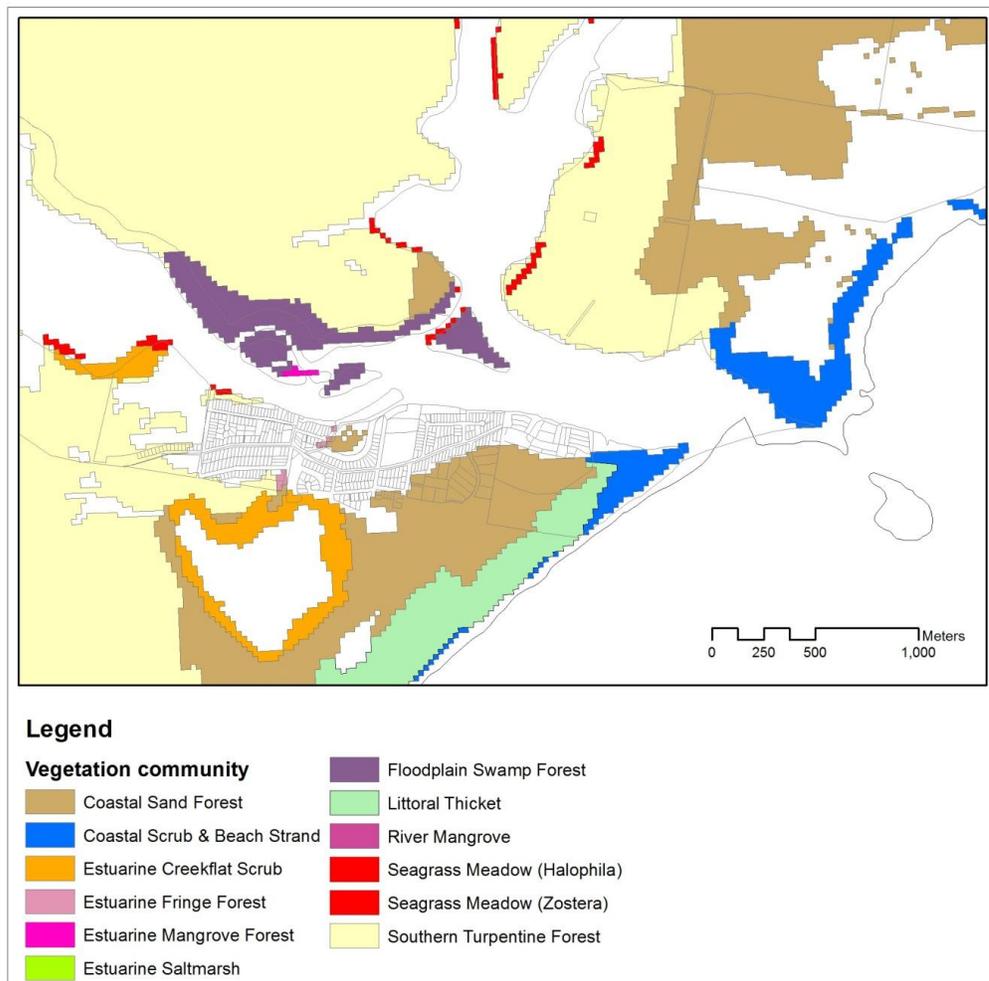
Photograph 2:  
 Showing various estuarine vegetation communities (treed communities represent Swamp Oak Floodplain Forest EEC). The sedgeland in the centre of the photograph shows a small area of Saltmarsh vegetation, which represents Coastal Saltmarsh EEC/PMV.



Photograph 3:  
 Showing typical condition of Swamp Oak Floodplain Forest EEC habitat on southern banks of the estuary, where the floodplain is largely developed..



Photograph 4:  
 Indicative seagrass distribution (2006 image by NSW LPI)



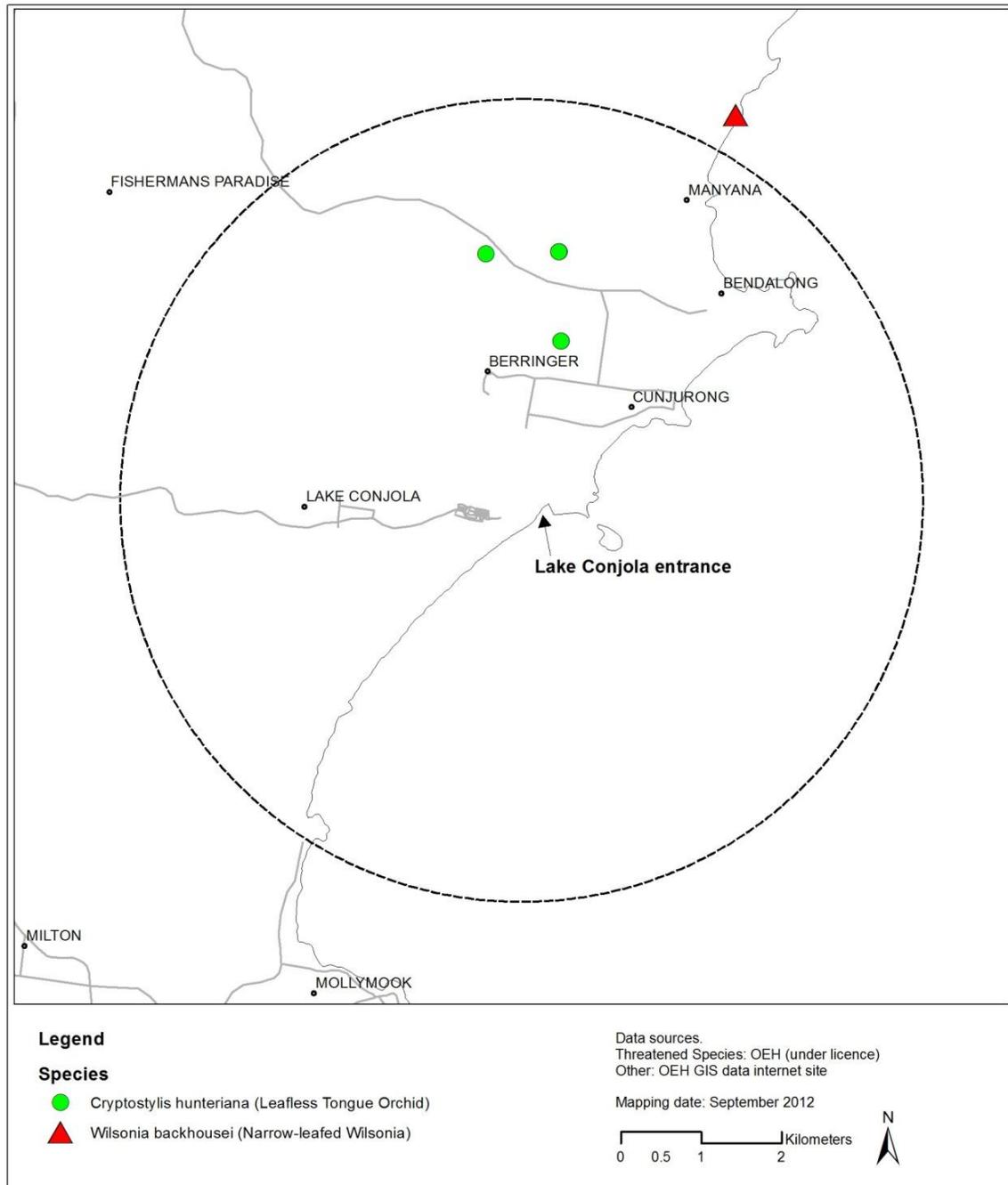
**Figure 3-1 Vegetation communities of the study area (refer to photograph 4 above for further mapping of seagrass meadows).**

### 3.6.2 Threatened flora species.

A flora survey was undertaken at the lake's entrance covering the sand spit and the dune to the south of it where works could potentially occur (undertaken by senior botanist Mark Harris in July 2012). No threatened flora species were found. Previous flora survey in this location also failed to find any threatened flora species (e.g. Kevin Mills and Associates, 2000).

A search of the Atlas of NSW Wildlife (License number CON11003) revealed two threatened flora species known from within 5km of the Lake Conjola entrance, as mapped in Figure 3-2. A search of the EPBC Act database revealed six threatened flora species that are predicted to occur in the locality. Species not associated with aquatic or estuarine habitats were culled, leaving the following species for inclusion in the likelihood of occurrence evaluation (Table 4-1):

- *Wilsonia backhousei* (Narrow-leafed *Wilsonia*) - previously recorded in saltmarsh habitat to the north of Manyana.



**Figure 3-2 Threatened flora species within 5km of Lake Conjola entrance.**

### 3.6.3 Noxious Flora

Lake Conjola is one of a number of south coast waterways infested with the fast growing marine alga *Caulerpa taxifolia*. *Caulerpa* is a Class 1 noxious species in all NSW waters under the *Fisheries Management Act 1994*. The invasive nature of *Caulerpa* has raised concerns as it has the potential to grow rapidly, alter marine habitats and affect estuarine biodiversity.

A 2007 study reported in Clarke (2012) examined the affect of water temperature and salinity on the growth and survival of *Caulerpa taxifolia* (West and West, 2007). It found that *Caulerpa* grew quickly at temperatures above 15° C and salinities above 22.5ppt. There was almost total mortality at salinities under 17.5, indicating that this species is mainly a marine alga which would not survive well under long periods of low salinity.

By returning the lake closer to its natural opening regime with periods of closure, there would be an expected decrease in *Caulerpa* in the estuary. Conversely attempting to maintain an open entrance would assist the recovery of *Caulerpa* with associated negative environmental impact.

An objective of increasing the trigger level for lake entrance interventions would assist with managing impacts on estuary biodiversity.

## 3.7 Fauna

The faunal groups assessed under this REF are fish, waterbirds, frogs and mammals.

### 3.7.1 Fish

At least two comprehensive fish fauna surveys have been undertaken within Lake Conjola (e.g. ERI, 1999; and Pollard, 1994). These surveys, as described by The Ecology Lab (2003), recorded approximately 100 fish species with the lake, with numerous species being of recreational and/or commercial importance.

No threatened fish species, as listed on the Schedules of the Fisheries Management Act 1994 have been recorded within Lake Conjola.

Based on the lack of threatened fish species records within the lake to date, along with the scale of the proposed activity being within naturally occurring regime of lake opening and closing, no further consideration is given to threatened fish fauna in this REF.

### 3.7.2 Birds

Containing a relatively long sand spit and low beach dune with sparse vegetation and scattered debris, the Lake Conjola entrance provides nesting and roosting habitat for a number of shorebirds of conservation significance (South Coast Shorebird Recovery Program, 2012). These include Hooded Plover (*Thinornis rubricollis*), Little Tern (*Sterna albifrons*), Pied Oystercatcher (*Haematopus longirostris*) (recorded during this study as shown in Figure 3-3), Lesser Sand-plover (*Charadrius mongolus*) and Sooty Oystercatcher (*Haematopus fuliginosus*).

A search of the Atlas of NSW Wildlife (5km radius) revealed records for 23 threatened bird species listed under the NSW TSC Act, as mapped in Figure 3-4. A 5km radius search of EPBC Act listed threatened, migratory and/or marine species was also undertaken. Refer to Refer to Section 4.4 for the impact assessment.



**Figure 3-3 Shorebird and wader habitat at the lake's entrance (facing north from near the viewing platform).**

### **3.7.3 Frogs and Mammals**

#### **Frogs**

The Green and Golden Bell Frog (*Litoria aurea*) is a species for consideration in this REF, being listed as an endangered species under Schedule 1 of the TSC Act and as vulnerable under the EPBC Act 1999. It has been recorded within 2km of the lake's entrance, as mapped in Figure 3-5, in areas such as a sand mine which contains fresh or only slightly brackish water.

The Green and Golden Bell Frog may utilise sedgeland communities for refuge and dispersal (Daly et al. 1998). The habitat of *Litoria aurea* and its successful breeding relies on areas of fresh and or lightly brackish water (less than 8 parts per thousand) in wetlands around the lake. Lake Conjola at times of high rainfall and high lake levels is potentially able to offer these combinations of habitat.

Refer to Section 4.4 for impact assessment.

#### **Terrestrial mammals**

Threatened terrestrial mammals known from the locality are mapped in Figure 3-5. While some of these species could use the lake for foraging habitat, they all require forest habitat for nesting, roosting and breeding. Refer to Section 4.4 for impact assessment.

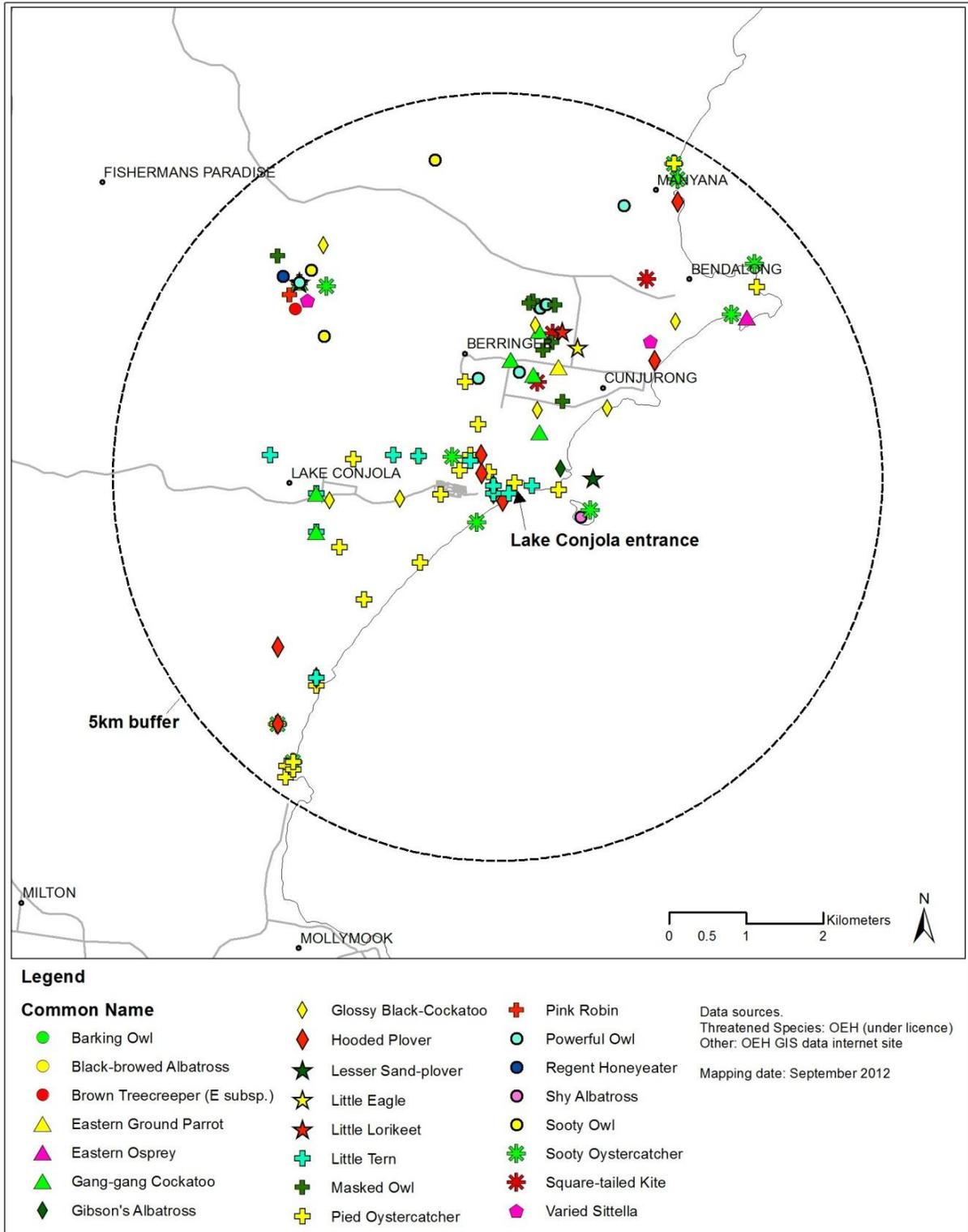
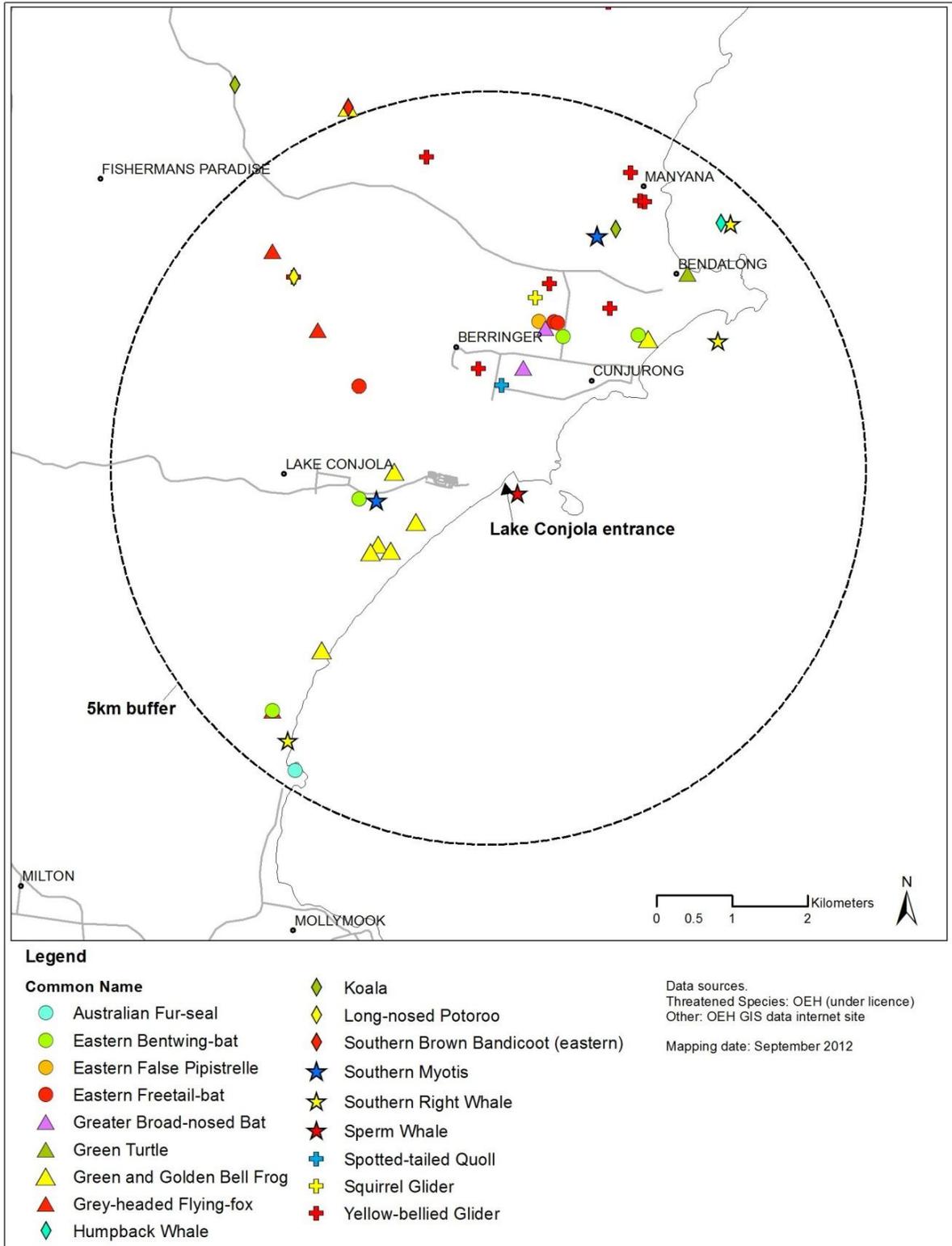


Figure 3-4 TSC Act listed bird species records in the locality



**Figure 3-5 Other threatened fauna in the locality**

## **3.8 Landscape Qualities and General Amenity**

### **3.8.1 Visual Amenity**

The entrance area itself, being simply a large expanse of bare sand, does not in general have strongly attractive landscape qualities when the entrance channel is closed. The adjoining ocean beach and the lake's waters tend to provide a more notable visual feature under these circumstances. When the entrance is open, visual qualities tend to be higher, being characterised by a series of tidal channels leading to the ocean.

The visual qualities are unlikely to be altered to any great extent by the construction of an excavated channel. There may be some temporary creation of an unnatural appearance due to excavated sand being piled alongside the channel, but this is also likely to be temporary as it would either be trucked elsewhere or wind and water action will erode it away and reduce it to the general level of the surrounding beach.

## **3.9 Commercial and Recreational Fisheries**

Lake Conjola supports a range of recreational uses including swimming, boating and fishing. The entrance area is used for fishing, swimming / surfing, walking, dog exercise and nature observation.

The lake is not used for commercial fishing operations. Oyster aquaculture is active in Berringer Lake and in two lease areas within the eastern end of Lake Conjola.

## **3.10 Archaeology**

A desktop search of the AHIMS database revealed four Aboriginal sites or artifacts recorded in the vicinity of the entrance. This result triggered the requirement to undertake an *Extensive Report*. The location data in the report showed that there are no AHIMS records at the lake entrance where works (or access) would occur.

Given the extremely dynamic nature of the entrance area, and the fact that the nominated locations for intervention works mimic natural lake opening zones, the proposed works are highly unlikely to uncover any Aboriginal objects or cultural sites.

Refer to Section 4.5 for mitigation measures should an Aboriginal Object be discovered during the works.

## 4.0 Potential Environmental Impacts

### 4.1 Direct and Indirect Effects

The activity - manual entrance berm breaching - will potentially affect the environment of the lake both directly and indirectly. Direct effects are likely to be localised and restricted to the sand spit, associated with the excavation of the entrance channel by machinery. They mainly relate to impacts upon seabirds possibly nesting on the sand spit, and will largely be dependent upon the season of occurrence. For example, if intervention is undertaken in spring, summer or early autumn there could be disruption to protected shorebird nesting. Entrance berm breaching in winter is unlikely to cause such problems since it is outside the breeding season. The approach to entrance management recognises the possibility of these impacts within or leading up to the breeding season. Any intervention works in the breeding season would follow consultation with NPWS.

Indirect impacts could affect the whole lake and adjacent ecosystems mainly by altering the hydrology. The hydrology of the lake, in particular the water level and the frequency and extent of its fluctuations, is one of the main determinants of the flora communities occupying the bed and banks of the lake. The fringes of Lake Conjola are mostly steep and the area influenced by water level fluctuations is quite narrow when compared to most other south coast estuaries. Further the lake itself is mostly deep so bed features within the lake are not exposed with lake openings. This limits impacts of lake openings that other estuaries can experience as reported in Stephens (2012).

The policy attempts to mimic natural hydrologic regimes as much as possible. Opening levels have been increased marginally in response to this REF. However, interventions earlier than natural openings are inevitable as developed parts of Conjola are low and prone to flooding. The policy applies if the lake is closed and the berm has built up to a level that requires intervention.

The complex inter-relationships between the water cycle, plants and animals at the terrestrial-estuary interface make it difficult to predict the significance of environmental impact of an artificial opening. It is possible to predict the types of impacts but very difficult to predict the ecosystem responses at the species or community level. The rate of change of ecosystem response may be too small to detect. Ecosystem and species response may only be detectable over the long term. These aspects may have already responded to many decades of post-development intervention with the lake entrance.

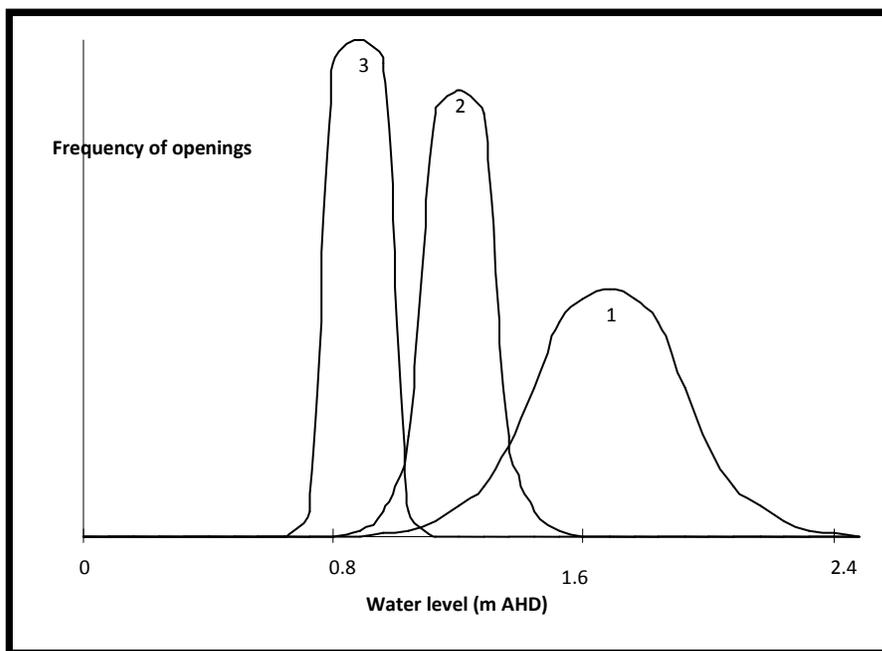
This REF concludes that broad impacts will be insignificant for Lake Conjola as it is operating at or near to its long-term behavior.

### 4.2 Water Level Impacts

Clarifying the nature and extent of potential indirect environmental impacts associated with this activity is difficult. This is due to the fact that the activity is not one that is wholly “unnatural”, but in most instances, is simply the early facilitation of a natural process. The nature and extent

of the environmental impacts will therefore depend upon the extent to which the activity departs from the natural process, which is not itself able to be precisely defined due to a lack of historic data. Therefore to gain an insight into the nature and extent of the environmental impacts it is necessary to understand the natural hydrologic processes that would have operated.

It is likely that under natural conditions, entrance breaching would occur over a relatively wide range of water levels depending upon prevailing sea and weather conditions. This is termed the 'natural breakout range' (see *Line 1* on Figure 4-1) and might be a reasonable representation for Lake Conjola. Note that this is a conceptual graph. It is in no way intended to imply that the levels are correct for Lake Conjola.



**Figure 4-1 Conceptual frequency distribution curves for natural breakout (line 1) and artificial breakouts (lines 2 and 3) of an intermittently opening lagoon. (after NSW Fisheries)**

*Line 1* - Natural breakout frequency curve. Upper and lower limits define natural breakout range.

*Line 2* - Artificial breakout frequency curve for a level within the natural breakout range (in this case 1.2 m AHD).

*Line 3* - Artificial breakout frequency curve for a level at the lower limit of or below the natural breakout range (in this case 0.8 - 0.9 m AHD).

A single artificial opening within the natural range is not likely to have a significant environmental impact since it falls within the expected natural variation. However over the longer term, continued opening at a low level such as 0.8m AHD, at the lowest end of or below the natural range, is much more likely to have a significant environmental impact since the

frequency distribution will be significantly altered (for example, *Line 3*). A series of artificial openings all at the low end of the natural breakout range (*Line 2*) will also have a potential environmental impact, as this series would not display a natural expected variation. The worst scenario in terms of environmental impact is likely to be provided by the circumstances depicted by *Line 3* whereby continued opening is practised well below the natural breakout range. Note this scenario does not now form part of the opening strategy.

A lack of data does not allow the natural breakout range to be positively determined, so it is impossible to be definitive about the magnitude of potential environmental impacts of manual entrance berm breaching. The breakout range might be inferred by reference to the level fluctuations of the beach berm at the lake entrance. It is probable that an intervention level of 1.0 to 1.2 m AHD would be well towards the lower end of the natural breakout range at this location. Beach berm survey in July 2012 after closure determined the berm level was 2.2 to 2.3m AHD in the mid-spit location. Clearly, this level fluctuates with sand movement and location, having been recorded as low as 1.7m AHD in the northern channel location that would control a natural breakout.

The Lake Conjola Interim Entrance Management Policy aims to reinforce entrance berm breaching at lake levels similar to those previously recorded. It also aims to breach the berm at the location most suited to local conditions at the time.

For the purposes of this REF and in the absence of any substantive evidence to the contrary, it is assumed that the intervention levels of 1.0 to 1.2m AHD lie at the lower end of the natural breakout range. It is assumed however that a single opening will have minimal impact, representing an insignificant departure from the lake behavior since intervention at similar levels since at least the 1930's. This assumption is the basis for the analysis and judgments made in the following sections.

There could be indirect impacts upon the ecosystems associated with the lake including the seagrass communities, riparian vegetation communities and fringing wetlands. In general, species occupying the area between about 0.0m AHD and 2.0m AHD have to contend with widely fluctuating ecological conditions. For example, they can be subject to prolonged flooding for many months with either saline or brackish water, or they can be subject to prolonged periods of drying. Those communities below 0.0m AHD, while remaining permanently wet, have to cope with varying salinity levels varying from ocean salinity to brackish.

There is a general requirement of saltmarsh and wetlands species for both freshwater and tidal flushing. The required balance between freshwater flushing and tidal inundation is not known for the areas surrounding Lake Conjola. The issue is by how much intervention in the opening regime of Lake Conjola is likely to change this flushing pattern. It is concluded in this REF that for Lake Conjola, the natural balance of fresh and tidal flushing of wetlands will not be significantly altered due to intervention in opening the lake, as these species would likely have adjusted to the current opening regime.

The nature of the indirect and cumulative environmental impacts can be inferred but it is extremely difficult to quantify their extent.

They may include:

- Possible invasion of species adapted to less widely fluctuating (or more predictable) ecological conditions due to the truncation of one of the environmental extremes (i.e. flooding);
- A reduction in the average size of fish and large macroinvertebrates due to the migration (escape) of large individuals to sea.
- Pattimores Lagoon is highly influenced by the entrance condition of Lake Conjola (Clarke 2012). The current range of behaviour of Pattimores Lagoon would not be expected to change. However the relative durations of the three lagoon states may alter to favour the first two states of connectivity – ‘no connection’ or ‘complete connection’. These two states produce very different lagoon saline conditions and water levels at the extremes of behaviour. It is impossible to predict the expected behaviour of the lagoon under these conditions. Impacts could be mitigated in the long term by progressively raising the intervention level.

The overall impacts are expected to be insignificant, as based on historical data the lake entrance has been breached over many decades at similar levels.

### **4.3 Water Quality Impacts**

Water quality within the lake when it is closed is generally characterised by naturally higher levels of nutrients and bacteria than exist in adjacent oceanic waters. Creating an artificial opening allows a limited degree of water exchange or flushing. However, the extent of flushing is very limited in Lake Conjola due to a meandering, shallow entrance channel reducing the volume of water exchange. It is expected that, in a similar fashion to many south coast estuaries, Lake Conjola’s water quality fluctuations will dominantly be seasonal, rather than relate to the state of the entrance and intervention levels.

Intermittently closed estuaries such as Lake Conjola are naturally vulnerable to an influx of organics and nutrients after heavy rainfall. To date the lake health is not of concern, and indications are that, with sensible land management that recognises the values of the waterway, water quality from catchment issues will not be an issue. The Entrance Management Policy, while maximising the potential for natural behaviour, will have little long-term impact on the natural range of water quality fluctuations.

### **4.4 Threatened and Migratory Species Impact Assessment**

Threatened and migratory species from the desktop database searches (5km radius) are listed below in Table 4-1. The conservation status under the NSW TSC Act and the Commonwealth EPBC Act is shown.

#### **4.4.1 Likelihood of occurrence evaluation.**

The following likelihood of occurrence evaluation (see Table 4-1) explores the habitat requirements (and proximity of previous records) for each threatened or migratory species to determine whether they have the potential to be impacted by the proposed activity (directly or indirectly). Each species found to have a reasonable likelihood of occurrence is then included in the TSC Act and/or EPBC Act significance assessments (Appendix 1).

Note: Marine species not requiring mainland terrestrial habitat have been excluded from this assessment, i.e. Whale, Shark, Albatross and Turtle species. Similarly, threatened flora species not associated with aquatic or estuarine habitats have been excluded.

**Table 4-1 Likelihood of occurrence evaluation for threatened and migratory species known or predicted from the locality.**

**E=endangered, CE=critically endangered, V=vulnerable, M=migratory.**

Species name & status	Recorded previously in locality	Habitat	Assessment required?
<b>FROGS</b>			
Green and Golden Bell Frog <i>Litoria aurea</i> E TSC. V EPBC	Yes	This species has been observed utilising a variety of natural and man-made waterbodies (Pyke & White 2001), with low salinity. Minor chance that this species would be found on the lake fringes.	Yes
<b>BIRDS</b>			
Black-faced Monarch <i>Monarcha melanopsis</i> M EPBC	No, predicted only	Coastal riparian areas	No, overfly only
Brown Treecreeper (eastern subspecies) <i>Climacteris picumnus victoriae</i> V TSC	Yes	Woodland, open forest	No, overfly only
Cattle Egret <i>Ardea ibis</i> M EPBC	No, predicted only	Marshes, avoids marine environments (McKilligan, 2005)	No, unsuitable habitat
Eastern Osprey <i>Pandion cristatus</i> E TSC. Marine, M EPBC	Yes	Forages over clear estuarine and inshore marine waters and coastal rivers. Nests in tall (usually dead or dead-topped) trees in coastal habitats from open woodland to open forest, within 1-2 km of water (OEH 2012).	Yes
Fork-tailed Swift <i>Apus pacificus</i> M EPBC	No, predicted only	Varied habitat with a possible tendency to more arid areas but also over coasts and urban areas (Simpson & Day 1999)	No, overfly only
Ground Parrot <i>Pezoporus wallicus wallicus</i> (eastern subspecies) V TSC	Yes	Coastal heath and sedgelands that provide a high density of cover and food foraging resources (Blakers et al. 1984; Simpson & Day 1999).	No, overfly only
Great Egret <i>Ardea alba</i> M EPBC	No, predicted only	Ephemeral freshwaters, wet pasture and estuarine mangroves and mudflats (McKilligan, 2005)	Yes

Species name & status	Recorded previously in locality	Habitat	Assessment required?
Gang-gang Cockatoo <i>Callocephalon fimbriatum</i> V TSC	Yes	Forest, woodland	No, overfly only
Glossy Black-cockatoo <i>Calyptorhynchus lathami</i> V TSC	Yes	Forest, woodland	No, overfly only
Hooded Plover <i>Thinornis rubricollis</i> CE TSC. Marine EPBC	Yes, incl. Lake Conjola entrance	Beaches occupied by Hooded Plovers (eastern) tend to be broad and flat, with a wide wave-wash zone for foraging and much beachcast seaweed, and backed by sparsely-vegetated sand-dunes that provide shelter and foraging and nesting sites (DSEWPC, 2012)	Yes
Lesser Sand-plover <i>Charadrius mongolus</i> V TSC	Yes	Within NSW, individuals have been observed on intertidal sand and mudflats in estuaries or roosting on sandy beaches or rocky shores at high tide (NPWS 1999).  The species breeds in the Northern Hemisphere, however it roosts and forages in the southern hemisphere. In Australia, it is most common to the north, with few recorded south of the Shoalhaven River (NPWS 1999)	Yes
Little Eagle <i>Hieraaetus morphnoides</i> V TSC	Yes	Open eucalypt forest, woodland or open woodland.	No, overfly only
Little Lorikeet <i>Glossopsitta pusilla</i> V TSC	Yes	Mostly occur in dry, open eucalypt forests and woodlands.	No, overfly only
Little Tern <i>Sternula albifrons</i> E TSC. Marine, M EPBC	Yes, incl. Lake Conjola entrance	Sheltered coastal environments (DSEWPC, 2012). Nests in low dunes or on sandy beaches just above high tide mark near estuary mouths or adjacent to coastal lakes and islands (OEH, 2012).	Yes
Masked Owl <i>Tyto novaehollandiae</i> V TSC	Yes	Associated with forest with sparse, open, understorey, typically dry sclerophyll forest and woodland (DECC 2007)	No, overfly only
Pied Oystercatcher <i>Haematopus longirostris</i> E TSC	Yes, incl. Lake Conjola entrance	Favours intertidal flats of inlets and bays, open beaches and sandbanks. Forages on exposed sand, mud and rock at low tide. Nests mostly on coastal or estuarine beaches, occasionally use saltmarsh or grassy areas (OEH, 2012).	Yes
Pink Robin <i>Petroica rodinogaster</i> V TSC	Yes	Rainforest and tall, open eucalypt forest, particularly in densely vegetated gullies (OEH, 2012).	No, overfly only

Species name & status	Recorded previously in locality	Habitat	Assessment required?
Powerful Owl <i>Ninox strenua</i> V TSC	Yes	Wide range of wet and dry forest types with a high density of prey, such as arboreal mammals, large birds and flying foxes (Environment Australia 2000, Debus & Chafer 1994).	No, overfly only
Regent Honeyeater <i>Anthochaera phrygia</i> E TSC. E, M EPBC	Yes	Temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts, and riparian forests of River Oak ( <i>Casuarina cunninghamiana</i> ) (Garnett 1993)	No, overfly only
Rufous Fantail <i>Rhipidura rufifrons</i> M EPBC	No, predicted only	Rainforest, dense wet eucalypt and monsoon forests, paperbark and mangrove swamps and riverside vegetation (Morcombe, 2004).	Yes
Satin Flycatcher <i>Myiagra cyanoleuca</i> M EPBC	Yes	Rainforest and eucalypt forests, feeding in tangled understorey (Blakers et al. 1984).	No, overfly only
Sooty Owl <i>Tyto tenebricosa</i> V TSC	Yes	Wet old growth forest on fertile soil with a dense understorey and emergent tall Eucalyptus species (Environment Australia 2000, Debus 1994)	No, overfly only
Sooty Oystercatcher <i>Haematopus fuliginosus</i> V TSC	Yes	A marine coastal species, which usually occurs within 50 m of the shore (Marchant and Higgins 1993). Mainly forages on rocky intertidal shorelines.	Yes
Square-tailed Kite <i>Lophoictinia isura</i> V TSC	Yes	In coastal areas associated tropical and temperate forests and woodlands on fertile soils with an abundance of passerine birds (Marchant & Higgins 1993)	No, overfly only
Swift Parrot <i>Lathamus discolor</i> E TSC. E EPBC	No, predicted only	Feeds in eucalypt forest habitat during autumn and winter (Blakers et al. 1984)	No, overfly only
Varied Sittella <i>Daphoenositta chrysoptera</i> V TSC. V EPBC	Yes	Inhabits eucalypt forests and woodlands	No, overfly only
White-bellied Sea-eagle <i>Haliaeetus leucogaster</i> M EPBC	No, predicted only	Forages over large open fresh or saline waterbodies, coastal seas and open terrestrial areas (Marchant & Higgins 1993, Simpson & Day 1999). Breeding habitat consists of tall trees, mangroves, cliffs, rocky outcrops, silts, caves and crevices and is located along the coast or major rivers. Breeding habitat is usually in or close to water, but may occur up to a kilometre away (Marchant & Higgins 1993).	No, no records in the locality, therefore unlikely to use the site

Species name & status	Recorded previously in locality	Habitat	Assessment required?
White-throated Needletail <i>Hirundapus caudactis</i> M EPBC	Yes	Forages aerially over a variety of habitats usually over coastal and mountain areas, most likely with a preference for wooded areas (Marchant & Higgins 1993; Simpson & Day 1999).	No, overfly or aerial foraging only
<b>MAMMALS (excl. bats)</b>			
Koala <i>Phascolarctos cinereus</i> V TSC. V EPBC	Yes	Eucalypt woodland and forest (DSEWPC, 2012)	No, unsuitable habitat
Long-nosed Potoroo <i>Potorous tridactylus</i> V TSC V EPBC	Yes	Open forests and the ecotones between them (DSEWPC, 2012)	No, unsuitable habitat
Southern Brown Bandicoot (eastern) <i>Isodon obesulus obesulus</i> E TSC E EPBC	Yes	Heath, coastal scrub, heathy forests (Menkhorst & Knight 2004), shrubland and woodland on well drained soils.	No, unsuitable habitat
Spotted-tailed Quoll <i>Dasyurus maculatus</i> V TSC E EPBC	Yes	We/dry forests, coastal heathlands and rainforests (Mansergh 1984)	No, unsuitable habitat
Squirrel Glider <i>Petaurus norfolcensis</i> V TSC	Yes	Dry hardwood forest and woodlands (Menkhorst et al. 1988; Quin 1995).	No, unsuitable habitat
Yellow-bellied Glider <i>Petaurus australis</i> V TSC	Yes	Tall mature forests, preferring productive tall open sclerophyll forests with a mosaic of tree species including some that flower in winter (Environment Australia 2000)	No, unsuitable habitat
<b>BATS</b>			
Eastern Bentwing-bat <i>Miniopterus orianae oceanensis</i> V TSC	Yes	Hunt in forested areas, catching moths and other flying insects above the tree tops. Roosts in caves, under bridges (OEH, 2012)	No, habitat not impacted by the activity
Eastern False Pipistrelle <i>Falsistrellus tasmaniensis</i> V TSC	Yes	Roosts in eucalypt hollows, under loose bark on trees or in buildings. Hunts above or just below the tree canopy (OEH, 2012)	No, habitat not impacted by the activity
Eastern Freetail-bat <i>Micronomus norfolkensis</i> V TSC	Yes	Occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures (OEH, 2012).	No, habitat not impacted by the activity

Species name & status	Recorded previously in locality	Habitat	Assessment required?
Greater Broad-nosed Bat <i>Scoteanax rueppellii</i> V TSC	Yes	Woodlands, open forests and tall open forests.	No, habitat not impacted by the activity
Grey-headed Flying-fox <i>Pteropus poliocephalus</i> V TSC V EPBC	Yes	Woodlands, open forests and tall open forests.	No, habitat not impacted by the activity
Southern Myotis <i>Myotis macropus</i> V TSC	Yes	Forage over streams and pools catching insects and small fish by raking their feet across the water surface (OEH 2012).	No, habitat not impacted by the activity
<b>FLORA</b>			
Narrow-leafed <i>Wilsonia</i> <i>Wilsonia backhousei</i> V TSC	Yes	Grows in coastal saltmarshes in the Sydney Region and Jervis Bay (Harden 1990).	No, very little saltmarsh on L. Conjola, and activity within natural hydrological regime

#### 4.4.2 Conclusion of likelihood of occurrence evaluation

The above likelihood of occurrence evaluation found that the following nine species have the potential to be impacted by the proposed activity and are, therefore, addressed under the TSC Act Assessment of Significance (7-part test) and/or the EPBC Act significance assessments (contained in Appendix 1):

- Green and Golden Bell Frog
- Eastern Osprey
- Great Egret
- Hooded Plover
- Lesser Sand-plover
- Little Tern
- Pied Oystercatcher
- Rufous Fantail
- Sooty Oystercatcher

#### 4.4.3 Conclusion of TSC Act assessment of significance

The TSC Act assessment of significance (7-part test), contained in Appendix 1, found that the activity is unlikely to have a significant effect on: Green and Golden Bell Frog, Eastern Osprey,

Hooded Plover, Lesser Sand-plover, Little Tern, Pied Oystercatcher and Sooty Oystercatcher provided that the recommendations outlined in Section 6.0 are fully adopted.

In this case, *the proposed activity will not require a Species Impact Statement.*

#### **4.4.4 Conclusion of EPBC Act significance assessments**

The EPBC Act significance assessments, contained in Appendix 1, found that the activity is unlikely to significantly impact on any EPBC Act listed threatened or migratory species, provided that the recommendations made in this REF are adopted and implemented.

In this case, referral to the Commonwealth under the EPBC Act would not be recommended.

#### **4.4.5 SEPP 44 Koala Habitat assessment**

There are no trees listed on Schedule 2 of SEPP 44 identified on site. As such, the study area does not qualify as Potential Koala Habitat and a Core Koala Habitat assessment is not required.

### **4.5 Archaeology**

As described in Section 3.10, four AHIMS database records occur in the vicinity of the entrance. While the location data is not always accurate, it is known that the 1999 opening of the entrance uncovered a significant site in the dune at the southern end of the entrance. It is possible that other Aboriginal sites/artifacts would be present in other sections of the southern dune.

The other AHIMS sites are at some distance from where excavation, access or disposal of excavated sand would occur and are therefore not threatened by the activity.

Given the extremely dynamic nature of the entrance area, and the fact that the nominated locations for openings mimic natural lake opening zones, the proposed works are highly unlikely to uncover any Aboriginal objects or cultural sites. However, as is required under the legislation, the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* should be followed as part of the activity (processes under the code are shown in Figure 4-2).

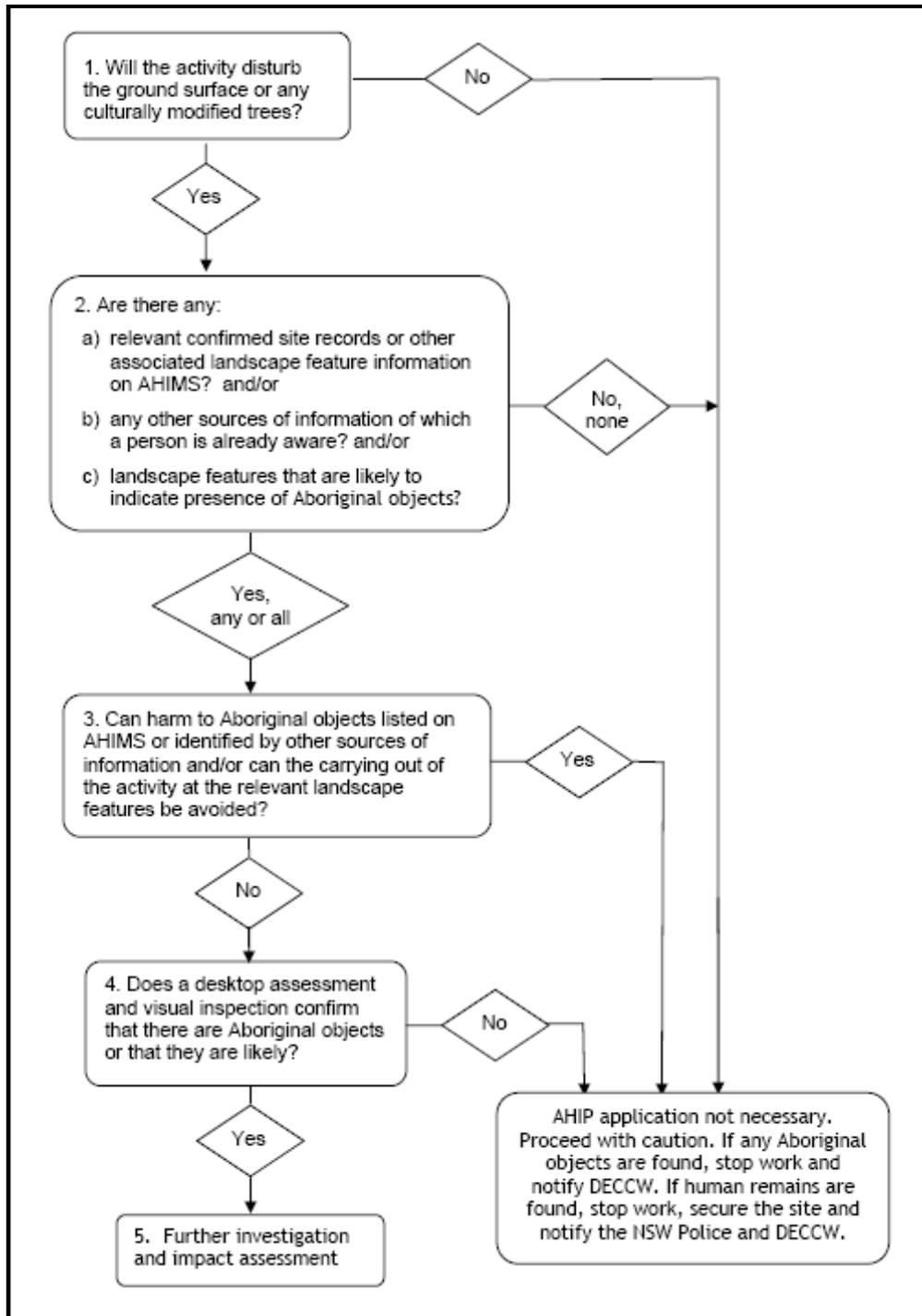


Figure 4-2 Due Diligence Code of Practice process

## 5.0 Checklist - Matters for Consideration

Clause 82 of the Environmental Planning and Assessment Act Regulation lists the factors to be taken into account when considering the likely impact of an activity on the environment under Part 5 of the EP&A Act. The following section deals in turn with each of the matters considered to be relevant to the artificial entrance berm breaching of Lake Conjola in accordance with the adopted Interim Policy.

**a) Any environmental impact upon a community**

The communities most likely to be affected will be the residents of the townships of Lake Conjola and associated villages on the perimeter of the lake. There will be no significant adverse impact upon these communities. If the activity were not to occur, there would be infrequent potential for flooding of the low lying areas. If the activity did occur, there is still the potential for flooding of low level areas.

**b) Any transformation of a locality**

The locality will not be transformed in any significant manner. The lake entrance will change temporarily, but these changes will be within natural bounds.

**c) Any environmental impact on the ecosystems of the locality**

The possible impacts have been discussed above under Section 4.0.

**d) Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality**

There is not likely to be any reduction in the aesthetic quality or value of the locality as a result of implementing the Policy.

Intervention in the natural breakout process diminishes slightly the scientific value of the system since an element of 'naturalness' has been modified. However ecological processes will continue to operate and the locality could still be suitably used for a wide range of scientific purposes.

**e) Any effect on a locality, place or building having aesthetic, anthropological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations**

There are no Aboriginal archaeological sites within the entrance area potentially affected by entrance berm breaching. It is understood that Lake Conjola has significance to Aboriginal people, however no potential adverse impacts of opening the lake are known.

Lake Conjola has significant aesthetic and social significance to local and holidaying communities. The process and consequences of entrance berm breaching do not impact adversely on these values.

**f) any impact on the habitat of protected or endangered fauna**

Refer to the threatened species impact assessment (Section 4.4) and the conclusions and recommendations (Section 6.0)

**g) Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air**

Addressed as per previous point

**h) Any long term effects on the environment**

The possible long-term effects of implementing this policy have been discussed above under Section 4.0. Cumulative effects of irregular intervention in Lake Conjola openings are identified in this document, and although the range of intervention levels would be well towards the lower end of the natural breakout range, the impacts would be expected to have already occurred due to the long history of intervention at similar levels.

**i) Any degradation of the quality of the environment**

The quality of the lake environment will be slightly degraded by virtue of the fact that a natural process is being interfered with. In effect the lake is losing an element of 'naturalness'. Naturalness is a significant environmental attribute. It is often a criteria used to determine environmental or conservation value.

However, Lake Conjola has been artificially opened at various intervals for a number of decades, and loss of naturalness will not be a direct result of implementing the policy.

**j) Any risk to the safety of the environment**

The environment will be no less 'safe' as a result of implementing the Policy. The robustness or ability of the environment to withstand environmental fluctuations should not be compromised.

**k) Any reduction in the range of beneficial uses of the environment**

There will be no reduction in the range of beneficial uses of the environment apart from those discussed under point d) above.

**l) Any pollution of the environment**

Pollution of the environment (noise, minor diesel fumes) may be experienced for a matter of up to a few days while construction equipment excavates a channel across the sand at the lake entrance.

**m) Any environmental problems associated with the disposal of waste**

Nil. Sand excavated from the channel will either nourish the front of the dune south of the entrance, add to the beach width north of the entrance or sand may be used in areas around the lake entrance experiencing erosion when feasible. In an emergency intervention, excavated sand could be incorporated into the channel as it naturally expands. Alternatively, it will spread later by natural causes (wind, waves).

**n) Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply**

None are relevant.

**o) Any cumulative environmental effect with other existing or future activities**

Other activities are likely to be based in the catchment or on the foreshore. Although it is difficult to predict other future activities that may take place, it is unlikely that implementation of the Policy would have a cumulative effect with these other activities. Cumulative impacts are further considered in Section 4.0 of the REF document.

## 6.0 Conclusion and Recommendations

This report has considered all factors identified in Clause 228 of the EP&A Regulation (2000). Predicted site impacts, mitigation and management requirements as a result of the development have been assessed in the preceding report.

It is concluded that implementation of the Lake Conjola Interim Entrance Management Policy is unlikely to cause a significant impact on the local environment, provided that the mitigation measures described below are adopted and implemented.

### Shorebirds

The proposed activity has the potential to have a significant adverse impact upon threatened and/or migratory shorebird species by disrupting breeding colonies or disturbing or destroying nesting sites. This scenario could result from direct disturbance by machinery at the time of an artificial lake opening or by subsequent expansion and northerly migration of a mid-spit intervention, removing habitat. To avoid such impacts, the following mitigation measures are recommended:

- *Suitable intervention location.* It is recommended that the northern intervention site could be used for all entrance berm breaching activities as it occurs on bare sand that is not used by shorebirds for nesting or roosting and is at a suitable distance from such habitat so as not to cause significant noise / movement or disturbance. Mid-spit options may offer a shorter route with less sand volume to remove, but its use should be restricted to outside the shorebird breeding season (September to March inclusive).
- *Suitable excavated sand disposal locations.* Sand disposal must not impact on actual or potential nesting or roosting habitat for shorebirds. Therefore, the following range of disposal locations are seasonal and include:
  - a) Spread sand to raise the dunes to the north of the entrance channel to 7m AHD and revegetate
  - b) Nourish the front of the dune south of the entrance
  - c) Spreading sand in areas around the lake entrance experiencing erosion, when feasible
  - d) Fill to nourish the beach on north side of entrance

#### NOTES:

The community did not support option a) and this has not been included in the adopted interim policy.

Options a), b) and c) are only suitable outside shorebird breeding season.

- *Access.* Access is not to impinge on shorebird breeding areas. All vehicle/machinery movement associated with excavation and sand disposal would be from Manyana via the beach or the Conjola boat ramp when feasible. The Cunjurong boat ramp can be used as a last resort and remediated once works are complete.

**Note:** Close consultation with the NPWS is required to ensure shorebird impacts are avoided. This should include the proponent contacting NPWS in the lead-up to the breeding season so that relevant Council staff members are aware of nesting/roosting. If breeding activity is taking place and an artificial intervention is unavoidable, the proponent will liaise urgently with National Parks officers and comply with NPWS directions.

### **Green and Golden Bell Frog (GGBF)**

The threatened species impact assessment in this REF concluded that there is only a minor chance that the GGBF would occur in Lake Conjola. The most recent record for GGBF occurring at the edge of the lake dates back to 1978. If a population is still present it is most likely to have been observed since then, given the high amount of survey for the species in the region. Most of the recent records in the locality are from sites with higher freshwater content, e.g. a local sand mine/quarry and the local STP.

The proposed activity - implementation of the Lake Conjola Interim Entrance Management Policy - is unlikely to have a significant adverse impact upon threatened amphibian species by disrupting breeding due to salinity increases. If breeding activity is taking place, and an artificial intervention is unavoidable, the proponent will comply with NPWS directions.

### **Lake Ecosystems**

The proposed activity is unlikely to have a significant environmental impact upon the ecosystems of the lake in the short term. The impacts could relate to minimal shifts in the wetland and fringing vegetation community structure and distribution of Pattimores Lagoon. To mitigate against this possibility it would be necessary to raise the intervention level where practical. This action is consistent with the precautionary principle.

This review assumes that the main basin of Lake Conjola and its fringing ecology has adjusted to entrance berm breaching at similar levels to those proposed, for at least the last eighty years.

### **Archaeology**

Given that there is an AHIMS record showing the presence of a significant Aboriginal site on the dune at the southern end of the entrance (which was uncovered during an artificial opening in 1999), it is recommended that any future works avoid this area in order to avoid the existing site and potentially other sites in the vicinity. Note: The *Due Diligence Code of Practice* would trigger cessation of works in the event that a site is uncovered.

Given the extremely dynamic nature of the entrance area, and the fact that the nominated northern and mid-spit locations for intervention mimic natural lake opening zones, the proposed works are highly unlikely to uncover any Aboriginal objects or cultural sites. The *Due Diligence Code of Practice* process should be followed as part of the activity (as shown in Section 4.5).

### **Alternatives**

There are no viable alternatives to the activity in the short term. The Policy can be implemented in the short term, recognising that there is a remote possibility of minor cumulative ecological impacts over the long term. It may be possible to reduce the extent of impacts by continuing a review of flood warnings and evacuation procedures. With time there will be an opportunity to

review the intervention levels. This would allow the lake to move further towards a natural condition.

**Declaration**

This Review of Environmental factors provides a true and fair review of the proposed activity - implementation of the Lake Conjola Interim Entrance Management Policy as revised by this REF - in relation to its potential effects on the environment.

Having considered this document, and the factors listed in Clause 82 of the Environmental Planning & Assessment Regulations, the Shoalhaven City Council is of the view that the proposed activity - the implementation of the Lake Conjola Interim Entrance Management Policy (*August 2013*) - **will / will not** (*delete one*) have a significant adverse environmental impact.

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*Signed*

*Date*

For Shoalhaven City Council

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## 8.0 Appendix 1 - TSC and EPBC Acts

### 8.1 Assessment of Significance (TSC Act 7-part test)

The EP&A Act includes in Section 5A, seven factors which are to be considered when determining if a proposed development or activity '*is likely to have a significant effect on the threatened species, populations or ecological communities, or their habitats*'. These seven factors must be taken into account by consent or determining authorities when considering a development proposal or development application. This enables a decision to be made as to whether there is likely to be a significant effect on the species and hence if a Species Impact Statement is required (DECC 2007).

Based on the field surveys and likelihood of occurrence evaluation, seven TSC Act listed species were deemed to have the potential to be impacted by the activity. These were the:

- Green and Golden Bell Frog
- Eastern Osprey
- Hooded Plover
- Lesser Sand-plover
- Little Tern
- Pied Oystercatcher
- Sooty Oystercatcher

The following section provides significance assessments for these entities.

**(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,**

#### **Green and Golden Bell Frog (GGBF)**

Formerly, this species had a wide distribution across most of NSW, however since 1990 recorded populations have become largely isolated and separated, restricted to small, coastal or near coastal populations. It is known to inhabit marshes, dams and stream-sides, particularly those containing bulrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.) (Gaia Research, 2003). Optimum habitat includes fresh water-bodies that are unshaded, free of predatory fish such as Plague Minnow (*Gambusia holbrooki*), have a grassy area nearby and diurnal sheltering sites available (DEC 2005).

The species is also known to utilise intermittently closed or open (to the sea) lakes and lagoons (ICOLLS). In a study at Meroo Lake (Gaia Research, 2003), adult frogs were observed calling from on top of submerged aquatic plants (Sea Tassel *Ruppia polycarpa*). Subsequently tadpoles were found in the lake. Although the concentration of the lake at this time was 3 ppt, tadpoles of GGBF can tolerate concentrations up to 7-8 ppt (Pyke and White, 2001). The minimum salt concentration for Lake Conjola is likely to be above most of the time, with lower levels occurring during high rainfall periods and with little or no saltwater intrusion. These concentrations are

above the threshold for Green and Golden Bell Frog tadpoles to survive. The artificial opening of Lake Conjola would have a minor impact on the refuge and foraging habitat for adult Green and Golden Bell Frog. Even if the opening and closing of lake's entrance was left to its natural regime, it would only be on rare occasions that salt concentrations would be low enough to support long term GGBF habitation and breeding. That is, it would require exceptionally high flood levels to increase freshwater content, but with no opening of the entrance to a) hold the freshwater in the lake for an extended period and b) exclude saltwater from being introduced from the sea. The lack of suitable habitat in the lake is reflected in the records for the GGBF in the locality. That is, the most recent record for GGBF occurring at the edge of the lake dates back to 1978. If a population is still present it is most likely to have been observed since then given the high amount of survey for the species in the region. Most of the recent records in the locality are from sites with higher freshwater content, e.g. a local sand mine/quarry and the local STP.

The proposed works footprint occur on, predominantly, bare sand at the lake's entrance which do not constitute suitable refuge or foraging habitat for GGBF. No sedges or rushes are present on the water edge or shoals.

Based on the above, it is deemed that there is not a viable population of GGBF on the Lake Conjola estuary. Therefore, the action proposed is unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

### **Eastern Osprey**

The Eastern Osprey is found around most of the Australian coast line. The species is uncommon to rare or absent from closely settled parts of south-eastern Australia (OEH 2012). It favours coastal areas - in particular the mouths of rivers, lagoons and coastal lakes where it hunts for fish and, to a lesser extent, small terrestrial vertebrates, seabirds and crustaceans (Marchant and Higgins, 1993). The species will breed within one kilometre of the coast where it will nest high up in dead trees or in dead crowns of live trees.

The nearest known record is about 4km from the works site. If a nest is present in the vicinity of the Lake Conjola entrance, it is likely that it would have been recorded, given the large amount of fauna survey (and general bird watching) taking place in the locality.

This species may utilise areas surrounding the site for breeding or foraging and may therefore be affected temporarily by construction noise. However, it is considered unlikely that development would impact on the life cycle of this species to a level that would place them at a risk of extinction due to the high mobility and large home range of the species and similar or better quality forested habitat being abundant nearby and along the coastline of the locality. Therefore, it is unlikely that the proposed activity could have an adverse effect on the life cycle of the Eastern Osprey, such that a viable local population of the species is unlikely to be placed at risk of extinction.

## **Shore birds**

Opening options 2 and 3 are constrained by proximity to breeding habitat, but Option 1 provides opportunity to excavate the entrance without direct disturbance to the habitat. Refer below for further detail.

**Hooded Plover –habitat and ecology.** The Hooded Plover occurs around the southern coast of Australia and Tasmania, and on inland saline wetlands in south-west Western Australia (Marchant & Higgins 1993). It is restricted to the littoral zone of beaches and sandy estuaries, where it nests on the ground just above the tide line. Recent studies suggest that a variety of beach types may be used, with the species sometimes found in habitats other than beaches, e.g. on rock platforms, reefs, around near coastal lakes and lagoons (DSEWPC, 2012). In NSW, the Hooded Plover historically occurred north to at least the Sydney region, and possibly to Port Stephens. Resident birds are now found only south of Wollongong, although occasional vagrants are seen north to the Central Coast and (rarely) south-east Queensland. Its current northern breeding limit is around Shoalhaven Heads. NSW birds constitute a single population, having possible dispersal and genetic interchange across the NSW-Victorian border.

The species uses the Lake Conjola entrance on a fairly regular, but not annual, basis. At the time of this assessment, it was not present at the site (September/October 2012) but it is possible that it may arrive later in the year, i.e. as of November.

Refer to the following sub-heading below for further detail: 'Conclusion to Part (a) (for all shorebird species)'

**Lesser Sand-plover – habitat and ecology.** This species breeds in the Northern Hemisphere, however it roosts and forages in the southern hemisphere. Within NSW, individuals have been observed on intertidal sand and mudflats in estuaries or roosting on sandy beaches or rocky shores at high tide (NPWS 1999). In Australia, it is most common to the north, especially the Gulf of Carpentaria, with few recorded south of the Shoalhaven River.

Refer to the following sub-heading below for further detail: 'Conclusion to Part (a) (for all shorebird species)'

**Little Tern – habitat and ecology.** The Little Tern is migratory and leaves eastern Australia outside the summer breeding season and moves north into Asia (Higgins and Davies, 1996). The species is found in Australia from September to March.

The Little Tern inhabits sheltered coastal environments, including lagoons, estuaries, river mouths and deltas, lakes, bays, harbours and inlets, especially those with exposed sandbanks or sand spits (Higgins and Davies, 1996). The species nest on raised sandy areas within 150 m of the tide line, most within 5 m of the high tide mark in areas with sparse (5 %) vegetation cover (Higgins and Davies 1996). They forage in shallow waters of estuaries, coastal lagoons and lakes, usually over channels next to spits and banks, often close to the breeding colonies (Higgins and Davies, 1996).

Smith and Smith (1995) states that the Little Tern historically nested at nine sites in the area, from Shellharbour to Meroo Lake . Over the last 40 odd years there has been a dramatic

decline in the records of nests in the region. The only sites where the species currently nests in the Shoalhaven are Comerong Island, Lake Conjola and Lake Wollumboola (Smith 1996, pers. obs.).

Refer to the following sub-heading below for further detail: 'Conclusion to Part (a) (for all shorebird species)'

**Pied Oystercatcher – habitat and ecology.** The Pied Oystercatcher occurs on the coast especially in intertidal mudflats, sandbanks and open beaches (Marchant and Higgins. 1993). The species forages on exposed sand, mud, rock or coral for molluscs, worms, crabs and small fish.

Pied oystercatcher nests on areas of sand immediately above the high-water mark of beaches, sand bars and margins of estuaries and lagoons (Marchant and Higgins, 1993). Usually two eggs are laid in an unlined scrape between September and December in southern Australia.

At the time of the writing of this assessment, a pair of Pied Oystercatchers was recorded nesting on the sand spit between the Option 2 and Option 3 locations (site photograph shown in Figure 3-3, taken in late September 2012).

Refer to the following sub-heading below for further detail: 'Conclusion to Part (a) (for all shorebird species)'

#### **Sooty Oystercatcher – habitat and ecology**

The Sooty Oystercatcher is strictly a marine coastal species, which usually occurs within 50 m of the shore (Marchant and Higgins 1993). It prefers rocky intertidal shorelines where it forages for molluscs, crustaceans, polychaetes, echinoderms and small fish (Marchant and Higgins, 1993).

Adult Sooty Oystercatchers are territorial and often breed on offshore islands. Sooty Oystercatcher will nest from August to March, but nesting locations would be well removed from the entrance area. The nest is a scrape in the ground where two eggs are usually laid (Marchant and Higgins, 1993). The entrance berm breaching of Lake Conjola entrance would have a minor impact on the foraging habitat for the Sooty Oystercatcher.

Refer to the following sub-heading below for further detail: 'Conclusion to Part (a) (for all shorebird species)'

#### **Conclusion to Part (a) (for all shorebird species)**

Foraging habitat. The action proposed would have minimal impact on local foraging habitat, i.e. the mud flats, shoreline and rock shelves. This assumes that appropriate sites for the disposal of excavated sand are chosen, as detailed below and under the conclusion heading of this report.

Breeding and roosting habitat. Were intervention works to occur at either the southern or mid-spit sites between September and March, it is likely that at any of the shorebird species present at the time would be adversely impacted by the action such that a viable local population/s of the species is likely to be placed at risk of extinction.

However, the northern site occurs at sufficient distance from the breeding/roosting habitat such that the opening works could occur in that location between September and March without an

adverse effect on the life cycle of these species such that a viable local population is likely to be placed at risk of extinction. Note: this conclusion assumes no impacts on nearby shorebird breeding/roosting habitat caused by the disposal of excavated sand. A flexible approach has been demonstrated to be successful in the past, e.g. by moving sand to suitable locations such as the vicinity of the viewing platform inside the estuary (where it was used to widen foot access beside the water and to ameliorate dune erosion). This conclusion also assumes the involvement of NPWS (Ulladulla office) during the planning and implementation phases of artificial entrance opening in order that impacts are managed and avoided.

Refer to Section 6.0 of this report for further detail regarding mitigation measures.

**(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,**

No endangered populations are known within the area.

**(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:**

- (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction,**
- (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,**

Swamp Oak Floodplain Forest is associated with humic clay and sandy loam soils on waterlogged or periodically flooded areas. These soils are generally deposited during flood events and occur on the flats and drainage lines of the Coastal Floodplain. The community is usually found below 20m in elevation although sometimes up to 50 m elevation. It is found in the NSW North Coast, Sydney Basin and South East Corner bioregions (NSW Scientific Committee, 2011a).

Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions is the name given to the ecological community occurring in the intertidal zone on the shores of estuaries and lagoons including when they are intermittently closed along the NSW coast. This EEC is frequently found as a zone landward of mangrove stands, with scattered mature mangrove trees occurring through saltmarsh at some sites. In brackish areas dense stands of tall reeds (*Phragmites australis*, *Bulboschoenus* spp., *Schoenoplectus* spp., *Typha* spp.) may occur as part of the community (NSW Scientific Committee, 2011b).

Swamp Oak Floodplain Forest EEC and Coastal Saltmarsh EEC occur sporadically along the fringes of the lake system. Remnants in urbanised areas are in a highly degraded condition, while in non-developed areas they are in good condition.

No EECs occur in the vicinity of the Options 1 to 3 sites. Therefore, there is no potential for direct impact on extent or composition. Were the lake to be opened artificially on a permanent basis (or for the majority of the time), there would be potential for indirect impact on EEC extent and/or composition. However, the regime proposed, i.e. entrance berm breaching at the lake entrance on an occasional basis to alleviate flooding, closely mimics natural fluctuations in water levels and salt concentrations in the lake system. Even without intervention during flood events, it is likely that high flood levels would cause the entrance to open naturally after some time, especially as high rainfall events are often associated with high seas and wave run-up.

Therefore, the action proposed is unlikely to: (i) have an adverse effect on the extent of the ecological communities; or (ii) substantially and adversely modify the composition of the ecological communities such that their local occurrence is likely to be placed at risk of extinction.

**(d) in relation to the habitat of a threatened species, population or ecological community:**

- (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed**
- (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action**
- (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality**

Extent – shorebird breeding habitat. No threatened species breeding habitat is likely to be removed or modified as a result of the action proposed, provided that: a) the northern site is chosen for intervention works; b) that excavated sand is disposed of outside of and remote from the shorebird breeding habitat area; and c) that vehicle/machinery access does not impinge on the shorebird breeding areas.

Extent – shorebird (and other bird) foraging habitat. The action proposed (i.e. northern opening and associated operations mentioned in previous paragraph) would temporarily reduce the extent of potential foraging habitat during the works due to disturbance from vehicle/machinery movement and operation (estimated at up to 10% of entrance foraging habitat temporarily impacted).

Fragmentation. Based on the above, there would be no fragmentation of breeding habitat caused by the northern opening and only minimal short term impact on fragmentation of foraging habitat caused by the northern opening.

Importance. The temporary disturbance to a small proportion of foraging habitat during northern opening works is not considered to be important to the long-term survival of the species, population or ecological community in the locality.

There are no threatened populations or ecological communities within the entrance area.

**(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),**

There is no critical habitat as listed by the TSC Act found within the Eurobodalla LGA.

**(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,**

At the time of writing, a number of recovery plans were available for entities that are the subject of this assessment. These plans are listed and considered below.

*Little Tern (Sterna albifrons) Recovery Plan (NPWS, 2003)*

Objectives of relevance to the action proposed are:

- Little Tern Specific Objective 1: Inform land managers of their responsibilities regarding the conservation requirements of Little Tern
- Specific Objective 2: Site Management

The above objectives are being met under the Lake Conjola Entrance Management Policy and this REF through consultation with NPWS staff during the planning process and through the formulation of the requirement that NPWS are informed leading up to the commencement of entrance berm breaching works to ensure that the action proposed does not impact on the species.

The Lake Conjola Entrance Management Policy and this associated REF have been prepared in consultation with the South Coast Shorebird Recovery Program, administered by NPWS (<http://www.southcoastshorebirds.com.au>)

Other shorebird species.

There are no other recovery plans specific to the remainder of shorebirds addressed here. However, the majority of recovery planning for them is covered by the South Coast Shorebird Recovery Program, administered by NPWS. The Lake Conjola Entrance Management Policy and this REF have been informed by this program.

Draft Recovery Plan for the Green and Golden Bell Frog (*Litoria aurea*).

- Management to reduce the risk of further spread of the chytrid fungus and other pathogens within and between GGBF populations.

As discussed above, it is highly unlikely that this species would be found at the lake's entrance due to salinity levels.

**(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.**

Schedule 3 of the TSC Act lists "the alteration of rivers and streams and their flood plains and wetlands" as a Key Threatening Process. The proposed development is considered a threatening process under this definition. Section 4.0 discusses relevant aspects of hydrology and water level impacts.

Three anthropogenic processes have predominantly altered flows in streams, rivers and their floodplains and wetlands in NSW. These are a) building of dams (including all dams and weirs and off-river storages); b) diversion of flows by structures or extraction and c) alteration of flows on floodplains with levees and structures (including those on wetlands to allow water storage). The issue as a Key Threatening Process has little relevance to the species addressed in this test.

The Scientific Committee has made a Preliminary Determination to support a proposal to list infection of frogs by amphibian chytrid causing the disease Chytridiomycosis as a Key Threatening Process. Chytridiomycosis is potentially fatal to all native species of amphibian. As such, all frog species that are listed under the schedules of the Act may be affected by the disease. Chytridiomycosis has been reported from Green and Golden Bell Frog (*Litoria aurea*), which is known in the Lake Conjola catchment and addressed under this test. However, the actions proposed under the policy are not known to impact on the spread of this disease or GGBF's susceptibility.

#### **Conclusion of TSC Act Assessment of Significance**

This Assessment of Significance has determined that the proposed activity is unlikely to have a significant effect on: Green and Golden Bell Frog, Eastern Osprey, Hooded Plover, Lesser Sandplover, Little Tern, Pied Oystercatcher and Sooty Oystercatcher provided that the recommendations outlined in Section 6.0 are fully adopted.

In this case, *the proposed activity will not require a Species Impact Statement.*

## **8.2 EPBC Act Significance Assessments**

The EPBC Act Administrative Guidelines on Significance set out '**Significant Impact Criteria**' that are to be used to assist in determining whether a proposed action is likely to have a significant impact on matters of national environmental significance. Matters listed under the EPBC Act as being of national environmental significance include:

- Listed threatened species and ecological communities
- Listed migratory species
- Wetlands of International Importance
- The Commonwealth marine environment
- World Heritage properties
- National Heritage places
- Nuclear actions

Specific ‘**Significant Impact Criteria**’ are provided for each matter of national environmental significance except for threatened species and ecological communities in which case separate criteria are provided for species listed as endangered and vulnerable under the EPBC Act. Threatened and migratory species listed under the EPBC Act that are considered likely or potentially to occur within the study area are given in Section 4.4.1. The relevant Significant Impact Criteria have been applied to these threatened and migratory species to determine the significance of impact of the project.

MATTERS TO BE ADDRESSED	IMPACT (COMMONWEALTH LEGISLATION)
a. any environmental impact on a World Heritage Property;	No
b. any environmental impact on Wetlands of International Importance;	The proposal will not affect any part of RAMSAR wetland.
c. any impact on Commonwealth Listed Critically Endangered or Endangered Species;	No Commonwealth listed endangered species considered likely to occur in the study area:
d. any impact on Commonwealth Listed Vulnerable Species;	<p>One Commonwealth listed vulnerable species are considered potential or likely to occur in the study area:</p> <ul style="list-style-type: none"> <li>• <b>Green and Golden Bell Frog (GGBF)</b></li> </ul> <p>The significant impact criteria in terms of the vulnerable species is are discussed below:</p> <p><i>a. lead to a long-term decrease in the size of an important population of a species,</i> The most recent record for GGBF occurring at the edge of the lake dates back to 1978. Since the early 1990s the distribution of this species has contracted to isolated populations. If a population is still present on the lake fringes it would have been most likely to have been observed since then (given the high amount of survey for the species in the region). Most of the recent records in the locality are from sites with higher freshwater content, e.g. a local sand mine/quarry and the local STP. Based on these factors, it is deemed unlikely that the lake contains any GGBF populations whatsoever, let alone an important population.</p> <p><i>b. reduce the area of occupancy of an important population</i> As per previous point, the lake’s entrance does not possess a GGBF population. The wider lake is unlikely to possess a GGBF population.</p> <p><i>c. fragment an existing important population into two or more populations</i> As previous, the lake’s entrance does not possess a GGBF population. The wider lake is unlikely to possess a GGBF population</p> <p><i>d. adversely affect habitat critical to the survival of a species</i> Based on factors above, the lake does not contain habitat critical to the survival of the species. Local records show that the species occurs in freshwater habitats (possibly slightly brackish at best).</p>

MATTERS TO BE ADDRESSED	IMPACT (COMMONWEALTH LEGISLATION)
	<p><i>e. disrupt the breeding cycle of an important population</i> As the site is not considered to contain any important populations, this proposal will not cause any disruption to the breeding cycle of an important GGBF population.</p> <p><i>f. modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</i> The species has not been recorded on the lake since 1978. Therefore, it is unlikely that the activity would modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</p> <p><i>g. result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat</i> The proposal will not increase the risk from the relevant invasive species, i.e. Plague Minnow (<i>Gambusia holbrooki</i>).</p> <p><i>h. introduce disease that may cause the species to decline</i> The proposal will not lead to the introduction of a relevant disease (i.e. chytrid fungus disease) that may cause the species to decline at the site. In the unlikely probability that the species were found during the project AND if it were handled, it would be done by NPWS personnel following the Hygiene Protocol for the Control of Disease in Frogs.</p> <p><i>i. interferes substantially with the recovery of the species.</i> The species has not been recorded on the lake since 1978. Therefore, it is unlikely that the recovery of the species will be substantially impacted</p>
<p>e. any environmental impact on Commonwealth Listed Migratory Species;</p>	<p>Three Commonwealth listed migratory species were considered likely to occur at the study area:</p> <ul style="list-style-type: none"> <li>• Eastern Osprey</li> <li>• Great Egret</li> <li>• Little Tern</li> <li>• Rufous Fantail</li> </ul> <p>The guidelines in terms of the migratory species are discussed below:</p> <p><i>a. substantially modify (including fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat of the migratory species</i> In regards to important habitat for the four species considered here, it is only Little Tern that would potentially be impacted through substantial modification to its habitat (the other three species can use more wide ranging habitats than that at the lake's entrance). A key consideration in the development of the Lake Conjola Entrance Management Plan has been to avoid impacts on shorebird nesting and roosting habitat (including the Little Tern). Similarly, this REF provides recommendations to avoid such impacts (see Section 6.0). Therefore, provided that these are adopted and implemented, the proposal will not substantially modify, destroy or isolate an area of important habitat for the Little Tern.</p> <p><i>b. result in invasive species that is harmful to the migratory species becoming established in an area of important habitat of the migratory species</i> The proposal will not introduce or facilitate an invasive species that is harmful to these species in an area of important habitat or otherwise.</p> <p><i>c. seriously disrupt the lifecycle (breeding, feeding, migration or nesting behavior) of an ecologically significant proportion of the population of the species.</i> Provided that the recommendations made in this REF are adopted and implemented, it is unlikely that the proposal would seriously disrupt the lifecycle of an ecologically significant proportion of the species.</p>

MATTERS TO BE ADDRESSED	IMPACT (COMMONWEALTH LEGISLATION)
f. does any part of the Proposal involve a Nuclear Action;	No. The project does not include a Nuclear Action.
g. any environmental impact on a Commonwealth Marine Area;	No. There are no Commonwealth Marine Areas within the study area.
h. In addition, any direct or indirect impact on Commonwealth lands	No. The project does not directly or indirectly affect Commonwealth land.

### **Conclusion of EPBC Act Significance Assessment**

It is unlikely that the development will significantly impact on any EPBC Act listed threatened or migratory species, provided that the recommendations made in this REF are adopted and implemented.

In this case, referral to the Commonwealth under the EPBC Act would not be recommended.

## 9.0 Appendix 2 Agency Correspondence



The General Manager  
Wollongong City Council  
PO Box 42  
NOWRA  
NSW 2533

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[www.lands.nsw.gov.au](http://www.lands.nsw.gov.au)

Attention: Ray Massie  
Coasts and Estuaries Enthusiast

Our Ref: 11/12839

Dear Ray

12 October 2012

Thankyou for your advice on the community meeting on 28/9/2012, that discussed the manual entrance opening of Lake Conjola. I note the community preferred option from the meeting is one of mechanical intervention for a mid spit opening at 1.0m AHD if an engineered entrance, substantial dredging campaign or southern opening is not available.

I note the Interim Lake Conjola Entrance Policy options for manual entrance opening are:

- Emergency opening @ 1.2m AHD in the shortest and quickest way possible;
- Low level pre-holiday opening at a level between 0.8 and 1.0 m AHD with moderate to heavy rainfall ongoing or predicted;
- Planned intervention @ 1.0m AHD (stand-by at 0.8m AHD; pilot channel prepared at 0.9m AHD)

In supporting a preferred option Crown Lands has considered the timeliness, cost, persistence of works, and their potential impact of shorebird nests, as noted in the discussion paper provided.

Crown Lands preference is for an opening at the northern site due to the likely persistence of the entrance, and the ability to have a Planned or Emergency opening, the lower cost and time taken in sand removal, and the lesser likelihood of disturbing shorebird nests.

At a mid spit opening site Crown Lands support the Planned intervention option, due to the risks involved with the other 2 options in this location. The large amount of sand which would be required to be moved in an Emergency opening situation may not be physically possible to move due to weather forecasting and anomalies; and a Low level pre-holiday opening is unlikely to persist due to infill and washover, especially if forecast rainfall does not eventuate.

I trust this assists with council's deliberations.

Yours sincerely

Helen Wheeler  
Natural Resource Project Officer

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Crown Lands Division  
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Nowra NSW 2541  
02 44289100  
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# 10.0 Appendix 3 - Entrance Location Data

Council holds data on entrance opening location, cause of closure, ocean storm / washover events and rainfall data. The following information is useful to reveal reasons for closure and to examine whether entrance breaching location affects the duration of openings.

## LAKE CONJOLA ENTRANCE MANAGEMENT - ENTRANCE LOCATION DATA

This discussion paper is a follow-up to the public meeting held in September 2012 to explain the processes influencing management of the lake entrance.

At the public meeting, lake entrance processes that are common to all lake entrances up and down the NSW coast were discussed. The understanding of natural processes is at a high level of confidence for Lake Conjola.

These processes that determine entrance behaviour are summarised as:

- Heavy rainfall that produces runoff is required on a regular basis to flush sand seawards so as to maintain an open entrance.
- Ocean processes naturally favours an inward flow of sand into the lake entrance area.
- Drift of beach sand from south to north provides a plentiful sand supply to the entrance.
- Washover of storm waves across the spit, during severe ocean storms with elevated ocean levels is the main cause of channel choking. This was last seen in June this year and has resulted in closure.

The evidence clearly points to an open entrance through the 1950's, early to mid '60's, most of the 70's and '80's into the late '90's. Recent entrance behaviour, especially in the last 17 or so years has been different. There are good reasons, based on the above processes, why this has occurred. However these behaviours are not related to the entrance location.

Typical behaviour of a lake opening in the south is reported in 1943 which coincided with 631mm of rain. The comments of the day confirm that it took 2 years for the entrance to get to the north side. Contrary to claims that the southern entrance is stable, the natural tendency is for the entrance to meander northwards. The northern location has inherently better protection from wave action and will therefore be more stable.

Typical behaviour of the entrance channels has been well studied. As a case in point the behaviour of the entrance from 1943 to closure in 1957 is as follows:

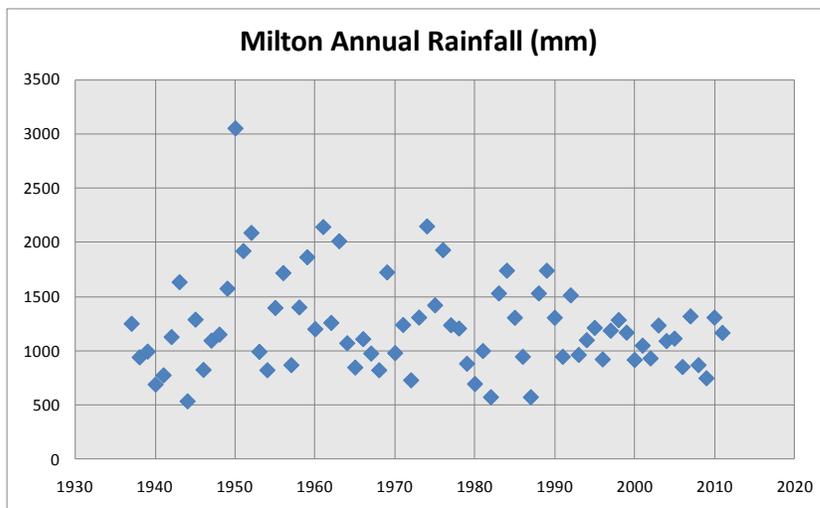
- The entrance was opened at the south side in May 1943. February 1944 aerial shows migration to the north.

- Entrance heavily shoaled by ocean storms in March 1945 but was rejuvenated in the April and June 1945 floods. Migration north in March 1945 aerial. Entrance was stable through 1946 and 1947.
- Entrance almost closed by a major ocean storm in December 1948.
- Wet years in 1949 and 1950 (the wettest year on record with just over 3m of rainfall) scoured a wider channel. The entrance was kept open by more wet years in 1951, 1952 and 1953.
- A major ocean storm in February 1954 again shoaled the entrance but it remained open to be rejuvenated again in heavy rain over 1955 and 1956.
- Entrance finally closed after a heavy ocean storm in August 1957.

Clearly the balances between the rainfall outputs and the ocean storm and washover inputs over this period have determined how long the entrance remained open. If the rainfall or ocean storm timing had been different at vulnerable periods such as 1945, there would have been different outcomes. The longevity of the 1943 southern opening has no relationship to the intervention location.

The 1998 lake opening in the south side is often quoted to demonstrate how stable a southern opening can be. Yet the 1998 opening in August was followed up by 400mm of rain and a flood. Furthermore, in 1999 Council undertook a major dredging program, removing 8,500 cubic metres of sand from the entrance. Not surprisingly the entrance remained open with these follow-up events that both cleared the channel. It would have remained open regardless of the opening location.

So what has been different about the last 17 years or so that has required intervention more frequently? The simple answer is a shift in balance between the rainfall outputs and the ocean process inputs. **Figure 1** clearly shows a decrease in annual rainfall after 1992. Flood-producing rainfalls are critical to keeping the entrance scoured, and these have been far less frequent in recent decades.



**FigureA1 Annual Rainfall at Milton 1937 to present**

The suggestion was made at the September 2012 public meeting that a southern opening can last longer than other locations. A set of statistics were provided to council after the meeting to support this assertion that a southern opening lasts longer than a northern opening.

When we look at the occurrence and severity of ocean storms the true reasons for this past behaviour is clear. **Figure 2** shows the years since 1937 that have experienced an ocean storm, with a vertical scale an indicative measure of storm severity. The 16 year period 1978 to 1994 saw 6 years with ocean storms. The more recent 17 years from 1994 to 2011 has seen 9 years with ocean storms, including some severe events with elevated ocean levels that overtopped the spit. Ocean storms alone do not cause closure. However, if accompanied by elevated ocean levels, a washover event overtopping the spit will add significant volumes of sand to the entrance. This leads to closure as last seen in June 2012.

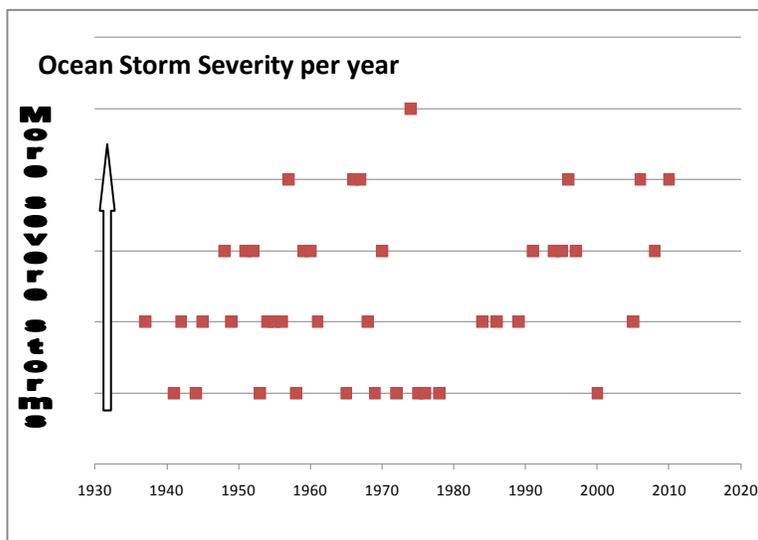


Figure A2 Ocean Storm Severity at Lake Conjola Entrance 1937 to present

### LAKE CONJOLA ENTRANCE MANAGEMENT - OPERATIONAL ISSUES

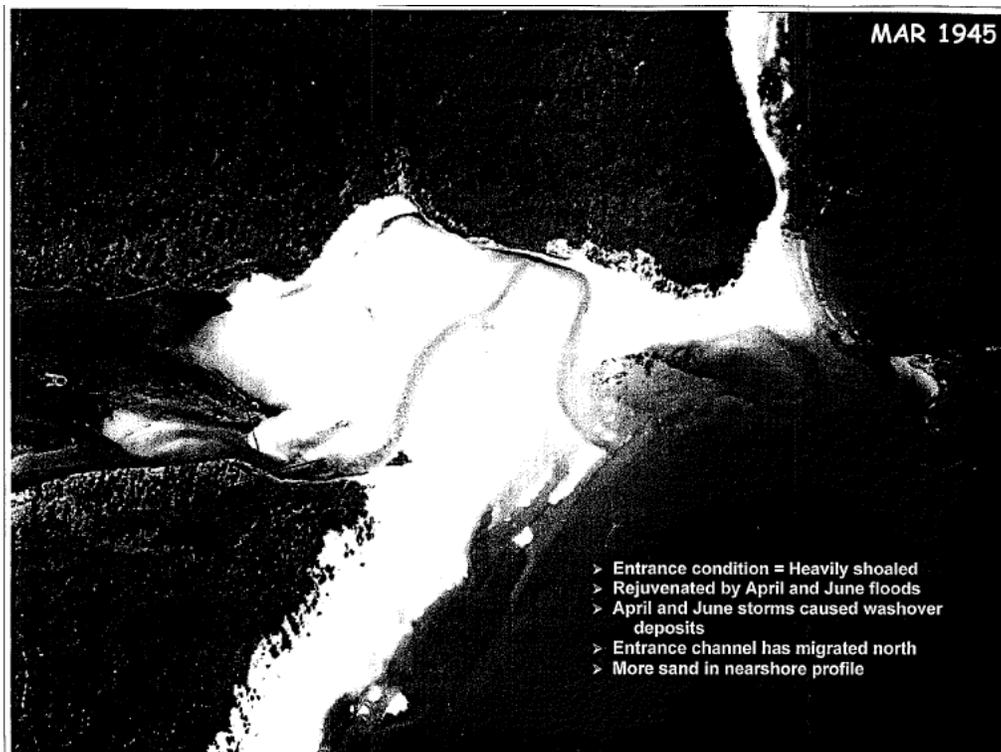
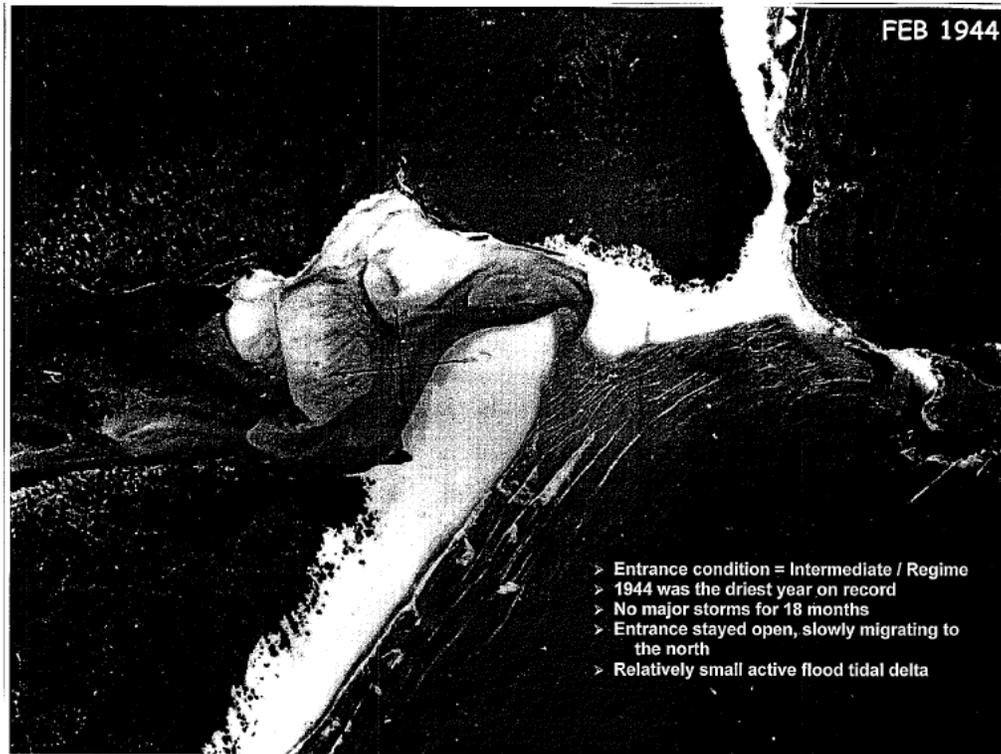
The practicality of having up to three potential entrance intervention strategies on standby involves considerable operational difficulties. Considering that:

- Bureau of Meteorology rainfall models provide 7 days outlook;
- BoM 4 days maps give improved accuracy allowing contractors notification;
- Manly Hydraulics Laboratory give real time advice.

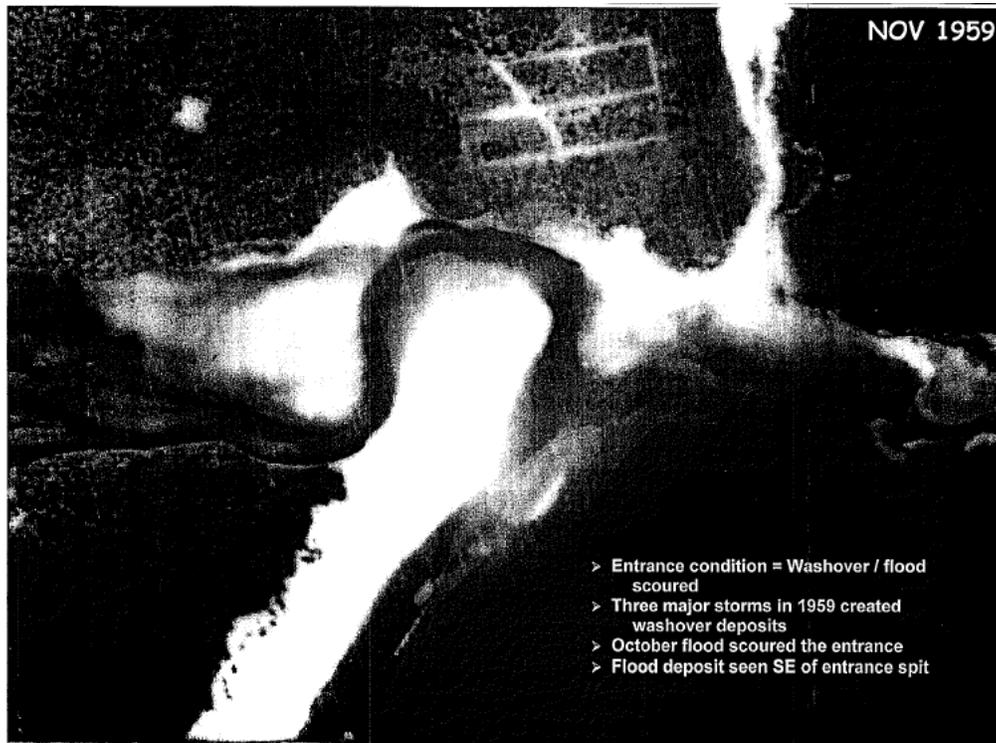
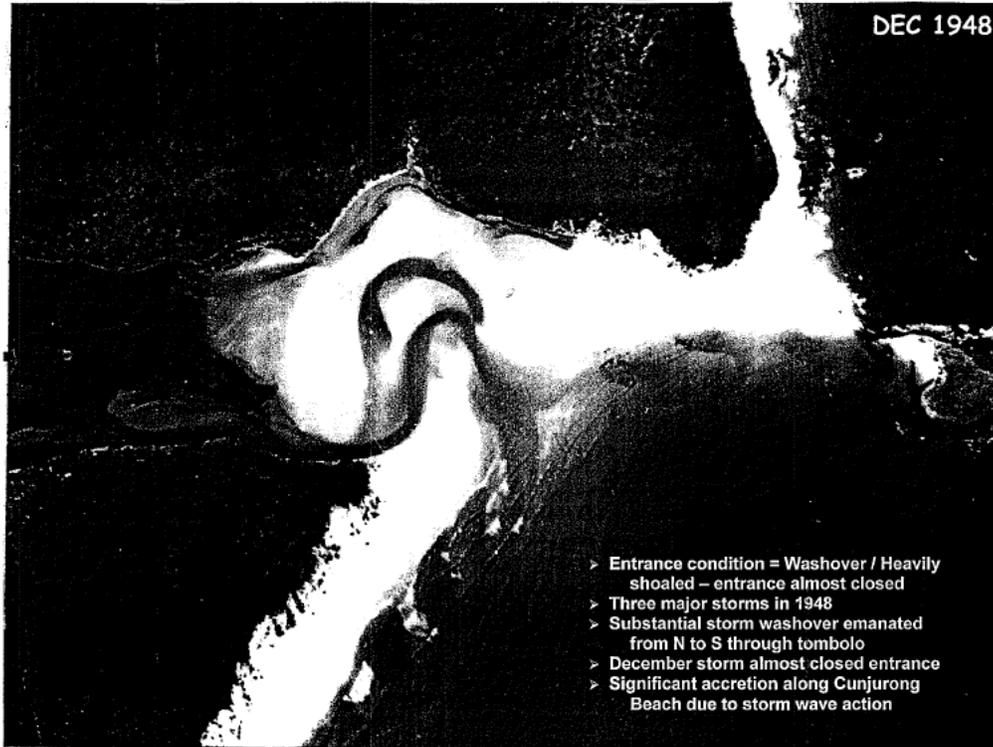
This means that under ideal circumstances with predictable rainfall, there are 3 days of operation response time.

At an achievable rate of some 3,000m<sup>3</sup> excavation over 3 days (20 tonne excavator and two articulated dump trucks), the north or modified mid-spit options are attainable in volumetric terms before flooding around the village becomes an issue.

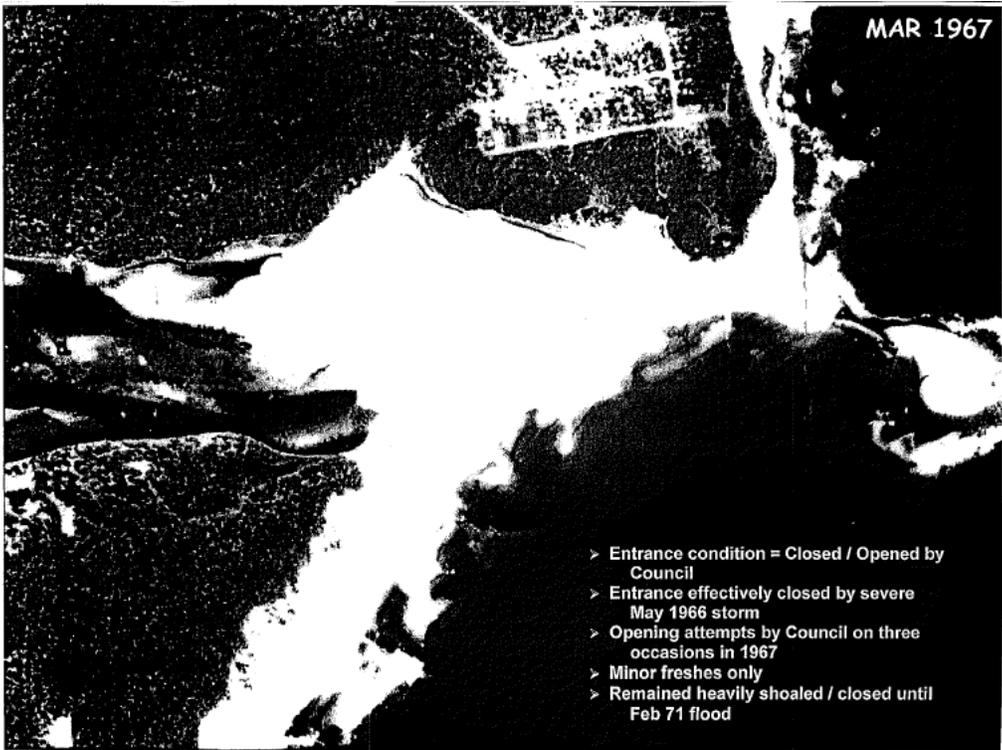
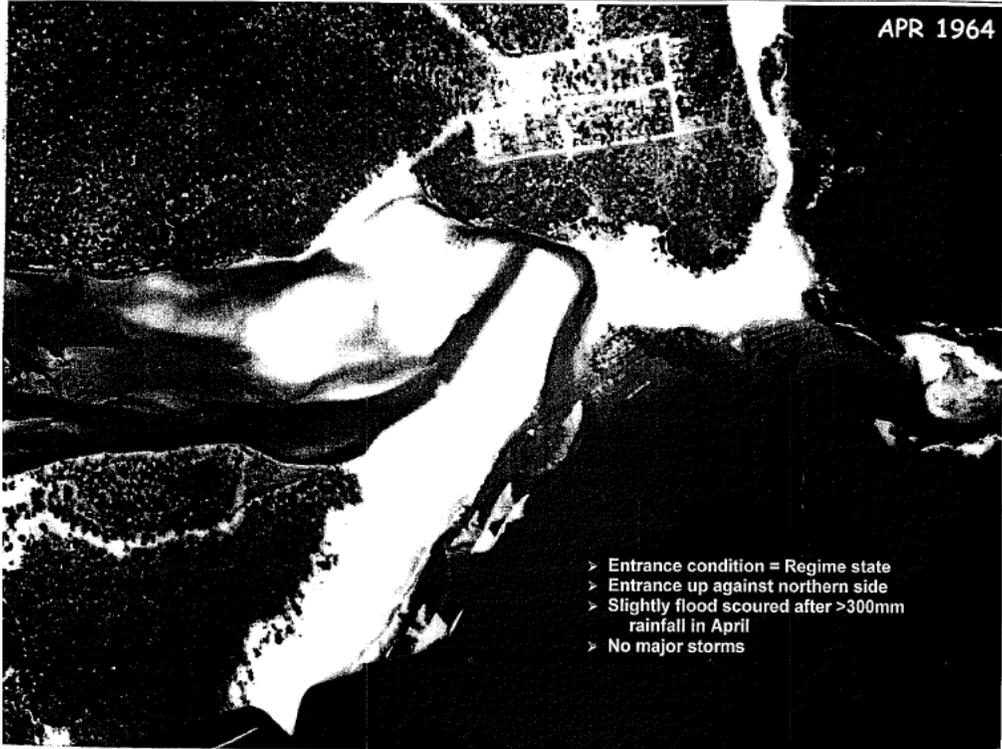
HISTORICAL AERIAL PHOTOGRAPHY



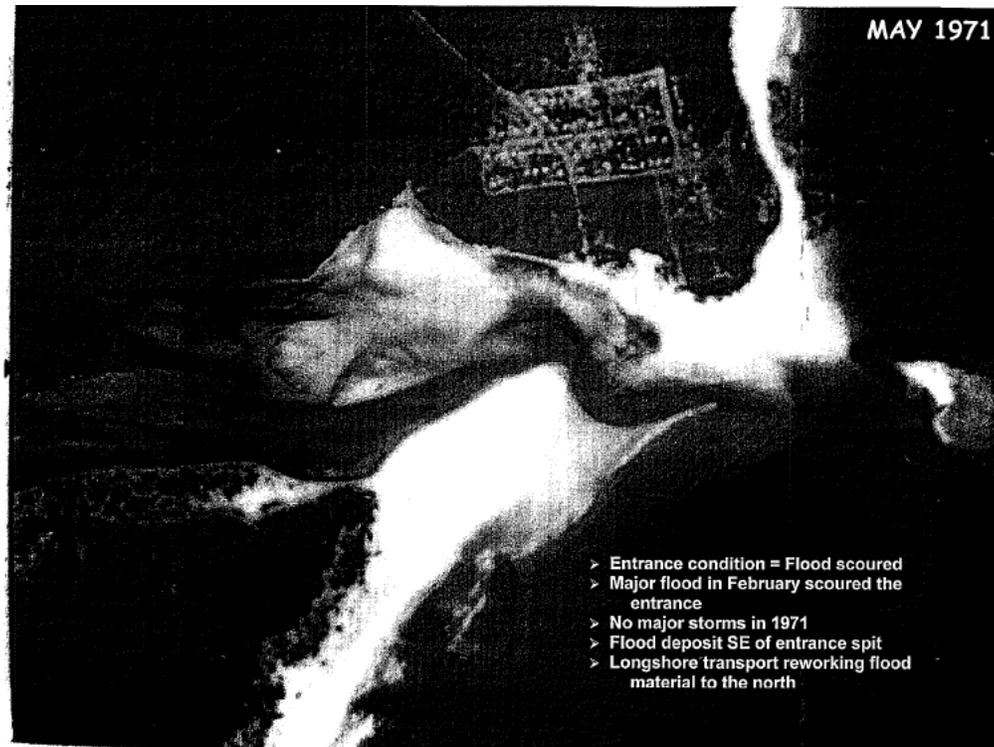
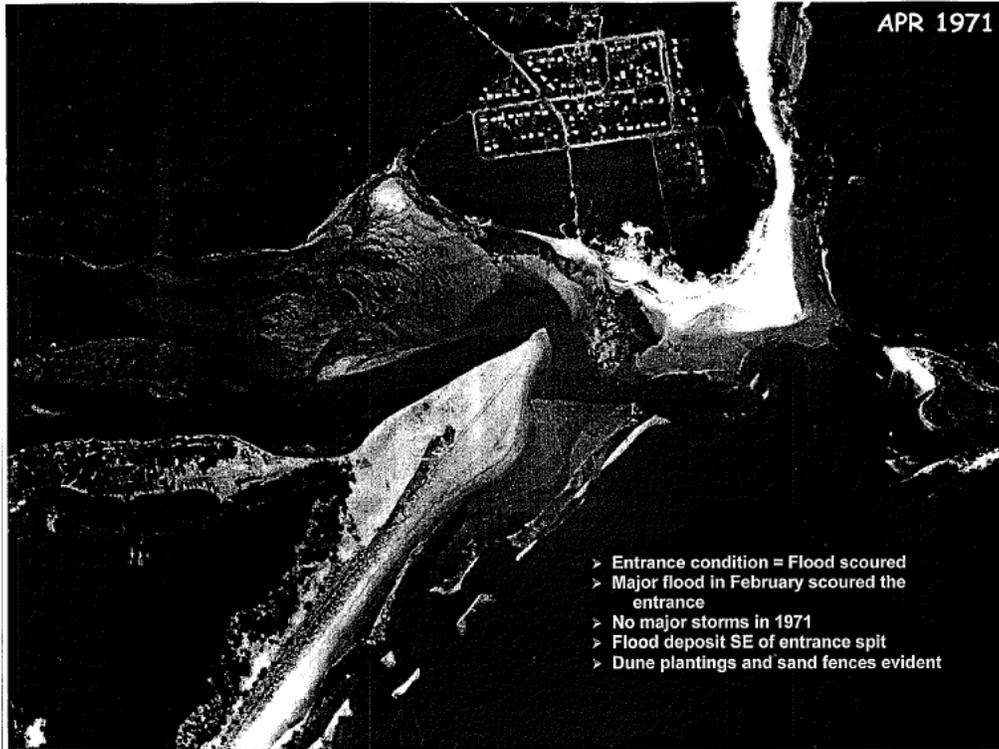
Source: Patterson Britton 1999



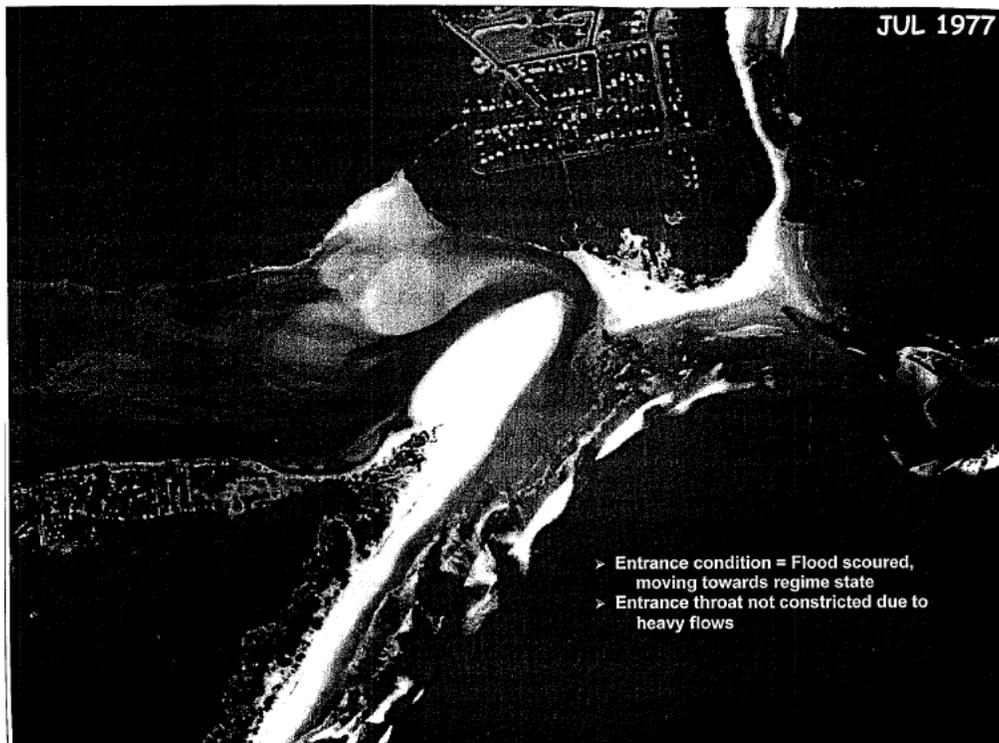
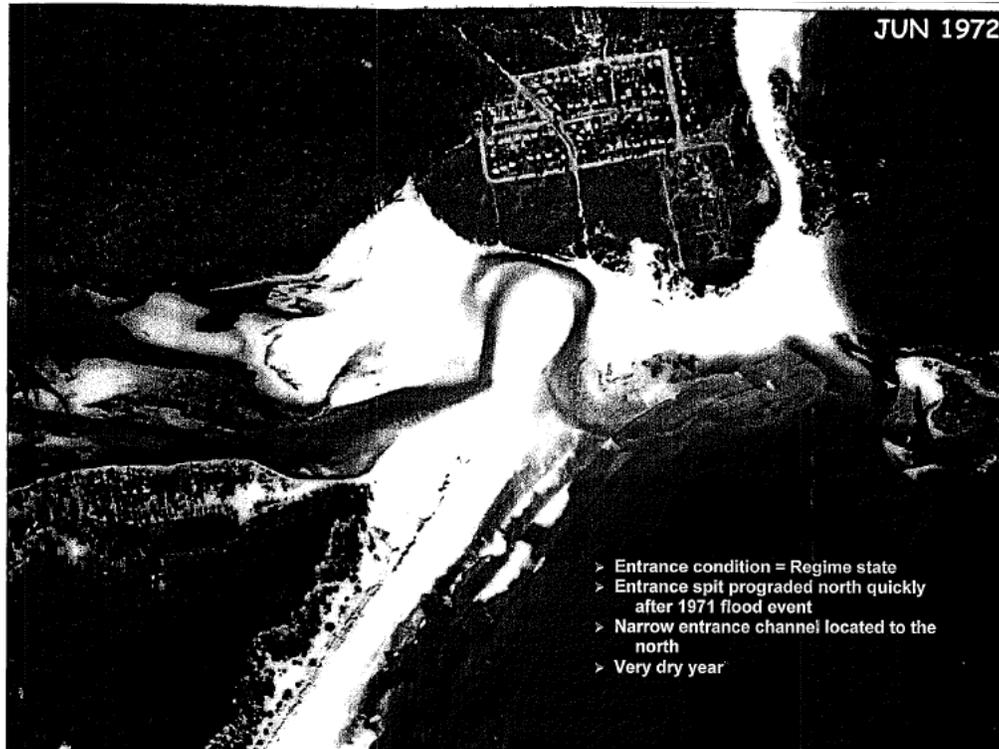
Source: Patterson Britton 1999



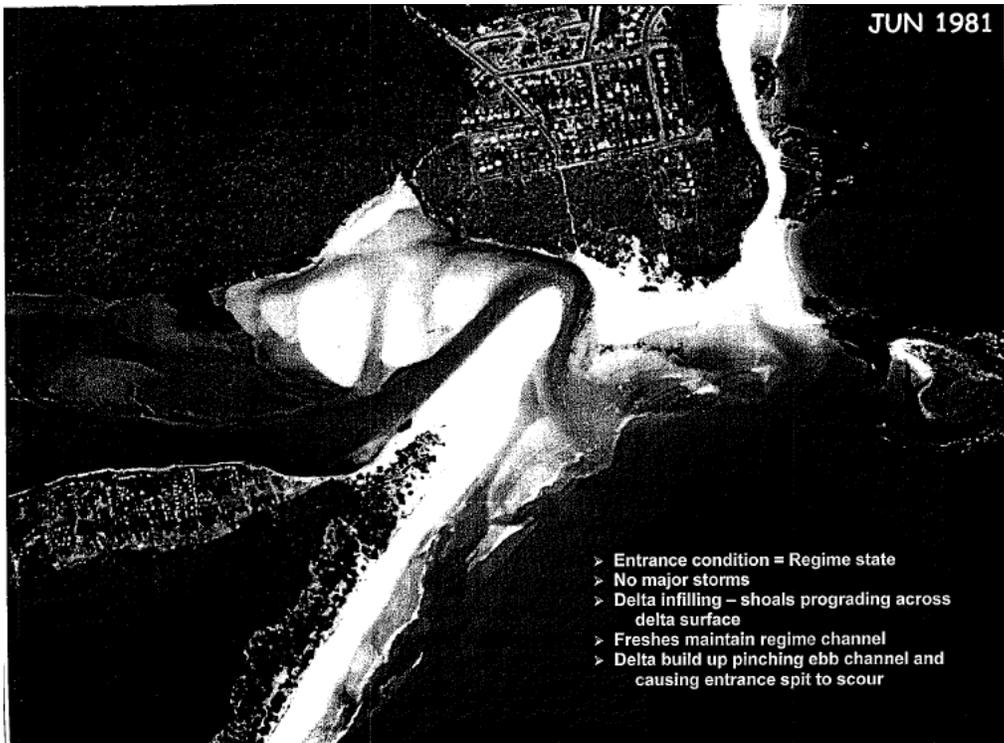
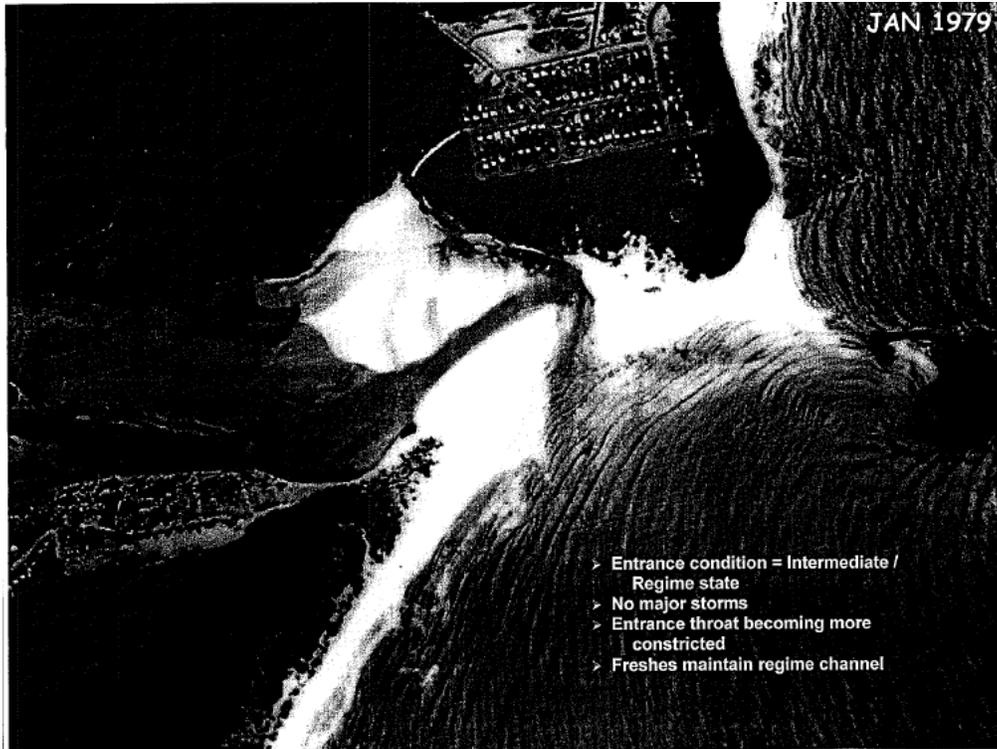
Source: Patterson Britton 1999



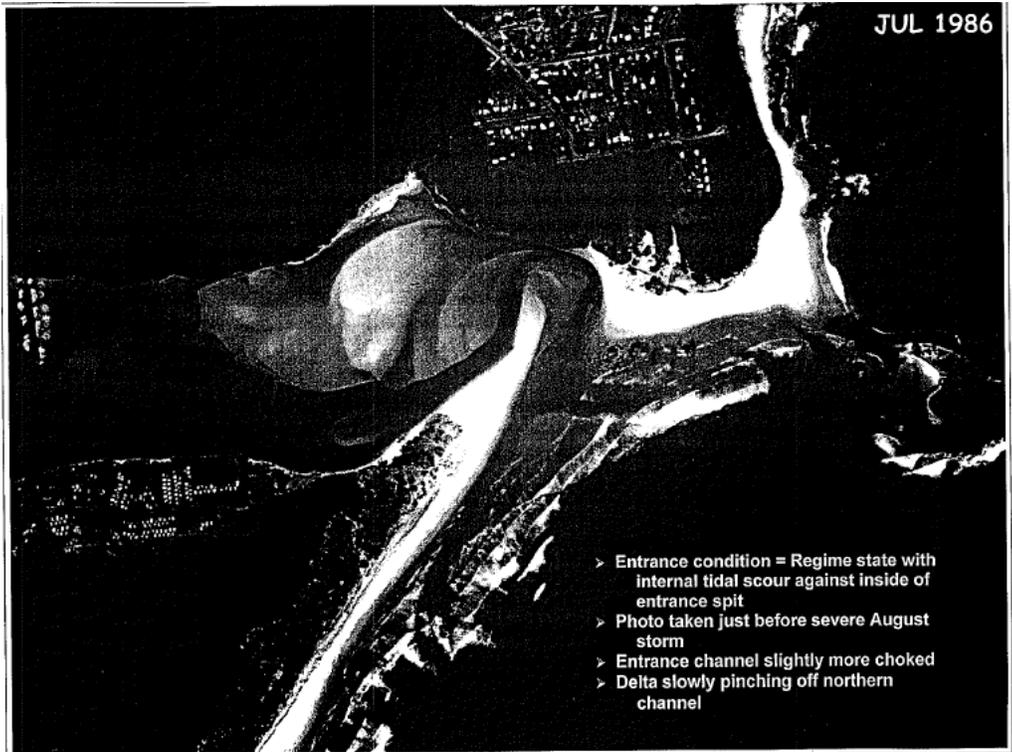
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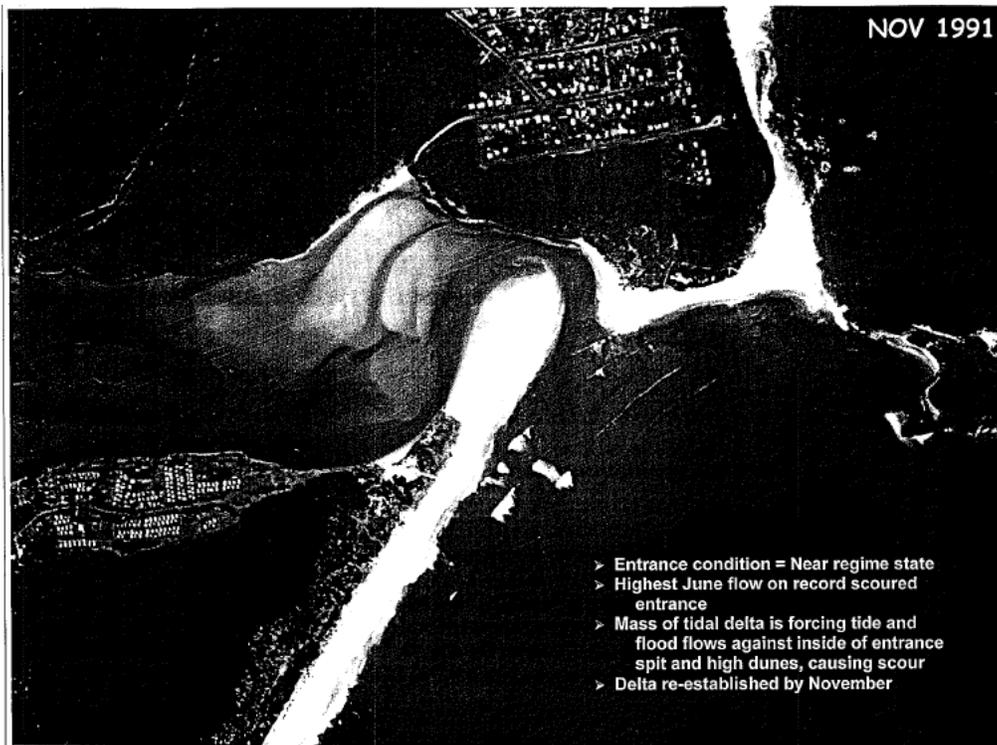
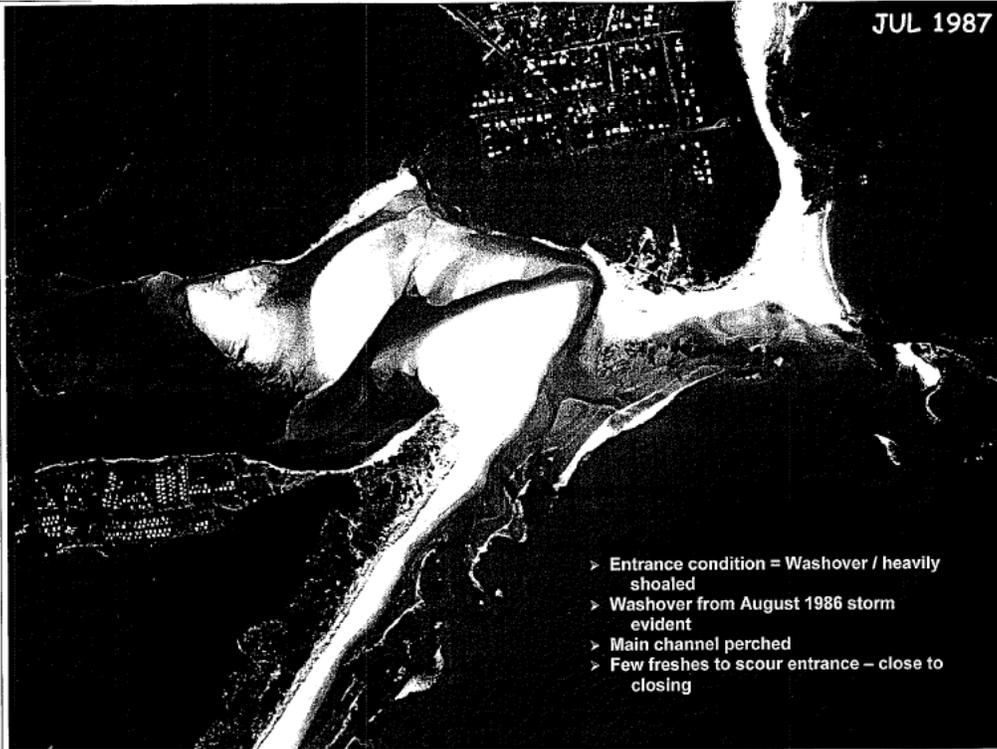
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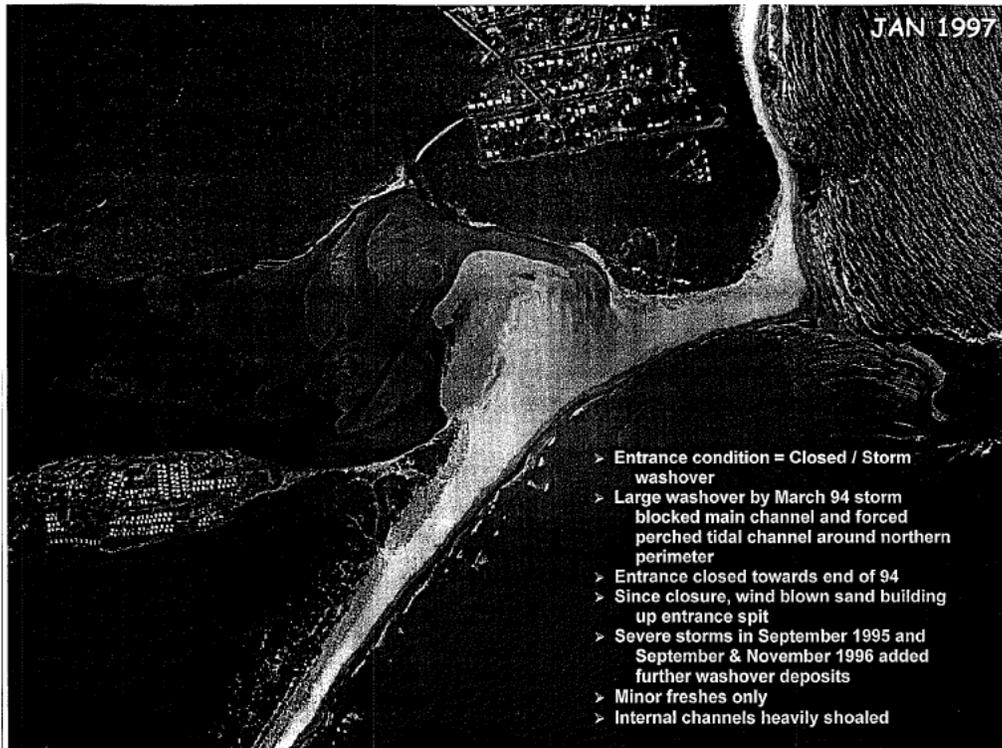
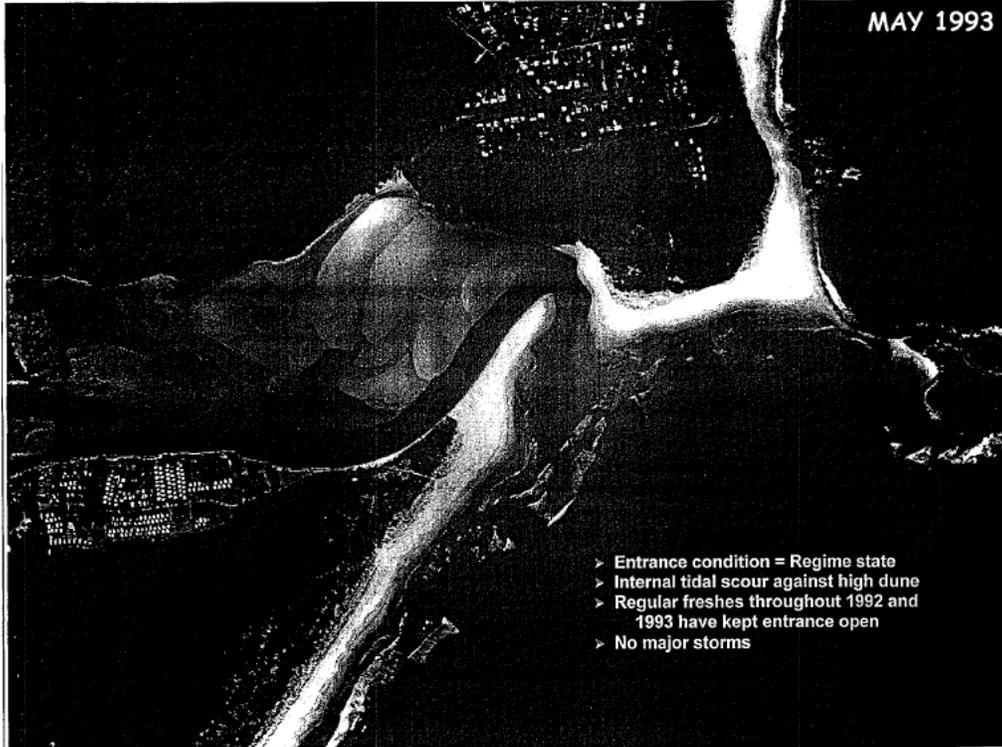
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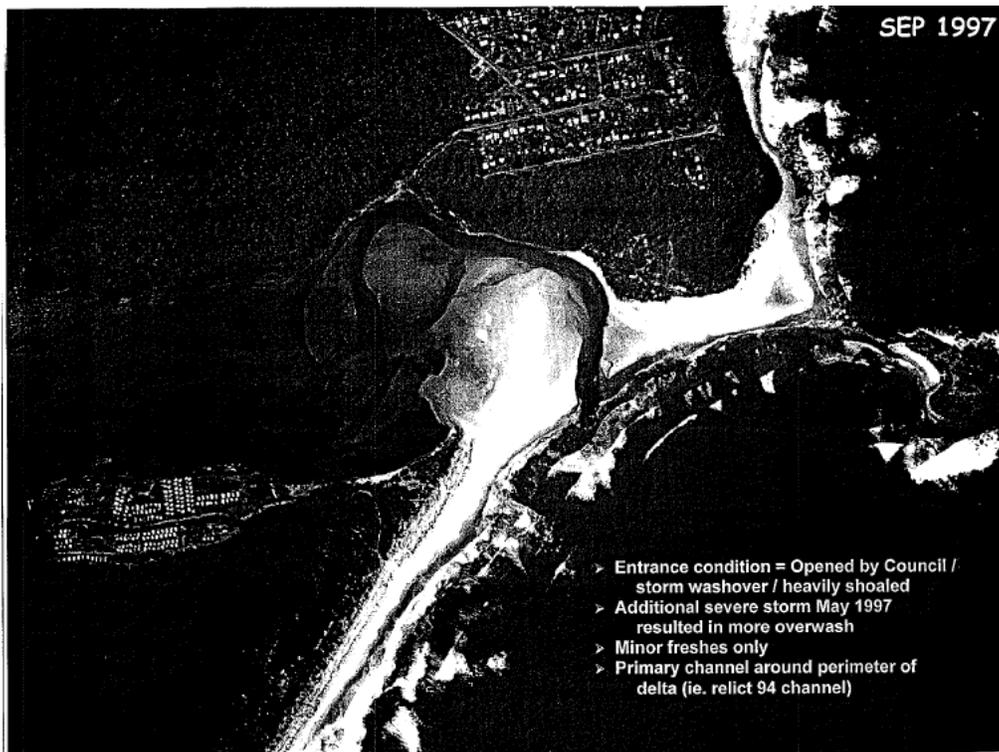
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Source: Patterson Britton 1999



Source: Patterson Britton 1999



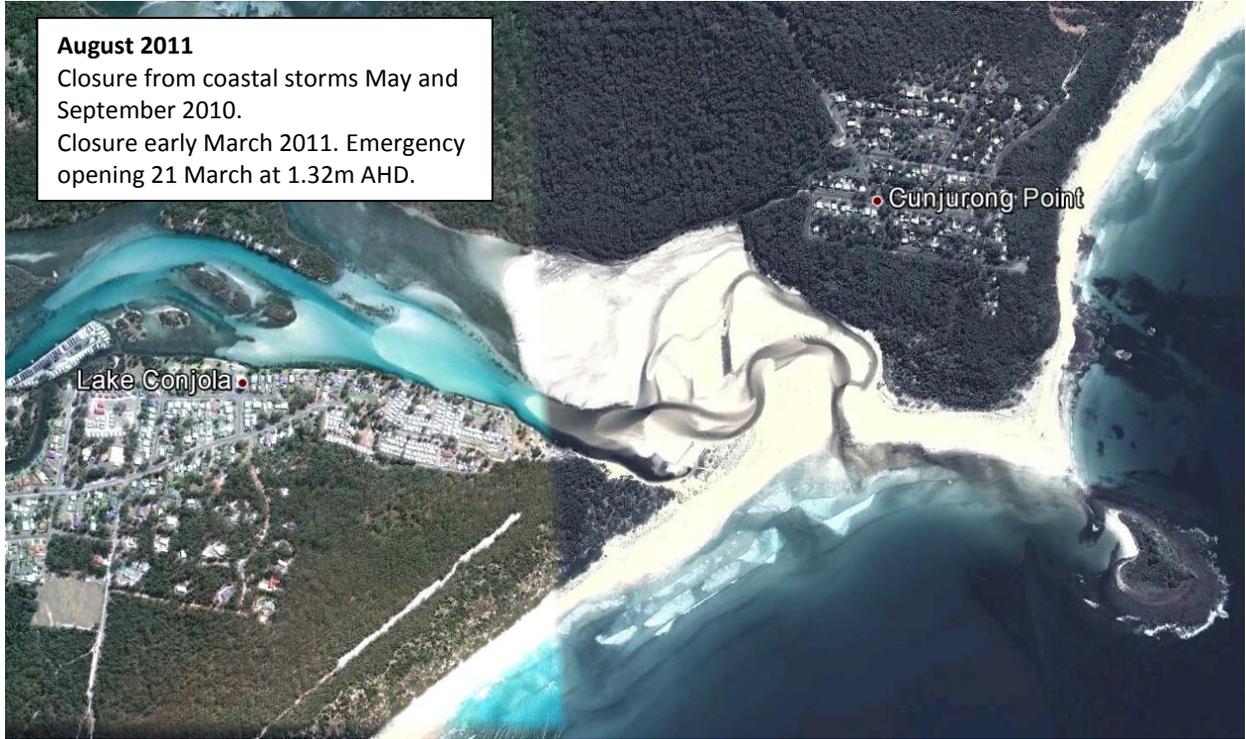
Source: Patterson Britton 1999



Source: Google Maps



Source: Google Maps



Source: Google Maps



1. Source: <http://www.nearmap.com/>

**APPENDIX B: SHOALHAVEN CITY COUNCIL RESOLUTION MIN19.51**

**FOR ACTION**

**DEVELOPMENT & ENVIRONMENT COMMITTEE**

**05/02/2019**

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**Subject:** Lake Conjola Opening - make representations - open entrance - recommendation - Community Consultative Body  
**Target Date:** 07/03/2019  
**Notes:**  
**HPERM**  
**Reference**  
**Related Report**  
**Item Number** DE19.8

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**DE19.8 Lake Conjola Opening**

Note: Clr Digiglio and Clr Gartner left the meeting, the time being 6.08pm.

**RESOLVED** (Clr White / Clr Proudfoot)

**MIN19.51**

That Council make urgent representations to the relevant agencies for approval to remove the “channel plug” and the entrance opened at Lake Conjola to relieve the flooding that has been affecting residents and foreshore areas for over 7 weeks and in accordance with the recommendation from the Lake Conjola Community Consultative Body.

**FOR:** Clr Gash, Clr White, Clr Wells, Clr Guile, Clr Pakes, Clr Watson, Clr Kitchener and Clr Proudfoot

**AGAINST:** Clr Levett and Mr Pigg

**CARRIED**

**APPENDIX C: SHOALHAVEN CITY COUNCIL RESOLUTION MIN19.143**

**FOR ACTION**

**ORDINARY MEETING**

**26/03/2019**

**Subject:** Mayoral Minute - Lake Conjola - Entrance Opening - Dry notch -  
ICOLL listing - Marine life deaths / Lead levels - Old Waste Depot -  
Safety audit - Coastal Man Plan - CCB GIPA - Policy

**Target Date:** 25/04/2019

**Notes:** Please advise Governance if additional action sheets need to be  
created. Part 9 will be actioned by Sara McMahon

**HPERM** 50252E

**Reference**

**Related Report** D19/88545

**Item Number** MM19.4

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**FORESHADOWED MOTION RESOLVED** (Clr Pakes / Clr White)

MIN19.143

That Council

1. Make further representations to the relevant agencies for approval to open the entrance of Lake Conjola on the following grounds:-
  - a. To minimise risk to public safety associated with excessive inundation of foreshores and infrastructure as a result of low level flooding that has been affecting residents and foreshore areas for more than 3 months.
  - b. In accordance with the recommendation from residents and community members at the Lake Conjola Community CCB Meeting 21 January 2019.
  - c. In-line with the Interim Entrance Management Plan:-
    - i. On the planned openings prior to Christmas and Easter holiday trigger levels.
    - ii. Social, mental and physical impact and wellbeing of residents and tourists including events that occurred over last 3 months
  - d. The continued threat of weather i.e. heavy rain from storms and capacity of contractor's timeframes and safety to open the entrance in an emergency
2. Continue to make ongoing representations to the relevant agencies for approval to open the entrance at Lake Conjola in accordance with Item 1 above until such opening has occurred.
3. Seek approval from the NSW Government Ministers of Crown Lands, Office Environment and Heritage and Department of Primary Industries (Fisheries) to immediately prepare and maintain a "dry notch" at the entrance to Lake Conjola to allow "break out" of the lake

should flooding occur. This is to be maintained until a new Coastal Management Plan is approved by the Minister.

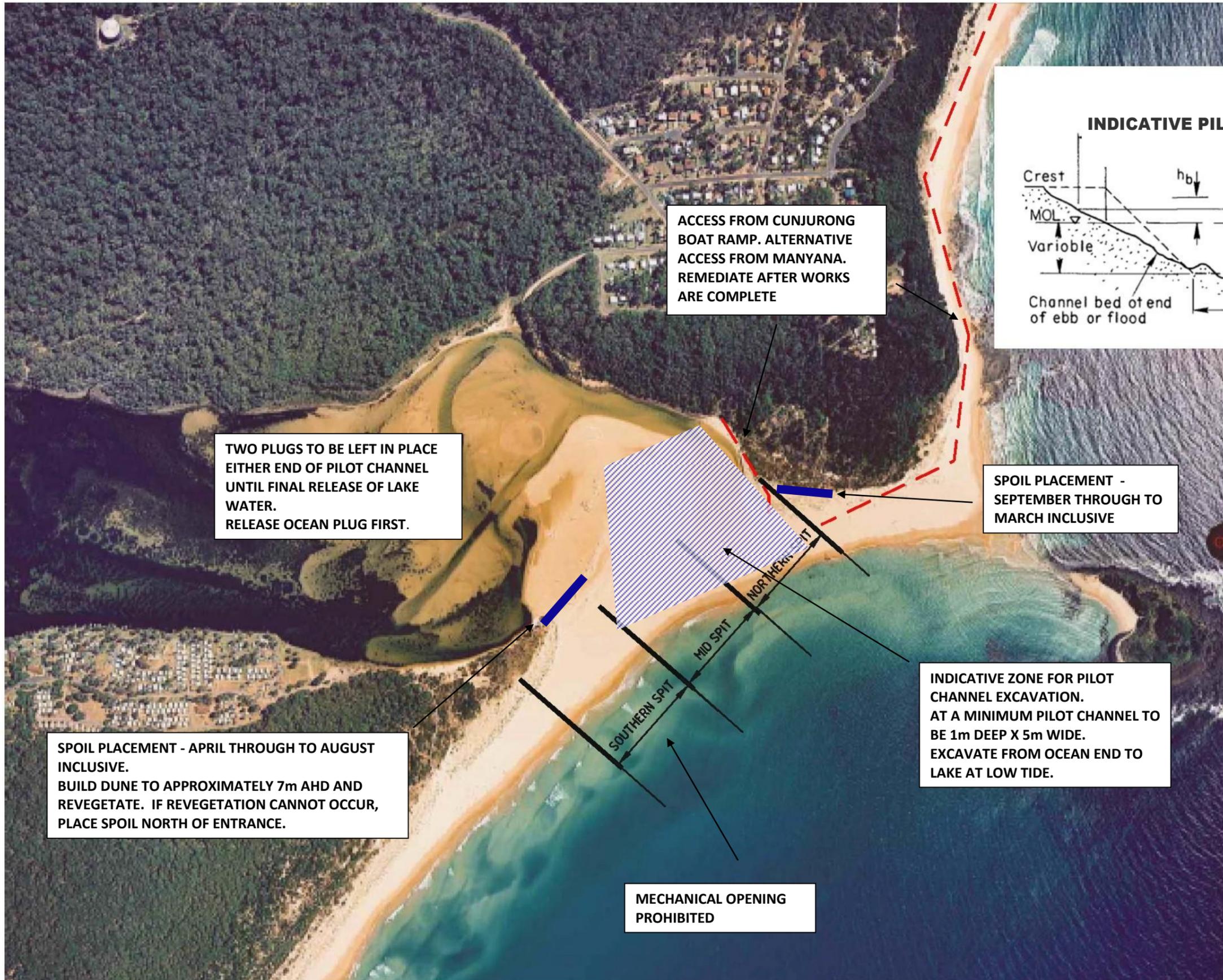
4. Write to the Minister for Crown Lands & Office of Environment & Heritage requesting that an investigation be undertaken immediately to establish how and why Lake Conjola was listed as an "ICOLL" and not a Wave Dominated Barrier Estuary (WDBE).
5. Write to Department of Fisheries and request Fisheries to investigate:
  - a. All current, ongoing and future fish and marine life deaths/kills and sea grass kills in Lake Conjola
  - b. The amount of Lead in the Lake from lost lead from over a century of recreational fishing by testing water, fish and marine life species in Lake Conjola and the sands beds of the Lake with the lake closed and not being subject to two tidal interchanges per 24 hours, is this lead building up in the water column and the food chain.
6. Report back to Council with a proposed plan and costings to undertake investigations for contamination at the old Waste Depot at Lake Conjola. Such investigations to include:-
  - a. Water samples in Pattimores lagoon, land run off water, Ground water. Take soil core samples. Take into consideration that many residents use bore water to water their gardens, vegetable gardens and fruit trees.
  - b. Contaminations including asbestos, industrial liquids, insecticides.
  - c. Seek information from Local residents on knowledge of what was dumped at the site from the original opening.
7. Request the General Manager (or his delegate) to continue to audit the safety of Council assets at Lake Conjola and undertaken any works or signage that maybe necessary. This report to include an investigation of the condition of "Steps" over Lake Revetment walls created by Council on the Council reserve in front of the Lake Conjola Liquor Store and to the east towards Deep Water Resort to be repaired, cleaned and maintained by council.
8. Report timeframe and priority status for preparation of Coastal Management Plan for Lake Conjola to Council.
9. Report back to Council at the Strategy & Assets meeting in April on reasons for:
  - a. Not providing the CCB Executive with copies of documentation in relation to Lake Conjola requested over the last 9 months.
  - b. How Council can facilitate the requests from the CCB Executive for copies of documentation.
10. Provide monthly update reports to Councillors on all issues concerning Lake Conjola.
11. Formerly resolve as policy to continue to support and advocate for residents and community members at Lake Conjola on all issues pertaining to opening the entrance, flooding and erosion at Lake Conjola.

FOR: Clr Gash, Clr Wells, Clr White, Clr Alldrick, Clr Guile, Clr Pakes, Clr Watson, Clr Kitchener and Clr Proudfoot

AGAINST: Clr Findley, Clr Gartner, Clr Digiglio and Clr Levett

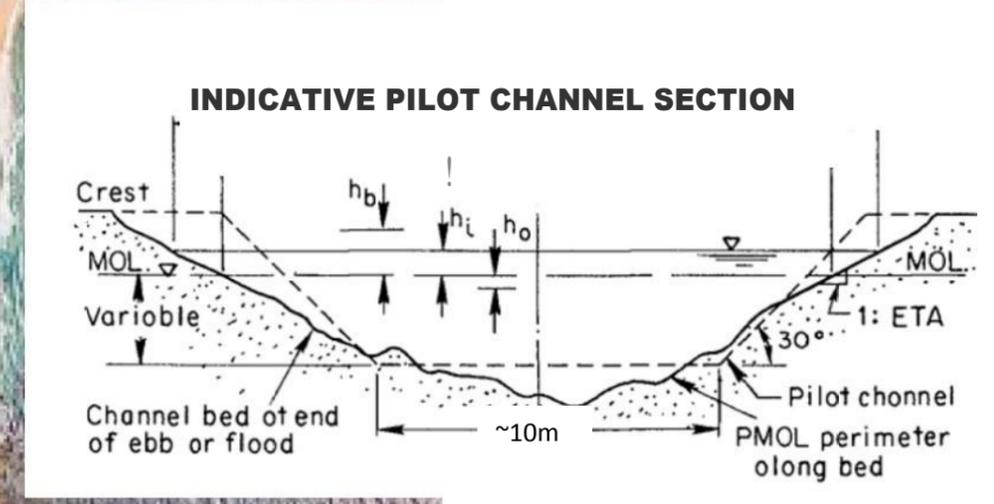
CARRIED

**APPENDIX D: LAKE CONJOLA ENTRANCE MANAGEMENT PLAN: OPERATING  
DETAILS – ENTRANCE OPENING**



ACCESS FROM CUNJURONG BOAT RAMP. ALTERNATIVE ACCESS FROM MANYANA. REMEDIATE AFTER WORKS ARE COMPLETE

TWO PLUGS TO BE LEFT IN PLACE EITHER END OF PILOT CHANNEL UNTIL FINAL RELEASE OF LAKE WATER. RELEASE OCEAN PLUG FIRST.



SPOIL PLACEMENT - SEPTEMBER THROUGH TO MARCH INCLUSIVE

INDICATIVE ZONE FOR PILOT CHANNEL EXCAVATION. AT A MINIMUM PILOT CHANNEL TO BE 1m DEEP X 5m WIDE. EXCAVATE FROM OCEAN END TO LAKE AT LOW TIDE.

SPOIL PLACEMENT - APRIL THROUGH TO AUGUST INCLUSIVE. BUILD DUNE TO APPROXIMATELY 7m AHD AND REVEGETATE. IF REVEGETATION CANNOT OCCUR, PLACE SPOIL NORTH OF ENTRANCE.

MECHANICAL OPENING PROHIBITED

FINAL

NO.	REVISION	DESCRIPTION
1	REVISED	description

Shoalhaven City Council  
 Lake Conjola Entrance Management Plan  
 Operational Details  
 Entrance Opening



scale INTS for A3  
 date October 2013

approved (PS) ..... SK001

NOTE: PILOT CHANNEL DIMENSIONS WILL CHANGE DEPENDING ON LEVEL OF BERM AT TIME OF EXCAVATION