

# Review of Environmental Factors: Tallow Creek Entrance Opening – Vol. 1

Reference: R.B20347.003.02.docx Date: October 2015

# Review of Environmental Factors: Tallow Creek Entrance Opening – Vol. 1

Prepared for: Byron Shire Council

Prepared by: BMT WBM Pty Ltd (Member of the BMT group of companies)

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	Document:	R.B20347.003.02.docx	
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Synopsis: This report presents a Review of Environmental Factors (REF) for the openir the Tallow Creek entrance to manage flood levels and/or water quality within Tallow Creek catchment, in accordance with the Management Plan provided within Council's Tallow Creek Floodplain Risk Management Study and Plan. Volume 1 contains the REF text, while Volume 2 contains supporting materia to the REF, such as predating correspondence and reports.			

#### **REVISION/CHECKING HISTORY**

Revision Number	Date	Checked by		Issued by	
0	28 <sup>th</sup> April 2015	J. Visser		D. Cavanagh	
1	9 <sup>th</sup> June 2015	J. Visser		D. Cavanagh	
2	9 October 2015	J. Visser	The	D. Cavanagh	Damiai Garman

#### DISTRIBUTION

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# **1** Brief Description of the Proposed Activity

### 1.1 Description of Proposed Activity

The proposed activity involves limited and infrequent sand relocation at the beach berm of Tallow Creek to allow waters within Tallow Creek to drain to the ocean.

The proposed artificial opening of Tallow Creek is for the prevention of potential flooding and/or adverse health risks arising to the residents of Suffolk Park from the elevated waters within Tallow Creek.

The proposed opening is to occur consistent with the triggers provided in the Byron Shire Council Tallow Creek Floodplain Risk Management Study and Plan, for the duration of that Management Plan (SKM, 2009).

The proposed entrance management is to be undertaken in consultation with OEH/NPWS and other experts, as required, to manage the potential impacts of moving machinery to the site and relocating sand to allow flood waters to drain.

### 1.2 Estimated Commencement Date

The commencement date(s) for the proposed activity will vary and be in response to water levels and health risks. The proposed activity will be undertaken within 1 to 3 days after the flood height or water quality trigger levels have been reached or exceeded as identified in the Floodplain Risk Management Study and Plan.

### **1.3 Estimated Completion Date**

The works will be completed on the same day as commencement. It is estimated that the works will take approximately 1 to 3 hours to complete. The approval is sought for the period of the Management Plan in the Floodplain Risk Management Study and Plan, until such time as the Final Management Strategy and Plan is developed and approved.



# 2 **Proponent Details**

The proponent's details are provided in Table 2-1.

#### Table 2-1Proponent Details

Name	Mr	Given name: James
	Surname: Flockton	
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ACN /ABN	ACN:	ABN: 14 472 131 473
(if applicable)		
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numbers		
Fax and Email	Fax: 02 6684 3018	Email: james.flockton@byron.nsw.gov.au



## 3 Permissibility

In accordance with the Office of Environment and Heritage (OEH) Proponent Guidelines for the Review of Environmental Factors (REF), the REF must consider the legal permissibility of the proposed works in relation to national parks, threatened species and environmental legislation, including planning instruments, as well as with OEH policy.

### 3.1 Legal Permissibility

Legal permissibility has been considered with regard to the following legislation as required by the 'Proponents Guidelines for the Review of Environmental Factors':

- National Parks and Wildlife Act 1974 (NPW Act);
- Marine Parks Act 1997 (MP Act);
- Environmental Planning and Assessment Act 1979 (EP&A Act), including environmental planning instruments (EPIs);
- Threatened Species Conservation Act 1995 (TSC Act);
- Fisheries Management Act 1994;
- Water Management Act 2000; and
- Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

As noted in OEH guideline, whether an activity is permissible under relevant legislation, in the most part relates to the consistency of the activity with the objectives of the relevant legislation, and the ability of the activity to be undertaken subject to a licence or exemption under the instrument.

#### 3.1.1 National Parks and Wildlife Act 1974

Permissibility under the NPW Act relates to (where relevant):

- Consistency with the objects of the NPW Act (s2A);
- Consistency with the reserve management principles (s30E-30K);
- · Consistency with the title and relevant sections of a plan of management; and
- Availability of a leasing, licencing or easement arrangement for the project under Part 12.

As the Byron Shire Council is seeking to conduct the works in accordance with a licence issued under Part 12, all of the above are relevant. Additionally, the Arakwal National Park is governed by the *Arakwal National Park Plan of Management*. This section outlines how the Project meets each of the above requirements.



The Project is regarded as consistent with the objects of the NPW Act (s2A), as presented below.

NPW s2A Objects	Response
<ul> <li>(a) the conservation of nature, including, but not limited to, the conservation of:</li> <li>(i) habitat, ecosystems and ecosystem processes, and</li> <li>(ii) biological diversity at the community, species and genetic levels, and</li> </ul>	Within the direct project disturbance area (i.e. the beach), the key environmental values are migratory and resident shorebirds that use the beach/dunes for roosting and feeding, and other beach fauna (e.g. infauna). Tallow Creek provides habitat values for aquatic species (e.g. fish) and for riparian ecosystems. These ecosystems include wetland areas, bordering onto woodland communities.
<ul> <li>(iii) landforms of significance, including geological processes, and</li> <li>(iv) landscapes and natural features of significance including wilderness and wild</li> </ul>	The key impact from the Project will be from the direct disturbance caused by movement of equipment and the actual excavation at the Tallow Creek mouth. This could disturb fauna utilising the beach (e.g. shorebirds, waders) especially if excavation occurs during migratory bird season (October to March). Excavation will also leave a temporary channel and stockpile of sand.
rivers	Opening the creek based on a water level trigger of 2.2m AHD will reduce the frequency that areas above this level will be inundated. Breakthroughs are believed to naturally occur between 1.8mAHD to a theoretical upper limit of 3m AHD, with most breakouts occurring below 2.2 m AHD. Therefore, habitat above 2.2m AHD may change from wetland/water- based ecosystem to drier, woodland based ecosystems. This will result in the movement of existing vegetation type boundaries in the order of metres, however, and is likely to be a small impact only.
	The artificial opening of Tallow Creek will also lead to more frequent flushing which will cause temporary changes in local hydrology and water quality for the creek.
	In considering these impacts, mitigation measures that will be adopted are:
	<ul> <li>use of a small excavator (no more than 5 tonne) for beach excavation</li> </ul>
	<ul> <li>minimisation of the 'trench' to be dug for the artificial opening</li> </ul>
	<ul> <li>placement of excavated sand within the active coastal zone</li> </ul>
	<ul> <li>opening of Tallow Creek only where a level of 2.2m AHD is met or likely to be met</li> </ul>
	It is also intended that works will occur in accordance with an Environmental Management Plan (EMP).
	The residual impacts after these measures are unlikely to be significant. Seven Part Tests conducted by BMT WBM (2013b) have identified that no significant impact is expected for any local population of threatened species or ecological communities. In addition, the active nature of the coastal and riverine environment in the Project Area is likely to ensure any geomorphological and hydrological changes caused by the artificial opening will be temporary.
<ul> <li>(b) the conservation of objects, places or features (including biological diversity) of cultural value within the landscape, including, but not limited to: <ul> <li>(i) places, objects and features of significance to Aboriginal people, and</li> <li>(ii) places of social value to the</li> </ul> </li> </ul>	Cultural heritage values have been identified by the Arakwal people for the entire area of Tallow Lake, Creek and Beach. This area is an important cultural landscape for the Arakwal, representing more than 100 years of use for social, recreational and cultural activities, as well as the location of a former Reserve and homes of the elders. The project area (where the work will take place) does not contain any objects or items of Aboriginal cultural heritage, however it is an



NP	W s2A Objects	Response
	people of New South Wales, and (iii) places of historic, architectural or scientific significance	intrinsic part of the larger cultural landscape. The likely impacts on cultural heritage values caused by the project will be minor as there are no known items of heritage significance within the project area and a very low likelihood that works would reveal any subsurface items.
(c)	fostering public appreciation, understanding and enjoyment of nature and cultural heritage and their conservation	As noted above, the artificial opening of Tallow Creek demonstrates an approach to management of local environmental issues that is sensitive to the conservation of nature and cultural heritage. Public appreciation values in the area relate primarily to heritage as well as recreational and aesthetic values. Careful management of the opening through the methods identified above will ensure these values and general public appreciation for the area will not be significantly or permanently impacted.
(d)	providing for the management of land reserved under this Act in accordance with the management principles applicable for each type of reservation	See below.

#### Consistency with the reserve management principles (s30E-30K)

As stated in a letter received from the OEH dated 26<sup>th</sup> June 2014 (Ref. 10/3560),

"the proposed opening of Tallow Creek is consistent with the stated Management Principles listed at Section 30E of the NPW Act, including the conservation of places, objects, features and landscapes of cultural value as well as the maintenance of ecosystem function, the protection of geological and geomorphological features and natural phenomena and the maintenance of natural landscapes."

NB – ss30F to 30K apply to other forms of reserve (e.g. historic sites, regional parks) which do not occur in the Project Area.

#### Consistency with the title and relevant sections of a plan of management

Under the *Arakwal National Park Plan of Management*, the Project is supported by the Arakwal Vision for country relative to the beach, creeks and swamps (Section 4.9) (p38):

"Let the creek run out into the ocean and make it clean, running, Teatree water..."

In addition to this clear intent, the Plan of Management also provides for the following provisions which are relevant to the Project:

- Section 4.9 The Beach, Creek and Swamps Catchment Management: 'As far as possible
  natural coastal processes at the entrance of Tallow Creek to the ocean will not be interfered
  with. Should the entrance channel need to be opened artificially at any time to flush the creek
  system (or for other environmental benefits), the excavated sand should be placed back within
  the active beach system to the north of the creek entrance' (p39). This is consistent with the
  proposed methodology for the Project works.
- Section 5.4 Pathways through Country Walking Tracks and Management Trails: 'Vehicle access in the Park will continue to be restricted to authorised vehicles on the existing access



trails as identified in Map 2 and the inter-tidal area of Tallow Beach to be accessed from Cosy Corner only'. While this requirement is prescriptive, it is not taken to apply to vehicle movements outside of the national park, such as is proposed by Council in opening the lake (refer to Section 5.3.6).

#### Availability of a leasing, licencing or easement arrangement for the project under Part 12

Byron Shire Council intends to undertake the Tallow Creek opening works under licence issued under Part 12 of the NPW Act. A licence can only be granted for a purpose listed in s151A. The following purposes are deemed relevant to the Project:

- (a)(v) to enable activities for natural heritage management, cultural heritage management, parks management or fire management to be carried out and the provision of facilities for that purpose;
- (a)(viii) any other purpose that is: (A) *consistent with relevant management principles* for the land set out in Division 2 of Part 4; and
- (c) any purpose that enables the adaptive reuse of an existing building or structure or *the use of* a *modified natural area.*

As the Project is seen as consistent with the s30E management principles and with the intended vision of the *Arakwal National Park Plan of Management*, it is considered that the works are for a park management purpose consistent with both s151A(a)(v) and (a)(viii). In addition, the definition of 'modified natural area' under s5(1) of the NPW Act is 'an area of land where the native vegetation cover has been substantially modified or removed by human activity (other than activity relating to bush fire management or wild fire) and that is identified in a plan of management as not being appropriate for or capable of restoration.' The *Arakwal National Park Plan of Management* identifies Tallow Creek as heavily modified as a result of historic sand mining and the influence of dredging and the South Byron Sewage Treatment Plant, making it a modified natural area. The opening of the creek resulting in enhanced flushing and a decrease in freshwater flooding impacts is viewed as consistent with the purpose of s151A(c).

#### 3.1.2 Marine Parks Act 1997

Permissibility under the MP Act has been considered in relation to the consistency of the Project with the objects of the Act (s3) and with the requirements of the *Cape Byron Marine Park Zoning Plan* and *Cape Byron Marine Park Operational Plan 2010*, and in relation to permit requirements under the Act. The Project works, as they occur below the mean high water mark, are located within the Cape Byron Marine Park. This area includes both Habitat Protection Zone and Special Purpose Zone, and is predominantly a highly mobile sandy shoreline (see MPA 2003). There may also be impacts to the marine water quality at the point of discharge; however these are expected to be short-term and very localised.

#### Consistency of the Project with the MP Act s3 objects

The consistency of the Project with the MP Act s3 objects, and the objects of the Habitat Protection Zone and Special Purpose Zone are summarised overpage.



Objects		Response		
	MP Act o	bjects (s3)		
(a)	to conserve marine biological diversity and marine habitats by declaring and providing for the management of a comprehensive system of marine parks	The purpose of the Habitat Protection Zone is to conserve marine biodiversity by protecting habitats and reducing high impact activities. The Tallow Creek Special Purpose Zone has been set aside for the protection, traditional use and rehabilitation of		
parks		The intertidal sandy beach habitat of the Project Area is ecologically linked to offshore soft sediment habitats (MPA 2003). These areas provide habitat for sand dwelling species such as polychaetes, molluscs, isopods amphipods. In turn, these species act as a food source for other organisms, including fish and shorebird species (BMT WBM 2013; MPA 2003). These areas may also provide nursery areas for various fish species. The artificial opening of Tallow Creek may lead to the discharge of poor quality water that may have an immediate impact on species in the Marine Park within the vicinity of the creek mouth. This impact is		
		within the vicinity of the creek mouth. This impact is consistent with natural opening events. The expected impact will be highly localised and temporary only. As a result, it is expected that there will be no significant or permanent impact on the existing highly result.		
		Park.		
(c)	<ul> <li>where consistent with the preceding objects:</li> <li>(i) to provide for ecologically sustainable use of fish (including commercial and recreational fishing) and marine vegetation in marine parks, and</li> <li>(ii) to provide opportunities for public</li> </ul>	The Project does not involve the use (commercially or recreationally) of fish or marine vegetation in the Cape Byron Marine Park. While there may be localised and temporary impacts on fish species following the discharge of poor water from the creek during opening events, this is expected to be consistent with natural opening events.		
	appreciation, understanding and enjoyment of marine parks.	No impact is expected to public appreciation or use of the Marine Park in conjunction with the Project works.		
	Habitat Protection Zone objects (s1.8 of Ma	arine Parks (Zoning Plans) Regulation 1999		
(a)	to provide a high level of protection for biological diversity, ecological processes, natural features and cultural features (both Aboriginal and non-Aboriginal) in the zone	As noted above, the Project Area supports intertidal sandy beach habitats and offshore soft sediment habitats. These areas are used by a variety of infauna (e.g. polychaetes, molluscs, isopods, amphipods) and species that feed on these		
(b)	where consistent with paragraph (a), to provide opportunities for recreational and commercial activities (including fishing), scientific research and other activities, so long as they are ecologically sustainable and do not have a significant impact on any fish populations or any other animals, plants or habitats	organisms (e.g. shorebirds, fish). Fish nurseries may also occur in the area. Some recreational fishing does occur along Tallow Beach though fishing activities seem to be more concentrated at Broken Head to the south (MPA 2003). Other recreational activities within the Marine Park near Tallow Creek are uncommon. No commercial fisheries are linked to the Project Area.		
		Impacts to the values of this zone may occur as a result of the discharge of poor quality water from Tallow Creek following an artificial opening event. This discharge is expected to be consistent with events that already naturally occur. In addition,		



Objects	Response		
	impacts will be highly localised and temporary. For this reason, it is expected that there will be no significant impact on ecological or recreational values in the Marine Park near the Project Area. Any impacts that will occur will be temporary, localised and consistent with existing natural processes.		
	Significant natural and cultural features include Tallow Creek itself. As the creek is beyond the boundary of the Marine Park, impacts have been considered above in relation to the Arakwal National Park (Section 3.1.1).		
Special Purpose Zone 4 (Tallow Creek) objects (s5	.12 of Marine Parks (Zoning Plans) Regulation 1999		
To provide for rehabilitation and traditional use	The Arakwal Vision for country identified in the <i>Arakwal National Park Plan of Management</i> identifies the need to let Tallow Creek run out into the ocean and provide for flushing. As the Project involves the opening of Tallow Creek at a level (2.2m AHD) consistent with existing natural opening events, the Project is seen as consistent with this vision.		
	Rehabilitation opportunities and traditional use values of the creek and local area relate to Tallow Creek itself and its local use. As the Project is consistent with naturally occurring opening processes, there will be no significant impact on the existing rehabilitation and use values of the area.		

#### Permit requirements

Section 15 provides for the *Marine Parks Regulation 2009* and the *Marine Parks (Zoning Plans) Regulation 1999* to identify activities which will require the consent of relevant Ministers in a marine park. Activities requiring a consent which are relevant to the Project include:

- Harming any species of fish or plant identified as a protected species in the zoning plan for the marine park; and
- Use of a motorised vehicle in contravention of the zoning plan for the marine park.

Protected species for the purposes of the Cape Byron Marine Park are those protected under the *Fisheries Management Act 1994.* Refer to Section 3.1.5 regarding this Act below (Clause 5.20). The use of motorised vehicles is prohibited in the Habitat Protection and Special Purpose Zone except where authorised by the relevant council. Movement and operation of construction equipment in the marine park will be conducted by Council or contractors to Council. Any such contracts issued by Council for these purposes would be considered sufficient evidence for the purposes of meeting the requirement of authorisation under the Act. It should be noted that Council intends to complete opening activities (rather than utilise a contractor).

#### 3.1.3 Environmental Planning and Assessment Act 1974

Section 76 of the EP&A Act provides that where 'an environmental planning instrument (EPI) 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' but that environmental assessment under Part 5 may still be required. The State Environmental Planning Provision (SEPP) (Infrastructure) 2007, an EPI, provides for 'development for the purpose of flood mitigation work carried out on behalf of a public authority on any land' (cl. 50) and 'development on land reserved under the NPW Act if the development is for a use authorised under the Act' (cl. 65) as development permitted without consent. Given the consistency of the Project with these provisions, the Project is exempt from development consent under Part 4.

Under Part 5, there is a general duty imposed to consider the environmental impact of a Project (s111), with an Environmental Impact Statement (EIS) required where the activity is a prescribed activity or of a prescribed kind, or where the activity is likely to significantly affect the environment or threatened species, populations or ecological communities or their habitats (s112). Given the ecological assessments discussed in Section 7.3 and Section 8, it is considered unlikely that the Project will have any such impact. This makes the Project permissible without an EIS.

SEPP No. 14 – Coastal Wetlands also applies for the wetland area within Tallow Creek (outside the Arakwal National Park). Clause 7(1) of the SEPP prevents proponents from clearing, constructing a levee on, draining or filling land that is within a SEPP 14 coastal wetland except with the consent of the Director. While the opening of Tallow Creek will lead to flushing of the creek, this will be consistent with natural events, albeit occurring on a more frequent basis. For this reason, the Project is seen as *not* involving any of the works requiring a consent under SEPP No. 14. In addition, previous advice from the Department of Planning indicates that the constraints imposed by SEPP 14 can only apply to land gazetted under this policy. As the proposed works will not occur on gazetted land, SEPP 14 cannot apply.

The following SEPPs do not apply to the Project:

- SEPP No. 44 Koala Habitat Protection: While the Project Area includes land to which the SEPP applies, as no development application for consent under a Local Environmental Plan (LEP) or Part 4 of the EP&A Act is required, Clause 6 of the SEPP No. 44 has no application.
- SEPP No. 71 Coastal Protection: While the Project Area is within the coastal management zone, as no development application for consent under a LEP or Part 4 of the EP&A Act is required, Clauses 7 and 8 of the SEPP No. 71 have no application.
- SEPP (Mining, Petroleum Production and Extractive Industries) 2007: This SEPP applies in the case of an 'extractive industry' which is defined to include the winning or removal of extractive materials (including sand). As the proposed work involves only the localised *relocation* of small quantities of materials, akin to earthworks, it cannot be seen as an extractive industry.

#### 3.1.4 Threatened Species Conservation Act 1995

Permissibility under the TSC Act has been considered with regard to the consistency of the Project with the objects of the Act (s3) and with the requirement for a licence under Part 6. The consistency of the Project with the s3 objects is presented overpage.



TSC Act s3 Objects	Response
(a) to conserve biological diversity and promote	The biodiversity and ecological values of Tallow Creek are discussed in Section 7.3. These values include (BMT WBM 2014):
ecologically sustainable development	<ul> <li>beach, estuary entrance, open water and sedimentary habitats, supporting shorebird, turtle, infauna and fish species, as well as some <i>Ruppia</i> sp.</li> </ul>
	<ul> <li>dune vegetation communities with banksia and she-oak species, providing habitat for bat species and some small ground-dwelling mammals.</li> </ul>
	<ul> <li>reed grassland consisting of <i>Phragmites australis</i> and other salt tolerant plants providing habitat for wetland bird species.</li> </ul>
	intertidal saltmarsh providing feeding habitat for shorebirds
	<ul> <li>groundwater and freshwater dependent <i>Melaleuca quinquenervia</i> woodland to forest habitats, supporting freshwater fish, acid frogs, bats and small carnivorous mammals.</li> </ul>
	These habitats are influenced by the natural opening and closing events of Tallow Creek. Currently opening events occur anywhere between water at 1.8m AHD and a theoretical upper limit of 3.0m AHD. Most breakouts occur at or below 2.2m AHD.
	The transport of machinery to and from the mouth of Tallow Creek combined with the direct excavation and sand placement works will have a direct impact on beach and estuary habitat values and fauna. In particular, the most important impacts would be to any shorebirds utilising the beach and estuary environment for roosting and feeding, and infauna within the excavation area and sand placement area.
	Disturbance to shorebirds and other species utilising the beach and estuary environment is likely to be temporary and restricted only to the time during which works are being undertaken. These impacts can be mitigated through the use of smaller equipment (i.e. five tonne excavator) and through the minimisation of the direct area of disturbance. Wherever possible, works can also be timed to occur outside of shorebird nesting season though this may not always be practicable.
	Direct impacts to infauna from machinery movement, excavation and sand placement cannot be avoided. However, these species occur in a highly dynamic beach environment and nearshore environment and are not expected to experience any significant or permanent impact as a result of these Project works.
	Artificial opening of the creek at 2.2m AHD will prevent water levels in the creek reaching higher levels than this. This will result in a changed hydrology/inundation cycle for vegetation communities and species that occur between 2.2m AHD and an unknown upper limit. This changed inundation cycle is likely to result in change in vegetation communities above 2.2m AHD. A shift in the margin between wetland and terrestrial ecosystems will occur, with wetland communities receding and terrestrial communities advancing downslope. While it is uncertain the exact extent of this shift, it is will be in the order of a few metres and unlikely to have any significant change to available habitat.
	At present, natural opening events do occur prior to the need for any intervention. Artificial opening events, therefore, are unlikely to be common. All opening events will be managed under a relevant EMP.
<ul> <li>(b) to prevent the extinction and promote the recovery of threatened species, populations and ecological communities</li> </ul>	A total of 40 threatened species and four endangered ecological communities have been identified for the Project Area (BMT WBM 2013a). For each of these species and communities a 7-Part test was conducted in relation to the Tallow Creek opening (BMT WBM 2013b). In the case of all 40 threatened species and four endangered ecological communities, the Project was <i>not considered likely</i> to result in a significant impact on local population(s) of the species/community.



TSC Act s3 Objects		Response
(c)	to protect the critical habitat of those threatened species, populations and ecological communities that are endangered	No critical habitat occurs in the Project Area
(d)	to eliminate or manage certain processes that threaten the survival or evolutionary development of threatened species, populations and ecological communities	Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands is a key threatening process (KTP) declared under the TSC Act. Specifically, the alteration of natural flow regimes includes changing the frequency of flow events. However, the opening of Tallow Creek, as assessed in Seven Part Tests for all local threatened species and ecological communities, will have no significant impact to any species/community, despite a likely increase in the frequency of breakthrough events. This is partly due to the natural occurrence of breakthroughs in any event, and the minor shift in ecological communities (in the order of metres) likely to result from changes in inundation levels. At present breakthroughs typically occur prior to the need for any intervention.
(e)	to ensure that the impact of any actions affecting threatened species, populations and ecological communities is properly assessed	An assessment of significance ('Seven Part Tests') has been conducted for all threatened species, populations and ecological communities in the Project Area (BMT WBM 2013b). This indicated no significant impact was considered likely for any of the 40 threatened species and four endangered ecological communities considered.
(f)	to encourage the conservation of threatened species, populations and ecological communities by the adoption of measures involving co-operative management	Management measures to ensure any impacts to threatened species and/or ecological communities are avoided/mitigated will be developed in accordance with those identified in BMT WBM's environmental assessment report (2013a) and other best practice management. This will be included within an EMP for the Project.

As there will be no significant impact on local population(s) of species and ecological communities, no licence is required under Part 6 of the TSC Act as such a licence authorises (s91):

- a) harm to any animal that is of, or is a part of, a threatened species, population or ecological community;
- b) the picking of any plant that is of, or is part of, a threatened species, population or ecological community;
- c) damage to a critical habitat; and
- d) damage to habitat of a threatened species, population or ecological community.

#### 3.1.5 Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) requires a permit for the conduct of dredging work (s200). This is defined to include any work involving the excavation of land submerged permanently or intermittently by water. Permits are also required where the works may cause an impact upon threatened fish species or on marine plants. Given the scope of the project and the lack of marine plants and threatened species in the Project Area, no impact on these values is expected. For this reason, no permit is required under the FM Act.



#### 3.1.6 Water Management Act 2000

An approval is required for the conduct of 'controlled activities'. These include activities that affect the quantity of flow of water in a water source. However, s38 of the *Water Management Regulation 2011* provides that all public authorities are exempt from the need to have a controlled activity approval. Therefore, Byron Shire Council is not required to have a permit for the purposes of this Project.

#### 3.1.7 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* provides for the management of 'controlled activities'. These are actions which could result in a significant impact in matters of national environmental significance (MNES). MNES includes threatened and migratory species and threatened ecological communities. Matters that are likely to or known to occur in the Project Area have been listed below. For each of these matters an assessment has been conducted as to whether or not there is likely to be a significant impact (see also BMT WBM 2013b; 2014).

As can be seen, there are no significant impacts identified for any MNES as a result of the artificial opening of Tallow Creek. This is due to the fact that only minor, localised and temporary impacts are expected to occur as a result of the artificial opening. Wherever possible, impacts will also be mitigated through relevant management actions and by following a Project EMP. For this reason the Project is not a controlled action and does not require assessment or regulation under the *Environment Protection and Biodiversity Conservation Act 1999*.

Matter	Status	Significant impact		
Australasian bittern Endangered species ( <i>Botaurus pociloptilus</i> )		<b>No significant impact</b> : No major impact upon species habitat (estuarine and wetland habitat)		
Great knot ( <i>Calidris</i> <i>tenuirostris</i> )	Migratory species	<b>No significant impact</b> : Disturbance of beach dwelling species expected during construction works but can be mitigated through appropriate controls and pre-works survey		
Red goshawk ( <i>Erythrotriorchis radiatus</i> )	Vulnerable species	<b>No significant impact</b> : No major impact upon species habitat (estuarine and wetland habitat)		
Black-tailed godwit ( <i>Limosa limosa</i> )	Migratory species	<b>No significant impact</b> : Disturbance of beach dwelling species expected during construction works but can be mitigated through appropriate controls and pre-works survey		
Osprey ( <i>Pandion</i> haliaetus)	Migratory species	<b>No significant impact</b> : No major impact upon species habitat (estuarine and wetland habitat)		
Little tern ( <i>Sterna</i> <i>albifrons</i> )	Migratory species	<b>No significant impact</b> : Disturbance of beach dwelling species expected during construction works but can be mitigated through appropriate controls and pre-works survey		
Grey-headed flying fox ( <i>Pteropus poliocephalus</i> )	Vulnerable species	<b>No significant impact</b> : No major impact upon species habitat (vegetation communities and wetland habitat)		
Koala ( <i>Phascolarctos</i> <i>cinereus</i> )	Vulnerable species	<b>No significant impact</b> : No major impact upon species habitat (eucalyptus communities)		
Wallum sedge frog ( <i>Litoria olongburensis</i> )	Vulnerable species	<b>No significant impact</b> : No major impact upon species habitat (freshwater wetland habitat)		



Matter	Status	Significant impact		
Loggerhead turtle ( <i>Caretta caretta</i> )	Endangered species Migratory species	<b>No significant impact</b> : Disturbance of beach dwelling species expected during construction works but can be mitigated through appropriate controls and pre-works survey		
Green turtle ( <i>Chelonia</i> <i>mydas</i> ) Vulnerable species Migratory species		<b>No significant impact</b> : Disturbance of beach dwelling species expected during construction works but can be mitigated through appropriate controls and pre-works survey		
Mitchell's rainforest snail ( <i>Thersites mitchellae</i> )	Critically endangered species	<b>No significant impact</b> : No major impact upon species habitat (freshwater and estuarine wetland)		
Eastern freshwater cod ( <i>Maccullochella ikei</i> )	Endangered species	No significant impact: No impact to naturally occurring freshwater bodies or processes		
Oxleyan pygmy perch ( <i>Nannoperca oxleyana</i> ) Endangered species		<b>No significant impact</b> : No major impact upon species habitat (freshwater wetland)		
Swamp orchid ( <i>Phaius</i> australis)	Endangered species	<b>No significant impact</b> : No major impact upon species habitat (freshwater wetland)		

### 3.2 Consistency with OEH Policy

The only policy for park management produced by OEH (formerly Department of Environment, Climate Change and Water) that is relevant to the Project is the *Vehicle Access – General Policy* (DECCW 2010). This policy allows vehicle access in a park where it does not cause unacceptable impacts on nature and cultural heritage, and is conducted by Council (or approved contractors) engaged to carry out approved works or activities in the park.

As the vehicle access required for the Project consists of the movement of machinery in the Arakwal National Park by Council for the purpose of relevant activities, and will occur only once licenced. As such aspects of the proposed works are seen as consistent with OEH Policy.

## 3.3 **Consistency with Key Coastal Policies**

Section 13.2 provides further details of the consistency of the proposal with relevant coastal policy including the NSW Coastal Policy and Estuary Management Policy.

### 3.4 Type of Approval Sought

As per Part 3.3 of the OEH REF template, a summary has been provided below of the type of permit being sought through this REF. As noted in Section 3.1, most activities proposed under the REF do not require a permit or licence under relevant environmental legislation. However, for works conducted in a National Park involving the artificial opening of Tallow Creek a licence is being sought under s151A of the *NPW Act*. More details on the consistency of the Project with the objects and requirements of s151A are discussed in Section 3.1.1.

Brief description of the type of approval sought		Licence for activities listed under s151A including 'enabling activities for parks management to be carried out, a purpose consistent with the management principles for the land, and enabling the use of a modified natural area.			
$\square$	Sections 151 and 151A of NPW Act				



# 4 **Consultation**

Consultations completed by Byron Shire Council from 2010 to 2012 are detailed as follows:

- Sue Walker (Manager: National Parks and Wildlife Service) on-going correspondence and meetings during the preparation of the Tallow Creek Floodplain Risk Management Study & Plan, which included the proposed activity as an interim action;
- Andrew Page (Manager: Cape Byron Marine Park) on-going correspondence and meetings during the preparation of the Tallow Creek Floodplain Risk Management Study & Plan, which included the proposed activity as an interim action;
- Toong Chin (Flood Officer: Department of Environment and Climate Change) on-going correspondence and meetings during the preparation of the Tallow Creek Floodplain Risk Management Study & Plan, which included the proposed activity as an interim action;
- Marcus Riches (NSW Industry and Investment Fisheries) discussed potential impacts of opening entrance and threatened species under the EPBC Act and FM Act, and approvals under FMA and permit-concurrence required for dredging and reclamation;
- Patrick Pahlow (DECCW NSW Office of Water) discussed need for approval of a controlled activity under the WMAct;
- Peter Nelson, Greg Yeates, Steve Jensen (Dept of Planning) discussed need for EIS under SEPP 14 and designated development;
- Phillip Haines, BMT WBM peer review of draft REF document and alterations as recommended; and
- Jan Olley (Byron Bird Buddies) discussed use of Tallow Beach, Tallow Creek, Tallow Lake-Lagoon and Tallow entrance by threatened and migratory species.

BMT WBM has been involved in the following consultation activities over the period 2013 to 2015:

- Letter from Council to Planning and Infrastructure regarding requirements for an EIS (5/11/13);
- Response from Planning and Infrastructure to Council (18/11/13);
- Letter from Council to MPA/NPWS/Arakwal Corporation seeking in-principle support for the preparation of a Review of Environmental Factors (19/5/2014);
- Response from DPI (covering both Fisheries NSW and the Marine Park Authority) to Council providing in-principle support to prepare the REF (28/5/2014);
- Response from NPWS to Council providing in-principle support to prepare the REF (i.e. this document) (26/6/2014); and
- Response from Arakwal Corporation to Council identifying in-principle support for the preparation of a Review of Environmental Factors (30/9/2014).

Copies of this correspondence are included in Volume 2.



# 5 **Proposed Activity**

### 5.1 Objectives of the Proposal

The proposed activity involves limited and infrequent sand relocation at the beach berm of Tallow Creek to allow waters within Tallow Creek to drain to the ocean.

The proposed artificial opening of the Tallow Creek is for the prevention of potential flooding and/or adverse health risks arising to the residents of Suffolk Park from the elevated waters within Tallow Creek.

The proposed opening is to occur consistent with the triggers provided in the Byron Shire Council Tallow Creek Floodplain Risk Management Study and Plan, for the duration of that Management Plan.

The proposed entrance management is to be undertaken in consultation with OEH/NPWS and other experts, as required, to manage the potential impacts of moving machinery to the site and relocating sand to allow flood waters to drain.

Further specific details are provided in the following sections.

### 5.2 Location of Activity

The site is located at the ocean entrance of Tallow Creek as it adjoins Tallow Beach. It is approximately 700m east of the road entrance to St Finbarrs Primary School and Byron Bay High School (at intersection with Bangalow Road). The site is to the south of Byron Bay and to the north of Suffolk Park.

Site commonly known as (if applicable)	Tallow Creek Entrance	(sandbar)	
Street address	No: NA	Street Name: NA	
(if available)			
	Suburb: Suffolk Park		
	State: NSW	Postcode: 2481	
Title reference	e-folio (if Torrens Land System)		
LOT 437 DP 729107			
	Registered deed number (if Old Land System)		
	NA		
Site reference	Easting: 560,691	Northing: 6,828,767	
	MGA zone: 56	Reference system: GDA94	
Local	Byron Shire		

Relevant details are provided as below.



Site commonly known as (if applicable)	Tallow Creek Entrance (sandbar)
Government Area	
NSW State Electorate	Ballina
Catchment	Tallow Creek
National Park	Arakwal

#### 5.2.1 Site Map

The location of the proposed activity is shown in Figure 5-1. This plan also shows cadastre and land tenure, as well as key planning overlays.

A zone depicting the potential location of opening has been shown. This zone is much larger than the area required for actual opening as it accounts for the potential migration of the entrance across this area. The zone is limited in its northward extent to limit risk of migration too far to the north which may impact on the stability of existing dunes. The exact location of the entrance (and hence location required for opening) depends on a complex mixture of environmental factors (i.e. catchment hydrology and hydraulic processes, as well as ocean and coastal processes) which govern where the creek is located at the time of breaching.





#### 5.2.3 Images of Previous Site Opening Events

Entrance openings over the past decade have been a mixture of artificial and natural, further details are provided below.

#### Artificial

Byron Shire Council has provided imagery of the last recorded artificial opening of Tallow Creek which was completed on 17 November 2004. The first image (i.e. Figure 5-2) shows what appears to be the commencement of the drainage channel with the second image (Figure 5-3) showing the completion of the channel and commencement of runout from Tallow Creek.



Figure 5-2 Commencement of Creek Drainage Channel





Figure 5-3 Completion of Creek Drainage Channel

SKM (2009) notes that the berm level at the time of opening in 2004 was 2.5 m AHD.

#### Natural

A detailed record of entrance opening is not available (i.e. water height at time of rainfall, exact date and time of breach, height of beach berm at time of opening, duration of opening, etc), however from available photographic records, it is known that significant natural entrance opening events occurred on the following dates:

- September 2007;
- November 2008;
- March/April 2009;
- February 2010;
- June 2010; and
- May 2014.

Pictures of these natural opening events are provided below in Figure 5-4 to Figure 5-9.





Figure 5-4 September 2007 Opening



Figure 5-5 November 2008 Opening





Figure 5-6 April 2009 Opening



Figure 5-7 February 2010 Opening





Figure 5-8 June 2010 Opening



Figure 5-9 16 May 2014 Opening



While the photos have been taken from different vantage points at different times on the breakout/open/closure cycle, it is evident that the location of the breakout channel is typically on the northern extent of the breakout range, but it is possible as was the case in February 2010 to have an opening event on the southern extent of the breakout range.

### 5.3 Description of the Proposed Activity

Provided below is a full and comprehensive description of the activity. All aspects of the proposed activity are described including artificial opening and pre-emptive beach scraping. As agreed with project stakeholders, an adaptive management approach is proposed that accounts for several aspects of opening variability (e.g. timing of breakouts, presence of nesting threatened and/or migratory shorebirds, relative locations of breakout channel and nesting species, etc). It is considered that the adaptive management approach will provide the greatest opportunity to minimise potential impacts to these species, without locking parties into a rigid approach which does not have the ability to recognise and adapt to a set of changed circumstances.

#### 5.3.1 Overview of the Adaptive Management Approach

The adaptive management approach has been integrated into actions outlined in Table 5-1 for entrance opening via trenching to drain waters and in Table 5-2 for pre-emptive beach scraping to limit future potential flood risks due to elevated beach berm levels. Key parts of the adaptive management process discussed with stakeholders include:

- NPWS periodically monitoring the creek entrance for nesting bird activity, commencing when Council notifies NPWS that Tallow Creek water levels have reached 1.8 metres AHD;
- Council's engagement of an ecological specialist to provide Council with further advice if NPWS observes threatened and/or migratory birds nesting adjacent the entrance. Council to liaise with NPWS regarding specialist management approaches for nesting species if identified to be subject to impact; and
- Liaison with NPWS regarding need for artificial opening based on poor water quality data.

The process outlined in Table 5-1 and Table 5-2 accounts for both low level (normal) activities and communications, as well higher order activities being initiated based on water or berm levels (or likely water level changes) within Tallow Creek.



·					
	Normal Moderate Alert High Alert		Initiate Opening		
Water Level	er Level <1.8 m 1.8 to 2.0 m AHD >2.0m		>2.2m		
Monitoring	Weekly water level checks	<ul> <li>Weekly water level checks (Dec. to June), or monthly water level checks (July to Nov.) and periodic water quality checks</li> <li>Level checks after rainfall events</li> <li>Daily observation of rainfall predictions</li> <li>Berm height check</li> </ul>	<ul> <li>Weekly water levels checks and daily observation of rainfall predictions</li> <li>Additional water quality testing (as required)</li> <li>Monitor complaints</li> <li>Berm height check</li> </ul>	<ul> <li>Opening required unless sandbar is likely to breach naturally (based on berm height)</li> </ul>	
Communications	• None	<ul> <li>Liaise with NPWS regarding need for NPWS observation of presence of nesting species at Tallow Creek entrance and to advise them of elevated water levels or depressed water quality conditions</li> </ul>		<ul> <li>Liaise with NPWS regarding opening level and planned timing of opening</li> <li>Advise Byron Bird Buddies of a planned opening event</li> </ul>	
Other Actions	• None	<ul> <li>Ecologist advising Council on management options (if nesting species present)</li> </ul>	<ul> <li>Council Works Depot on standby</li> <li>Ecologist advising Council on management options (if nesting species present)</li> <li>Aboriginal cultural heritage spotter on standby</li> </ul>	<ul> <li>Complete pre- start surveys and activities (as required)</li> <li>Complete opening of system (at or within 2 hours of a daytime low tide) after), with required persons present.</li> </ul>	

Table 5-1	Triggers and	Actions for	Artificial	Entrance	Opening
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Table 5-2	Triggers and	Actions for	Entrance	Scraping
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	Observation	Entrance Scraping
Berm Level	<2.2m	>2.2m
Monitoring	<ul> <li>Berm level observed at a minimum monthly frequency (this will typically occur associated with activities outlined in Table 5-2)</li> </ul>	Berm level observed at a minimum monthly frequency
Communications		<ul> <li>Liaise with NPWS regarding:         <ul> <li>Need for NPWS observation of presence of nesting species at Tallow Creek entrance</li> <li>Actual presence of species at entrance and</li> </ul> </li> </ul>



	Observation	Entrance Scraping
		<ul> <li>specialised management approaches</li> <li>Timing of pre-emptive scraping works</li> <li>Advise Byron Bird Buddies of a planned opening event</li> </ul>
Actions		<ul> <li>Ecologist advising Council on management strategies (if nesting species present)</li> <li>Complete entrance scraping with required personnel present applying agreed (with NPWS) management strategies for nesting species.</li> </ul>

#### Monitoring

#### Water Level and Rainfall

Council will observe water levels weekly (or less frequently) when water levels are below 1.8m AHD (particularly during extended dry periods). When levels increase to 1.8m AHD, Council will observe water levels weekly. Water level monitoring activities increase to sub-weekly when water levels increase above 2.0m AHD on the way to 2.2m AHD. Details of monitoring relative to water height are outlined in Table 5-1.

Since there is currently no automated water level sensor within Tallow Creek, Council staff manually monitor water level at the calibrated gauge attached to the public walkway bridge over Tallow Lake as shown in Figure 5-10. In the future (funds permitting) Council intends to install an automatic gauge which is linked to the Bureau of Meteorology website.



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Figure 5-10 Tallow Lake Bridge Water Level Gauge

#### Water Quality

As required under the Management Plan in the Tallow Creek Floodplain Risk Management Study and Plan, water quality monitoring is required to be completed by Council when water levels exceed 1.8m AHD to address potential human health risks. Water quality monitoring is completed at defined locations for a defined set of parameters as described further in Section 7.2.3.

Currently calls and complaints received at Council in relation to flooding in Tallow Creek are processed by Councils Flood and Drainage Engineer James Flockton (applicant). This provides an added level of observation to local conditions.



#### Berm Height

Berm height checks will be typically be completed when water levels are checked and should not exceed a month in duration between insepctions. Council has an indicative survey mark in the vicinity of the entrance which can be used to estimate berm height. When berm heights appear high, Council will initiate the collection of height data.

If berm heights significantly exceed the upper trigger level for flooding (which is 2.2 m AHD) then Council may complete pre-emptive scraping of sand down to 2.2m AHD as outlined in 'Description of the Activity' later in this section.

The scraping would lessen the chance that sudden and intense rainfall (noting that over 300mm can be recorded in the catchment in a single day) would result in more extensive flooding of the catchment if berm heights were higher. The pre-emptive works are also intended to negate the need for emergency openings which could be required at night time presenting a higher level of safety risk for machinery operators.

#### Communications

The key party with which Council will liaise will be the NPWS. Council will liaise with NPWS regarding need for observation of the presence of nesting species at the Tallow Creek entrance when Council themselves become aware that water level in Tallow Creek has exceeded 1.8m AHD. Alternatively, Council will liaise with NPWS regarding the need for observation of the presence of nesting species at the entrance when berm levels exceed 2.2 m AHD and pre-emptive scraping of the berm is being considered.

NPWS will then communicate back to Council regarding the presence of nesting species in the entrance area that may be affected by an artificial opening or berm lowering event. Council will then initiate its own monitoring program utilising specialist staff to determine the actual nesting locations of these species and the risk of their disturbance associated with the planned opening or scraping strategies.

When a breakout is imminent, Council will advise and liaise with NPWS about the timing and procedures for the artificial opening. Council will also advise and liaise with NPWS about the timing and procedures for the planned works.

Council will liaise with support staff as required to assist in the opening or scraping of the Tallow Creek ocean berm, this will include an ecologist to advise regarding potential adaptive measures to minimise impacts to species that may be present, and an Arakwal representative being present during an opening event to spot for any potential Aboriginal cultural heritage items.

#### **Other Actions**

When water levels reach 1.8m AHD or berm levels reach 2.2 m AHD and it is apparent that nesting species of concern (i.e. threatened and/or migratory birds) are present, then Council will consult with an ecologist regarding management options to limit the likelihood of these species abandoning their nests. In the situation that nesting species are present and an opening or scraping is required, the objective will be to promote a natural opening (i.e. by limited sand scraping) or by selecting the location of an outlet channel to as best possible avoid the nesting species.



It is understood that NPWS does not support relocation of nests/eggs of threatened and/or migratory species due to the propensity for abandonment and loss of progeny. As it may not be possible to avoid impacts in all circumstances (i.e. nesting species will be impacted by an opening which is required), Council intends to monitor the use of the region for populations of nesting species (such as little tern) and develop a suitable strategy for habitat preservation, including actions such as:

- Monitoring populations using the subject site;
- Designation of protection zones and maintenance of breeding site habitat condition (such as weed control, particularly Bitou Bush);
- Minimisation of human disturbance through fencing and sign posting of main breeding and roosting sites; and
- Controlling dogs, foxes and cats in the vicinity of habitat.

When an entrance opening or scraping is planned, a pre-works survey will be completed by Council to assess the beach access, transit route and work area. All activities will be completed to avoid damage to species and unnecessary human disturbance. Site works would be completed in accordance with the Environmental Management Plan for the activity, and special directives that may be applied to account for the presence of high conservation value nesting species.

#### 5.3.2 Description of the Activity

#### **Artificial Opening**

The proposed activity will comprise the mechanical opening of the mouth of Tallow Creek at the sandbar to artificially open the entrance of Tallow Creek. The excavation will normally be in the form of a "pilot" channel which is both narrow and shallow that initiates drainage of waters from Tallow Creek, noting that once drainage commences, the escaping waters will typically erode a much larger channel to the ocean. The channel will be excavated to between 0.5 and 1.0 m depth below the ground surface of the berm (depending on berm height and water level at the time). Details of the flooding and water quality triggers necessitating an artificial opening are described in Section 7.2.3.

The proposed location of artificial opening works is shown in Figure 5-11. This location is preferred on the basis that it promotes channel formation away from the northern and southern vegetated foreshores, which from the experience of previous opening events, has led to erosion of the established dunes and loss of associated vegetation. Loss of dunes and vegetation appears to have happened in past opening events and can partially be seen in Figure 5-4 and Figure 5-6.

The location of the opening is also subject to the outcomes of any pre-opening ecological surveys (if required based on advice from NPWS). These surveys may identify the presence of certain species which may influence the location and approach to opening activities. The intended outcome of the opening will be to avoid nesting species, this includes the opening channel and sand movement activities (including spreading) and the likely trajectory of the channel as it opens to the ocean. It is acknowledged that it will not always be clear to ground staff how the trajectory of the opening channel may change over time.



In summary, the location of the artificial opening works will aim to avoid locations near to the existing north and south dunes, as well as any nesting species identified from pre-works surveys and as communicated to Council.

In terms of dimensions, the channel is to be constructed nominally two (2) metres wide and is to be between 0.5 and 1.0m below ground surface elevations (depending on lake water levels and berm height levels). The length of the channel will vary as it will depend on the configuration of entrance and beach profile at the time of opening. It is expected that the length could vary between 50 and 80m althought it will be as long as it needs to be to ffect anadequate entrance opening. Figure 5-12 provides a scale image of an indicative entrance channel. Figure 5-3 provides a picture of excavation works in progress.






To demonstrate the variability of the entrance configuration, some available aerial photography (provided by Council) has been included to show the variation of the entrance (refer to Figure 5-13 and Figure 5-14 and also Figure 5-11). It can be observed that entrance shoal locations vary, as does the presence of a deeper channel projecting towards the ocean. It will be important that the machinery operator is aware of the need to excavate the channel in the correct location, even if an easier option may be apparent.



Figure 5-13 Tallow Creek Entrance A (Photograph Date Unknown)





Figure 5-14 Tallow Creek Entrance B (Photograph Date Unknown)

The excavator will operate from the shoreline toward Tallow Creek and then the last section of sand at the sandbar will be taken from the water in the estuary. The excavator will operate from either side of the channel, while operating to protect existing banks. All excavated material will be placed on the northern side of the work area to minimise erosion risks to existing dunes.

The proposed activity is likely to more likely during drier than normal years (as these allow the beach berm to grow higher) associated with wet weather. As Tallow Creek does not naturally breach very often (approximately once per year or less) the trigger heights have been set to reflect the apparent natural trigger heights to reduce the need for the proposed activity to be undertaken. Thus far natural breaches have occurred at relatively acceptable flood levels, with minor flooding of yards with no apparent health risks. The sandbar may open more frequently at lower levels in a wet season.

#### **Beach Scraping**

The proposed activity will comprise the mechanical scraping of the Tallow Creek ocean berm to facilitate a breakout in the event of future catchment rainfall events. Anecdotal information indicates that the beach berm at Tallow Creek can exceed 2.2m AHD. Such elevated beach berm levels can assist flood levels to elevate to high levels.



The scraping will form of a broad swale which has an invert (bottom) elevation at 2.2m AHD. Sands removed to form the swale will be dispersed on the northern side of the swale. The proposed location of scraping is shown in Figure 5-11 (although it is for a swale not a channel in this instance) and has been selected to minimise risks of impacts to vegetation and dunes.

The location of the swale is also subject to the outcomes of any pre-scraping ecological surveys (if required based on advice from NPWS). These surveys may identify the presence of certain species which may influence the location and approach to scraping activities. The intended outcome of the opening will be to avoid nesting species; this includes the sand scraping and dispersant activities.

In terms of dimensions, the swale is to be constructed nominally five (5) metres wide along the base with batter slopes of up to a couple of metres width. It is expected that the entire swale would around 10 to 15 metres in width. The length of the swale will vary depending on the configuration of entrance and beach profile at the time of opening. It is expected that the length could vary between 50 and 80m, although it will extend as far as required to provide a suitable escape path for.

In summary, the location of the swale will aim to avoid locations near to the existing north and south dunes, as well as any nesting species identified from pre-works surveys.

Figure 5-15 provides a scale image of an indicative scraped beach swale and sand dispersal area.





## 5.3.3 Construction Timetable and Staging

#### **Entrance Opening**

The timing and frequency of the activity are unknown as it is governed by a complex mixture of coastal processes (governing berm height), catchment rainfall and hydrology and groundwater conditions (which dictate the height of water in Tallow Creek and likely future increases in height based on rainfall). However, once the relevant trigger height has been obtained it is intended that the entrance will be opened within 1 to 3 days depending on factors associated with consultation with NPWS, completion of pre-works surveys and assessment and coordination of machinery and labour.

The opening will be timed to coincide with a daytime low tide (up to 1-2 hours after), this will allow the incoming tide to meet waters leaving Tallow Creek to reduce the depth of scour to the sandbar. This is important, as the opening activity is not intended to create a deeper scour. The risk of a deeper entrance scour is that water levels within Tallow Creek can reduce to such a low levels that water quality can be adversely affected within Tallow Creek resulting in fish kills. Fish kills are believed to have occurred most recently in December 2014, December 2012 and November 2008 and at times prior to this. The reasons for these fish kills have not been investigated, although the fish kill in November 2008 was noted to have been associated with a natural opening event.

The likely mechanism for a fish kill in Tallow Creek is deoxygenation of waters. This would occur as a result of the enhanced biological decay of materials in the creek, such as decay of plant material (e.g. seagrass), or aerobic breakdown of organic rich sediments. The reduced water volume in the lake at this time reduces the ability of the creek to buffer itself against these effects, and limits opportunities for fish and other creatures to move or relocate to safer environments within the creek.



Figure 5-16 provides some imagery of the 2008 event (after opening). The images show the low water level within the creek, mobilised sediment presence of dead fish (whiting in this instance).

Figure 5-16 November 2008 Opening (Low Water Level – left, Sediments and Fish – right)

A typical entrance opening will take approximately 1 to 3 hours to complete. This refers to the actual time taken for the machinery to excavate the channel once on-site.



#### **Beach Scraping**

Pre-emptive beach scraping will normally occur within a few weeks of the 2.2 m AHD limit being reached, depending on factors such as the actual berm height and its rate of growth and seasonal factors influencing occurrence of high catchment rainfalls.

Beach scraping will take only one to two hours to complete. This refers to the actual time taken for the machinery to form the swale and disperse the displaced sands.

#### 5.3.4 Activity Footprint

#### **Entrance Opening**

The pilot channel required for the artificial opening will be approximately 2m wide, between 0.5m and 1.0m deep and between 50 and 80 m in length (although it may be longer if required to affect an opening).

The pilot channel will be excavated in a location that will aim to avoid locations near to the existing north and south dunes, as well as any nesting species identified from pre-works surveys. Typically the channel would be excavated in the southern portion of the beach berm. Excavated sands will be placed on the north side of the excavated channel. These sands can be spread, or allowed to sit on the edge of the channel where they will over time fall into the channel and be washed to the ocean.

The proposed activity footprint (including channel and sand placement) is expected to be approximately 500-1000m<sup>2</sup>. It is anticipated that no more than 50-100 m<sup>3</sup> of sand will be relocated.

#### **Beach Scraping**

The swale would be approximately 5m wide on the base with batter slopes of up to a couple of metres (to prevent a sharp sided drop off) and be between 50 and 80 m in length (or longer if required to provide a suitable outcome).

The swale will be excavated in a location that will aim to avoid locations near to the existing north and south dunes, as well as any nesting species identified from pre-works surveys. Typically the swale would be excavated in the southern portion of the beach berm. Excavated sands will be placed on the north side of the swale.

The proposed activity footprint (including channel and sand placement) is expected to be approximately 500-1000m<sup>2</sup>. It is anticipated that no more than 50-100 m<sup>3</sup> of sand will be relocated.

#### 5.3.5 Ancillary Activities

There are no ancillary activities that will occur within the Arakwal National Park associated with the activity. Access to the site will be via the beach from locations outside of the Park.

To manage the risk to public safety during an artificial opening (or scraping) event temporary barriers may be erected by Council prior to the activity to the north and south on the beach (and at major access points), or alternatively Council may use a secondary operator as a spotter to approach and advise persons to avoid the activity area. At least two (2) Council staff in addition to the plant operator will be on site to complete the opening (or scraping).



Personal Protective Equipment (PPE) such as high visibility vests will be worn by staff, to ensure visibility to both the public and the plant operator. The two staff members ensure the public are maintained at a safe distance away from both the machine, and the location of work. As required, staff will warn the public about the dangers of the work, particularly bank collapse in the event of an entrance opening and the reasons as to why the works are being carried out. The public are directed by Council staff as to alternative routes of access along the beach, to ensure the public do not unintentionally endanger themselves.

Council staff will remain at the entrance channel location until the breakout channel is sufficiently wide to be an obvious hazard to the public. This will normally be a couple of hours after opening has commenced. At this point any barriers erected may be removed prior to Council leaving the site.

Opening will not be initiated at night, however, if berm height is above 2.2 m AHD and further catchment rains are expected in the next couple of days, Council may initiate pre-emptive sand scraping at the entrance at any time.

In the unlikely event that a spill of diesel, oil or hydraulic fluid from the plant (machinery) occur, the spill would be managed and cleaned up in accordance with the safe work method statement for operation of the plant, and associated Material Safety Data Sheets (MSDS) relating to these substances. In all cases, the spill would also be managed to mitigate and reduce potential impacts to the environment.

#### 5.3.6 Construction Methods, Materials and Equipment

Machinery will be used to undertake the proposed activity. It is proposed that an excavator with blade attachment is used to complete the opening (refer to example shown in Figure 5-17). This machine is approximately 5 m long x 2 m wide and 2.5 m high, weighing approximately 5 tonnes. The machine is equipped with tracks to enable sand access and to maximise load spreading across the sand.





Figure 5-17 Example of 5T Machine Used for Entrance Opening

The excavator will access the site via three potential access routes, in order of priority these are outlined below:

- (1) Clifford Street Suffolk Park (travel distance 3 km);
- (2) Beach Road/Broken Head Reserve Road Broken Head (travel distance 4.6km); and
- (3) Tallow Beach car park in Cape Byron State Conservation Area Byron Bay (travel distance – 2.6 km).

The selection of a beach access point would depend on suitability at the time works are proposed.

Access via location 1 is via various Crown Reserves (i.e. Suffolk Park Reserve and Byron Coast Reserve Trust). Byron Shire Council is the Trust Manager for both reserves and therefore no permit is required for accessing the beach from this location.

Similarly for access via location 2 near the caravan park, the access way is from the Council managed roads adjacent the caravan park, through Broken Head Nature Reserve (beach access) and then along the beach. Landowners include the Crown, NPWS and Council. Access through this section of NPWS land will be part of the licence approval granted for opening Tallow Lake.

Access option 3, while providing the shortest travel distance is only used if access from the south is unfeasible. An emergency access is also available via Ocean Street Byron Bay, however, this access has narrow clearances to vegetation and may have a sizeable beach dune to navigate to then access the beach. The three highest priority access options are shown in Figure 5-18.





#### 5.3.7 Materials

No external material is to be introduced to the location of the channel excavation/berm scraping. It is anticipated that no more than 50-100  $m^3$  of sand will be relocated. The sand is to be relocated on the northern side of the excavated channel or swale. No material disturbed as part of the activity is to be removed from the beach.

#### 5.3.8 Earthworks or Site clearing including extent of vegetation to be removed:

Access to the entrance of Tallow Creek is described above. It is intended to use existing cleared accesses on Clifford Street Suffolk Park (first priority), Beach Road Broken Head (second priority) and the Tallow Beach carpark, within the National Park (third priority).

A fourth access option is present via Ocean Street Byron Bay; however, this is only considered an emergency option. If the use of this access requires earthworks or vegetation clearing, then access condition will be photographed prior to and after use and actions initiated by Council in consultation to NPWS to rehabilitate the site subsequent to use.

#### 5.3.9 Environmental Management

The key potential impacts have been outlined later in Section 8 along with mitigation measures. These mitigation measures have been captured in the Environmental Management Plan developed for the activity.

#### 5.3.10 Sustainability Measures

Not applicable to this activity.



## 6 Reasons for the Activity and Consideration of Alternatives

## 6.1 Reasons for Activity

#### 6.1.1 Flooding

The principal reason for the proposed activity is to manage water Levels in Tallow Creek in accordance with the Management Plan identified in the Tallow Creek Floodplain Risk Management Study and Plan (SKM, 2009).

The study has investigated in detail flooding characteristics of Tallow Creek. It essentially identifies that waters levels within Tallow Creek lagoon (i.e. downstream of Broken Head Road to the entrance) are dependent on the build-up of sand at the entrance. These waters when elevated can increase flooding on local properties. To date, this flooding has been primarily nuisance flooding (as opposed to structural flooding). The Management Plan provides for a water level based trigger to reduce ocean berm height levels to reduce the risk of nuisance and or structural flooding within the catchment.

Another risk considered as part of this study is that of water quality. It is recognised that elevated water levels increase the likelihood of interaction between humans and the water; hence a water quality based trigger has been included within the Management Plan to alleviate health risks if water quality testing identifies legitimate concerns.

Further details of the flood modelling and the Management Plan are provided in Section 7.2.3.

## 6.2 Social and Community

In addition to the flooding / inundation effects to landowner properties, there is reduced use and amenity associated with other nearby community assets, such as the publically accessible walkway from Bangalow Road to Tallow Beach, as well as the public pathway which runs to the north of Beachside Drive.

Photo records provided by Council, indicate that at a flood height of 2.1m in Tallow Lake, sections of the public pathway (adjacent to the old STP) are inundated as shown in Figure 6-1 (pictures were recorded 11 September 2007).





Figure 6-1 2.1m Water Level (left) and Pathway Inundation (right) near STP

#### 6.2.1 Alternatives

#### Do Nothing – No Intervention

This option would involve no artificial opening of the Tallow Creek entrance. Breakouts would occur naturally, and only when water levels within the creek overtop the height of the entrance sand berm. The consequences of this option would be an increased potential for flooding and inundation of low-lying private and public assets around the foreshores of Tallow creek.

The low-lying assets within the catchment were generally established based on this managed hydrologic regime. This is the case for much of Suffolk Park which is within the catchment of Tallows Creek. This historic hydrologic regime incorporated Council's more pro-active management of the entrance berms. Prior to the 1993 version of the Local Government Act, Councils were required to manage the entrances of coastal lakes and lagoons in order to limit flooding and inundation. This maintenance approach was applied by Byron Shire Council post 1993, up until 2004 (noting that the Arakwal National Park was gazetted in 2001). This more pro-active management was ceased in 2004 because Council did not have a permit from NPWS to complete the activity on land that had become NPWS property.

Whilst the "Do Nothing" scenario would be most ideal from an environmental perspective, as it returns the systems to a natural hydrologic configuration, it would cause significant hardship on private property owners, and may cause on-costs for Council, through repairs existing assets such as pavements forming the public walkway adjacent the sewage treatment plan (this path is maintained by Council). Furthermore, adopting the do-nothing option may encourage unauthorised openings by the community, if they know that Council will not act. Unauthorised openings are likely to be far more problematic from an environmental and public safety perspective.

Given the presence of low-lying development within this catchment, this option is not seen as viable in the short-term.

In the long-term with greater clarity around potential climate change driven sea level rise and implications of this on coastal and ICOLL processes, reconsideration may be required in relation to the opening approach being considered, along with broader consideration of the sustainability of low-lying development and infrastructure within the catchment.



#### **Continue Existing Informal Opening Regime**

The Arakwal National Park was gazetted on 26 October 2001 arising out of an Indigenous Land Use Agreement between the Government and the Bundjalung People of Byron Bay (Arakwal). The National Park is jointly managed by the Bundjalung People of Byron Bay (Arakwal) and the NPWS.

Prior to this time Byron Shire Council managed the entrance in accordance with Council policy at that time, which is understood to have had the primary aim of managing flooding of low lying properties and assets within the catchment.

In 2004, Council completed the last artificial opening of Tallow Creek. It is understood that this was one (if not the first) artificial opening within the National Park since its gazettal. The opening activity had not been formally licenced or permitted under the relevant legislation.

The proposed entrance management program (refer Chapter 5) aims to minimise impacts on existing low-lying infrastructure, whilst preserving opportunity for existing natural processes (i.e. natural breakout) to still occur. It also seeks to minimise impacts on flora, fauna and cultural heritage.

Continuing with the existing informal procedures associated with entrance opening is not appropriate given that there exist specific legislative provisions to facilitate this activity, subject to consideration of its potential ecological and social impact (as outlined within this REF).

#### **Permanent Opening**

Several coastal lakes/lagoons along the NSW coast have been opened permanently through the construction of training walls that extend into the ocean. Construction of permanent entrances to the coastal lakes would provide some immediate benefit to the low-lying assets and infrastructure, as catchment runoff would be discharged directly to the ocean without significant storage and elevation of water levels within the lake. However, creating permanent entrances would have profound impacts on the environments of the coastal lakes, with the systems becoming more marinised, and estuarine vegetation along the foreshores retracting to a narrow band surrounding the inter-tidal zone.

Cost alone would be a significant inhibitor for this option, with permanent entrances likely to cost millions of dollars. The high costs and significant environmental impacts make this option unviable.

#### **Higher Trigger Levels**

Adopting higher trigger levels than that proposed in this REF, prior to modifications or removal of existing low lying assets, would result in further inundation of the assets and infrastructure when lake levels are high. This is counter-productive to the overall intent of the proposed activities, and as such is not considered a viable alternative.

#### Lower Trigger Levels

The trigger levels for the proposed activities have been selected on the basis of balancing the needs of the community (i.e. through reduced inundation of assets and infrastructure) with the needs of the environment (i.e. trying to maintain conditions within the creek). Adopting lower trigger levels, whilst likely to be acceptable from a social perspective, would likely have a greater environmental impact, achieving openings for shorter periods of time before the entrances re-close,



and flow on detrimental ecological impacts from increased frequency of opening, as discussed in Section 7.3 and 8.4.

## 6.2.2 Justification for Preferred Option

The proposed activities are considered to address the immediate demands imposed by existing low-lying assets and infrastructure. Formalisation of these policies in the near future will establish a framework for reducing the future need for such works. The trigger levels advocated by the proposed activities aims to a) maintain a near-natural hydrological regime within Tallow Creek, b) reduce demands on Council resources.

The works to be undertaken as directed by these proposed activities are considered temporary, as the highly dynamic nature of the coastal lagoon entrances will rebuild entrance berms in response to coastal and catchment runoff conditions within a matter of days, weeks or months. As such, the proposed entrance management programs can be terminated at any time without repercussion of permanent or irreversible environmental change.



# 7 Description of the Existing Environment

This section provides a description of the existing environment describing Tallow Creek and its catchment.

## 7.1 Natural Breakout Process of Coastal Lagoons

This section provides a description of the natural breakout processes for coastal lagoons (ICOLLS) as previously described in a previous REF for entrance opening (BMT WBM, 2011). It has been provided to assist in the understanding of entrance processes occurring at Tallow Creek (for reference).

In pre-European times, the behaviour of the entrance channel would have depended primarily on exposure to ocean waves and fluvial discharge, with the latter also being influenced by climatic fluctuations on decadal timescales (Roy *et al* 2001). Lugg (1996) suggested that the entrance is controlled by the morphology, the exposure of the entrance to longshore drift, the size of the catchment, the tidal prism and the prevailing climate conditions (refer Haines 2006), and believed that ICOLLS tended to breakout over a wide range of water levels - termed their 'natural breakout range'. The initiation of a breakout is dependent on the height of the berm and the water volume behind the berm. Under natural conditions these two parameters can be highly variable and different combinations of the two can produce the same effect: a breakout.

## 7.1.1 Beach Berm Characteristics

The height of the berm ultimately controls the water level before a natural breakout. The height of the berm directly relates to wave run-up (Figure 7-1) which is a function of the incident wave conditions and beach slope (Hanslow *et al* 2000). Along the NSW coastline, berm heights are typically higher on beaches that face south east (Hanslow *et al* 2000), due to their exposure to the predominant wave approach. Natural berm heights along the NSW coastline have been documented as falling between 2 - 3m AHD (Haines 2006).

Based on Council's experience with managing this estuary (especially over the past decade), natural breaching of Tallow Creek typically occurs between 2.2m AHD and 2.4m AHD (Pers. Comm. Flockton, 2013). The natural berm level has been observed to exceed 2.4m AHD when coastal conditions allow for a sufficient buildup of sand, and dry weather has negated the need for a forced opening. For example in November 2004, when the last artificial opening was undertaken, the berm was reported to be 2.5m AHD following an extended dry period.

While most ICOLL's in NSW are located near headlands, Tallow Creek is located midway along the beach (i.e. not adjacent to a headland). This means that the beach is exposed to a wide spectrum of wave directions and energies and that the entrance berm could build to reasonably high levels i.e. up to 3m AHD, especially during dry periods when opening would not occur very often, however, there is a lack of site specific data to support this theory. Other factors that will have an effect on the characteristics of the beach berm include the "openness" of the beach to wind/wave action and characteristics of sand supply to the beach compartment.





Figure 7-1 Berm formation (Source: Hanslow et al 2000)

#### 7.1.2 Berm Breakout Process

There are three stages that lead to the natural breakout of an ICOLL entrance (based on Gordon, 1990, and summarised in Haines, 2006):

- (1) The gradual overtopping of the beach berm Increases in water level within the ICOLL can occur through short intense rainfall events, providing an immediate increase in water level, or longer less intense rainfall events that produce a gradual rise in water level. When the ICOLL water level reaches a certain height, typically close to that of the natural berm height, overtopping will start to occur.
- (2) Development of a weir or hydraulic jump The pressure behind the berm will initiate the scouring of a channel and the flow of water will increase the size of the channel until it reaches a stable form. A natural feature of ICOLLS is the presence of large decreases in water level over a short period of time. Under natural variability an ICOLL may open during either high or low tide resulting in varying degrees of scour.
- (3) Initiation of river flow When the entrance is open short term stability may occur when the changes to the channel remain within set limits. Sediment transport is approximately proportional to the channel velocity to the power of four, therefore a slight increase in flood velocities can result in substantial increase in the transport of sediment. During the open state, the waves on the flood tide entrain sediment into the entrance but the ebb tide has no equal forcing to remove the sediment back out of the entrance, and the channel will slowly begin to shoal.

## 7.1.3 Opening Duration

The opening duration is governed by the balance between scouring and deposition within the entrance channel. This is controlled largely by the tidal prism of the ICOLL and the gross sediment transport environment of the adjacent coastline (Gordon, 1990).

When the entrance channel is open the ICOLL experiences tidal mixing and exchange with the ocean. These hydrodynamic processes can play a large role in defining the water quality of the ICOLL. Haines (2006) identified two types of ICOLLs, dependent on their waterway geometry that defined the mixing and water quality characteristics. The two types can be identified as displacement and mixing dominated ICOLLs. The displacement dominated ICOLLs are named due to the process that when catchment runoff enters the water bodies it pushes or displaces the resident water out of the system. Whereas a mixing dominated ICOLL has a greater ability to



assimilate any catchment runoff into the resident water through wind mixing. Displacement dominated ICOLLs tend to experience virtually a total 'emptying' of the waters when they are open, whereas the mixing dominated ICOLLs may not, particularly if the basins are deeper than mean sea level. According to descriptors included in Haines (2006) Tallow Creek would likely be classified as a displacement estuary based on its more linear shape.

In the larger ICOLLS, a setup of water levels may occur during the spring tides producing a fortnightly variation in water level. The spring tides 'pump up' the mean water level in the ICOLL and during the neap tides the excess volume returns to sea producing higher than average ebb tide flows over several tidal cycles. This process has been found to dominate the exchange in some ICOLLs (Gale et al 2006). When this occurs with a period of low wave activity, the entrance channel can experience scour, aiding in the maintenance of an open channel.

## 7.1.4 Opening Frequency

The frequency of opening events can play a large role in defining the berm height, the salinity and ecology of an ICOLL. During periods of drought the ICOLL may open very infrequently promoting a brackish water environment with a high beach berm. The higher beach berm consequently requires a greater volume of water behind it to initiate a natural breakout, and the frequency of openings is further reduced. Alternatively, during wetter periods, greater volumes of water entering the lagoon will promote more frequent openings resulting in a typically more marine environment. The increased openings will also promote a lower berm height due to the shortened duration for berm recovery between openings.

#### 7.1.5 Natural Closing Process

There are three documented stages of closure (based on Sheedy, 1996, and summarised in Haines, 2006):

- (1) Tidal exchange and early stages of infill When the entrance channel is open the berm height continues to grow as each wave slowly transports sediment onto the berm. The resulting entrance choking produces a progressive head loss, thereby reducing the tidal prism and reducing the capacity of the ebb tide to scour the entrance channel. After several weeks the berm height tends to stabilise with continued growth only on the high tides or under conditions where the berm height is only just overtopped (Hanslow et al 2000).
- (2) Low tide closure and berm crest formation At low tide the entrance channel is closed, however, waves can still enter the channel during high tide, continuing to widen and shallow the entrance channel. The berm across the entrance channel continues to build, forming a defined crest and gentle back slope to the lagoon. The vertical growth of the berm continues until it is equal to the maximum height of the wave run-up (Hanslow et al 2000).
- (3) Complete entrance closure Complete closure of the berm occurs with no flow during low or high tides. The time taken for the complete closure is a function of the tidal prism of the lagoon and the gross sediment transport environment of the adjacent beaches (Gordon 1990).



## 7.1.6 Current Management Approach for Tallow Creek Entrance

Tallow Creek is subject to modified entrance behaviour through artificial openings performed by Council to alleviate flooding concerns or other human intervention<sup>1</sup>.

Most typically (as has been the case since 2004), the entrance has self-managed and opened prior to flooding or water quality concerns becoming problematic (i.e. at or around 2.2m AHD).

## 7.2 Description of Existing Physical Environment

## 7.2.1 Topography and Landuse

Figure 7-2 provides an overview of the topography and landuse of the catchment.

In terms of topography, the catchment is characterised by a steep upper catchment and a low relief lower catchment. The upper catchment extends from the escarpment behind the Byron Hills Estate and Baywood Chase Estate where a maximum altitude of approximately 130m is observed. This upper catchment section drains via two crossings (North and South Tallow Creek Crossing) on Bangalow Road / Broken Head Road into the lower portion of the catchment. Elevations at these locations are in the vicinity 2.5 to 4m AHD.

The drainage lines continue through natural and altered waterways for over a kilometre before entering Tallow Lagoon which continues to the entrance on Tallow Beach. As noted above the lower catchment has limited relief. Most of the developed portions (i.e. residential lots) of the catchments have elevations of 5m AHD or higher, but there are a few with ground levels less than this with land elevations as low as 2 to 3 m AHD. The bulk of the vegetated wetland areas have an elevation of around 2m AHD. The northernmost extent of the lower catchment extends as far as approximately Beachcomber Drive in Byron Bay.

Landuse is evident within Figure 7-2. The catchment has relatively high proportions of urbanisation in the upper (western) portion of the catchment. In this portion of the catchment there remains distinct areas of intact vegetation, e.g. on the escarpment above the estates and to the south of the Byron Hills Estate.

In the lower portions of the catchment, there exist distinct pockets of urbanisation (at Suffolk Park in the south and Byron Bay in the north). However, there are larger areas of vegetation adjoining the lower sections of Tallow Creek with much of these vegetated areas included in the SEPP 14 region and Arakwal National Park.

<sup>&</sup>lt;sup>1</sup> Community initiated openings are suspected to have occurred in recent years, but Council does not have any evidence to confirm or prove this.





## 7.2.2 Rainfall and Entrance Opening Events

Using data accessible from the Bureau of Meteorology for Jacaranda Drive Byron Bay (Site 058007), rainfall data from 1892 to 2014 was downloaded (as daily totals). Yearly data was assessed and any year with less than 330 days of records was excluded leaving 100 years of data remaining. This data was assessed to provide a yearly average of 1,886 mm rainfall.

Table 7-1 provides monthly average rainfall totals along with timing of known recent opening events.

Month	Average Rainfall (mm)	No. of Recent Opening Events
January	208	
February	227	1
March	233	1
April	188	
May	185	1
June	167	1
July	121	
August	97	
September	73	1
October	110	
November	122	2
December	156	

 Table 7-1
 Monthly Average Rainfall (1892 to 2014 – excluding partial datasets)

Without detailed records of the opening events being available, it is difficult to understand the exact circumstances that led to either the natural or artificial breakout occurring. Recent high rainfalls are likely to be a trigger in most instances, but it is possible that water levels were also high for extended periods of time prior to an opening being effected. As an aid, cumulative frequency plots of total monthly rainfall have been prepared from available data and are presented in Figure 7-3.





Figure 7-3 Cumulative Frequency Plot – Monthly Byron Bay Rainfall

Table 7-2 provides preceding monthly rainfall (and largest one day totals) to provide added context to Figure 7-3, i.e. information provided in Table 7-2 can be compared to that in Figure 7-3, and used to determine possible reasons for the opening. These have been included, but it should be stressed that these are only potential reasons. Generally, it can be seen that there has been higher than average monthly rainfall in the period prior to the breakout, although this is not the only reason for the breakout occurring as this was not observed in all months when a breakout occurred. It is also not clear that Table 7-2 includes details of all breakouts as accurate data records have not been maintained of this.

Table 7-2	Breakout	Times and	Antecedent	Rainfall Data

Estimated Month of Breakout	Preceding 30 days Rainfall Total (mm)	Largest Day Rainfall in Preceding Month (mm)	Possible Reason for Opening
November 2004 (artificial)	221	68	>80% ile cumulative rainfall
September 2007 (natural)	135	40	>80% ile cumulative rainfall
November 2008 (natural)	177	29	>80% ile cumulative rainfall
April 2009	0	0	



Estimated Month of Breakout	Preceding 30 days Rainfall Total (mm)	Largest Day Rainfall in Preceding Month (mm)	Possible Reason for Opening
(natural)			
February 2010 (natural)	266	171	>60% ile cumulative rainfall, with large one day total
June 2010 (natural)	154	42	>60% ile cumulative rainfall
May 2014 (natural)	113	31	

Figure 7-4 provides daily and cumulative annual rainfall along with the timing of the known breakouts.



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



Figure 7-4 Daily and Yearly Cumulative Rainfall with Timing of Breakout Shown



## 7.2.3 Flooding and Water Quality

The Tallow Creek Floodplain Risk Management Study and Plan has investigated in detail flooding characteristics of Tallow Creek. Such a study will necessarily consider key informative documents such as NSW Government's Flood Prone Land Policy (part of the Floodplain Development Manual).

The study includes a section on the impact of the entrance of Tallow Creek entrance on catchment flooding as detailed below (SKM 2009) (S5.5 p55),

"5.5 Assessment of Tallow Lake Opening on Flood Hydraulics

Tallow Creek flows under Broken Head Road downstream of the Forest Glades wetland. From there it drains in a northerly direction into what is commonly known as Tallow Lake. Tallow Lake is a typical inter-dunal lake and is classified as a small Intermittently Closed and Opened Lake/Lagoon (ICOLL) which lies between the near-coastal dune systems. It has a surface area of approximately 14ha, and stores approximately 180-200ML of water under typical storage levels (say 1.5m AHD). The lake has a relatively narrow natural entrance and is separated from the Pacific Ocean by a sand dune system. <u>Tallow Creek gradients</u> downstream of Broken Head Road are very flat. Therefore, depending on the build-up of sand at the entrance, water can pond behind the sand dune for some distance upstream and will exacerbate flooding on local properties. At the time of this study these impacts have been confined to nuisance flooding on private properties adjoining the lake with no structural flooding. Some of the properties adjoining the lake are noted to contain natural wetland vegetation."

Further hydraulic modelling of the Tallow Creek entrance indicates that for an assessed flood event there is no hydraulic effect (relating to an assumed entrance berm level of 2.5 m AHD) upstream of Broken Head Road. This essentially means that with an entrance berm level of 2.5m AHD (which is around the highest recorded to date for Tallow Creek) the entrance will have an effect on flooding downstream of Broken Head Road, but not upstream of it. This is effectively due to a change in catchment gradient which limits the build-up of flood waters above Broken Head Road.

The flooding study also identifies (S 5.5.1 p 47),

"At 1.8m AHD and above, the waters from Tallow Lake begin to enter the backyards of private properties as well as public access infrastructure. This is considered to raise the risk of inundation to structure footings, public infrastructure as well as raising the cost of damage from flooding through incidental damage."

The flood study goes on to recommend in the Management Plan for Tallow Creek in respect of flooding as follow (S 7.3.3.1, p 82),

#### "Interim Management Plan

The interim management plan for the Tallow Lake mouth considers two potential triggers to manual intervention at the creek mouth. These are water quality based and water level based, reflective of the potential human health and ecological aspects and flood risks



respectively. These interim measures have been accepted for application by National Parks and Wildlife Service.

The water level triggers to the interim management approach consider that standing lake levels should not exceed 2.2m AHD. When the water level is above 1.8m AHD Council will carry out water sampling at the locations shown in Table 7-3..."

"...If the water level is beyond 1.8m AHD Council will inspect the beach berm regularly to ensure the sandbar is not at a height which would affect a natural breaching of the berm during the next rainfall event. If the lake levels go beyond 2.2m AHD a manual intervention will be triggered, no matter what the water quality, this is due to the serious flood risks involved with high lake levels...

It has been determined since the writing of the Interim Management Plan that Council will engage with NPWS with respect to water quality issues that promote Council's consideration of a manual intervention (i.e. opening) to reduce the water levels and reduce the human health risks.

Council and NPWS will discuss and resolve water quality concerns to an opening being undertaken. Council will provide the necessary supporting information and justification to NPWS in this eventuality.

Table 7-3 provides a revised water quality monitoring program for the lake which responds to various lake events, including elevated water levels and artificial opening.

Parameter	Unit	Site 1	Site 2	Site 3	Site 4	Site 5
Health*						
Enterococci (any one sample)	EC/100mL	N/A	N/A	>700	>700	>700
Enterococci (median across 4 out of 6 samples)	EC/100mL	N/A	N/A	>230	>230	>230
Faecal coliforms (median in 4 out of 6 samples)	FC/100mL	N/A	N/A	>1000	>1000	>1000
Cyanobacteria (toxic species)	cells / mL	N/A	N/A	>15000	>15000	>15000
Mosquito larvae	Lv/100mL	N/A	N/A	>100	>100	>100
Physical (Permanent Log	gger)**					
Water Level	Metres AHD	N/A	N/A	N/A	N/A	0-2.5
Conductivity (Salinity)	µS/cm	N/A	N/A	N/A	N/A	0-50,000
Physical (on mechanica	l opening or sl	kimming)***				
Conductivity (Salinity)	µS/cm	125-2200	125-2200	0–10,000	0–10,000	0-10,000
Temperature	Degree C	8-25	8-25	8-25	8-25	8-25
Dissolved oxygen	% Saturation	85-110	85-110	80-110	80-110	80-110
pH (outside range)	no units	6.5 to 8.5	6.5 to 8.5	7 to 8.5	7 to 8.5	7 to 8.5
Turbidity	NTU	6-50	6-50	0.5-10	0.5-10	0.5-10
Physical (twice a year)****						
Conductivity (Salinity)	µS/cm	125-2200	125-2200	0–10,000	0–10,000	0-10,000
Temperature	Degree C	8-25	8-25	8-25	8-25	8-25

 Table 7-3
 Revised Water Quality Parameters for the Tallow Lake



Parameter	Unit	Site 1	Site 2	Site 3	Site 4	Site 5	
Dissolved oxygen	% Saturation	85-110	85-110	80-110	80-110	80-110	
pH (outside range)	no units	6.5 to 8.5	6.5 to 8.5	7 to 8.5	7 to 8.5	7 to 8.5	
Turbidity	NTU	6-50	6-50	0.5-10	0.5-10	0.5-10	
Nutrient (desirable program and range)*****							
Total phosphorus	mg/L	<0.025	<0.025	<0.03	<0.03	<0.03	
Chlorophyll a	µg/L	<5	<5	<4	<4	<4	
Total nitrogen	mg/L	<0.35	<0.35	<0.3	<0.3	<0.3	

Key:

Site 1 - Entry point from Byron Hills drainage system – Broken Head Road near BP station

Site 2 - Stormwater drain into Tallow Creek on boundary of Byron @Byron, near the weir

Site 3 - End of Marattia Place

Site 4 - Behind 34-38 Acorn St

Site 5 - Footbridge over Tallow Lake

\*Samples to be taken fortnightly when lake water level is above 1.8m AHD. If results above these figures are found, a discussion with NPWS will be held. Council will advise if they believe the results warrant an opening and request concurrence from NPWS, in accordance with licence conditions.

\*\*A single logger constantly monitoring water level and salinity. To provide long term data on the effects and timing of openings. The numbers provided indicate the range of values that need to be recorded by the logger.

\*\*\*Sampling regime to occur 1 day before and 6 days post a mechanical opening or an opening due to mechanical skimming. Figures for Site 1 and 2 show desirable catchment runoff targets, Sites 3, 4 and 5 show the estimated ranges for Tallow Creek. ICOLLS such as Tallow Creek tend to display a wide range of water quality data and further data is required to derive typical "healthy" values for this estuary.

\*\*\*\*Twice yearly sampling program. If a mechanical opening does not occur. Figures show the typical ranges for catchment runoff and estuaries.

\*\*\*\*\*A desirable sampling program should funding become available through Council, NPWS or grants.

Note: Health parameters taken from ANZECC Guidelines, Paper 4, Vol 1, Section 5 for secondary contact. i.e boating, walking or riding through water, fishing, water in private back yards

The extent of inundation in the Tallow Creek catchment when water levels are at 2.2m is shown in Figure 7-5. It can be seen from this figure that water at this level will:

- Affect businesses such as Byron at Byron, although the building floor levels are appropriate, pathways and other areas will be inundated;
- Flood water will encroach into the backyards of at least a dozen residents along Alcorn St, and others along Broken Head Road; and
- Public pathways are covered as described further in the next section.

The extent of property flooding will increase during an actual flood event. The exact extent of additional flooding is difficult to determine, as it will depend on a range of factors, such as the magnitude of the flood event, and status of the entrance at the time flooding commences. Typically the entrance scours at or below 2.2m AHD, however, if berm heights are higher more severe flood impacts could be experienced.

SKM (2009) included water level profiles across Tallow Creek resulting from a 5 year ARI flood event, when the berm height was 1.4, 1.6 and 1.8m. The water level profiles during this event



across the bulk of Tallow Lake (i.e. from the location of the entrance to adjacent Oceanside Place, approximately 2.5 km upstream) are:

- 2.16m AHD for a berm height of 1.4m AHD;
- 2.34m AHD for a berm height of 1.6m AHD; and
- 2.53m AHD for a berm height of 1.8m AHD.

It is expected as noted above, that peak flood levels will be higher if a larger berm height exists at the time of the flood and / or a higher magnitude flood event is received.





## 7.2.4 Geology and Geomorphology

A description of geology and geomorphology focusing on the foreshore has been summarised from the Byron Shire Coastline Hazards Assessment Update (BMT WBM, 2013). It includes coastal information specific to the Byron Shire Local Government Area coastline, as well as specific information pertaining to the Tallow Beach compartment and Tallow Creek itself.

"The beach system of the study region is the product of its geological history and the persistent influence over millennia during the late Quaternary period of the prevailing waves, currents and winds on the unconsolidated sediments of the continental shelf and coastal zone. The beaches and associated dunes, tidal inlets and nearshore active seabed areas are thus units within a larger geological framework, formed over timeframes commensurate with the processes involved, linked intimately to:

- Changes in relative level between land and sea through cycles of climate change, associated with those glacial and inter-glacial periods;
- Wind-generated waves and currents that transport unconsolidated sediments within coastal systems;
- Sources, supply and movement of sediments that comprise the sand that form the beaches; and
- Progressive evolutionary changes of the shorelines, dune barriers and active seabed areas."

#### Sea Level Changes

Changes in sea level over the Pleistocene and Holocene periods associated with glacial and interglacial periods (going back hundreds of thousands of years) are widely documented. Of most importance is that sea level is believed to have remained relatively stable at the present level for the past few thousand years.

While past sea level changes have shaped the coastal barriers and beach systems as we see them today, the present and projected future sea level rise will have impacts on the coastline that need to be understood and taken into account in the management of coastal areas.

Given that sea level has remained relatively constant, then changes to the coastal profile (i.e. the evolution of the coastal barrier) are dominated by other local level factors associated with winds and waves which are discussed further below.

#### **Coastal Barrier Evolution**

The Byron Bay coastline is noted to contain two main types of dune barriers, namely:

- Older Pleistocene inner barrier deposits; and
- Younger Holocene outer barrier dunes that abut or overly the Pleistocene deposits.

The Pleistocene deposits are likely to have resulted from historical peaks in sea level, with the active outer barrier beaches and dunes being formed in this last post glacial period. The rates of



accretion were thought to be the fastest after the end of the last glacial period, but have slowed to a near stable level as noted earlier.

#### **Dune Formation**

Beach sands are transported landwards by onshore winds to the back-beach where dunes form. In this region, dunes develop in the back beach with a crest level of about 5m above sea level. The dunes are stabilised with native vegetation which is of importance in locking the sand in the location to allow for its loss through storm driven erosion.

BMT WBM (2013) notes that, "the study area presently has typically stable dune systems not vulnerable to landward losses of sand by wind erosion because of the abundant availability of suitable native dune plants. These plants thrive in this region due to the suitable climate and availability of nutrients, with various species evolved to perform different roles (Barr & McKenzie 1975). They include the primary sand trapping spinifex grass which has the remarkable ability to grow just above high water mark on the beach. Its resistance to salt and sand drift makes it the most important of species in stabilising these coastal dunes."

#### Northward Longshore Sand Transport

There exists a northward wave-induced net longshore transport of sand along the coast associated with the predominantly southeast sector waves in the region. This exists through northern NSW and southern Queensland beaches.

BMT WBM (2013) suggests that the entire length of the study area coastline is eroding as a result of a substantial gradient in the longshore sand transport, i.e. Holocene barriers that had developed in the southern parts of the study region band have since been removed by erosion associated with the northward drift of sand. The sand budget (i.e. which dictates whether a beach is gaining or losing sand) consists of the alongshore sand transport (to north) and shoreward supply of sand from the continental shelf. The shoreward supply of sand may completely or partially offset any progressive shoreline erosion that may otherwise result from alongshore gradients in longshore sand transport.

#### 7.2.5 Soil Types and Properties

This section discusses soil types and properties of the lower catchment areas of Tallow Creek. GIS mapping provided by Council indicates that lying behind the beach sands (i.e. beaches and foreshore dunes); there are large extents of Aeolian soils, which are essentially windblown sands. As discussed in the previous section, these sands are likely to have been formed during the Pleistocene or Holecene period, with more recent windblown sand additions residing on top. There exists a region of metamorphic soil in the north part of the lower catchment (in Byron Bay) where ground elevations increase above the low-lying wetland areas.

The catchment also contains Acid Sulfate Soils (ASS), there are different categories of ASS apportioned by the relative risk they pose when disturbed. The ASS categories vary from 1 to 5 with Class 1 representing the highest risk of impact (resulting from disturbance). The categories are based on ASS Risk Maps developed by the Department of Land and Water Conservation (DLWC) in 1995 and the ASS Planning Maps developed by the DLWC in 1998.



GIS mapping sourced from Council and the NSW Department of Planning has been used to identify the distribution of ASS in the catchment. The mapping identifies that the lower portions of Tallow Creek (sometimes referred to as Tallow Lake) are Category 2 ASS. Surrounding this zone are Category 3 ASS soils, these occupy most of the remainder of the low-lying portions of the lower catchment. Some Category 5 ASS soils exist in the far north of the lower catchment (where soil types change to metamorphic and elevations increase) and also in the upper catchment (west of Bangalow Road/ Broken Head Road) where elevations increase. The beach strip and foreshore dune are also classed Category 5 (lowest risk).

The need to manage ASS risks require consideration of the nature of the soil and types of works which are proposed. Certain types of works present a higher risk of disturbing ASS such as excavation, lowering the watertable, etc.

The physical activity of artificially opening Tallow Creek is considered a low risk of disturbing acid sulphate soils as the risk Category of soils at this location is 5 (i.e. lowest risk). However, the activity also lowers water levels in Tallow Creek. Given that the artificial opening is planned to occur near natural opening levels (i.e. normally 2.2m AHD) the additional risk of the activity on reducing groundwater levels and increasing the risk of promoting acid drainage to the estuary (beyond the natural range) is considered to be very low.

#### 7.2.6 Waterways

The REF is applicable to the opening of Tallow Creek. Aspects of Tallow Creek are described throughout this REF. Tallow Creek is not a wild or scenic river. There is no estuary focused Coastal Zone Management Plan for the Tallow Creek estuary.

## 7.2.7 Catchment Values

The catchment of Tallow Creek has a variety of values (described in more detail in this REF), but may be summarised as:

- Human Use Values: High quality low density residential land forming suburbs including Byron Hills Estate, Baywood Chase Estate and Suffolk Park itself. The catchment also provides for a variety of commercial uses (primarily tourism based, e.g. holiday accommodation), and a number of other passive and recreational uses.
- Ecological Values: A broad range of ecological values including a total of 40 threatened species and four endangered ecological communities (and a large number of more common species). Some of these areas are included in various protected zone, i.e. SEPP 14 wetland areas, the Byron Bay Marine Park and Arakwal National Park. The areas also provide an important buffer between the urban extents of Byron Bay and Suffolk Park.
- Heritage Values: whilst containing no areas or sites of European heritage significance, Tallow Creek and the associated lake, beach and dune systems are an important Aboriginal cultural heritage landscape for the Arakwal people.



#### 7.2.8 Coastal Hazards

A description of coastal hazards focusing on the foreshore has been summarised from the Byron Shire Coastline Hazards Assessment Update (BMT WBM, 2013). It includes coastal information specific to the Byron Shire Local Government Area coastline, as well as specific information pertaining to the Tallow Beach compartment and Tallow Creek itself.

Generally coastal hazards considered include:

- Storm bite and shoreline recession associated with long shore transport and sea level rise;
- Coastal entrance instability; and
- Coastal inundation hazard.

#### **Shoreline Recession**

Allowing for longer term shoreline erosion, storm bite and the impacts of sea level rise, the position of the eroded scarp crest is typically 30 to 50m landward from the 2007 frontal dune edge, with greater distances where the dunes are relatively low and adjacent to creek entrances. Coastal hazard recession lines are presented in BMT WBM (2013).

#### **Coastal Entrance Instability**

BMT WBM (2013) identified that the Tallow Creek entrance may have migrated to the north over time. However, the mouth position has been relatively stable for a number of years and is not expected to become unstable in the foreseeable future. The Tallow Creek entrance also presents no off-shore bar or delta (as it is mostly closed), making it unlikely to influence regional shoreline alignment.

#### **Coastal Inundation Hazard**

In terms of wave run-up and overtopping, the dunes are noted to be sufficiently high to accommodate wave run-up without this resulting in inundation of developed areas behind the dunes. An exception to this is around the entrance to Tallow Creek.

SKM (2009) have considered storm tide events concurrent with a rainfall event with allowance for climate change to determine ocean water levels for use in flood modelling within the catchment. These represent an accepted worst case design for determining tailwater levels and result in the prediction of conservative flood height estimates. This forms part of the basis of the Management Plan for the entrance of Tallow Creek.

## 7.3 Description of Ecological Environment

A series of reports are provided in Volume 2 which describe the ecological environment of Tallow Creek and surrounds. These include:

- Tallow's Creek Proposed Artificial Opening Threatened Species and Communities Data Review (BMT WBM, 2013a);
- Tallow Creek Entrance 7 Part Tests (BMT WBM, 2013b); and
- Tallow Creek Flora and Fauna Habitat Assessment (BMT WBM, 2014).



Information included in these reports has been referenced in the following sections.

## 7.3.1 Wetland Communities including SEPP 14 Wetlands

Wetland habitats and communities are described and mapped in Section 3 of BMT WBM (2013a) (desktop assessment). Some wetland communities are described as Threatened Communities (or Endangered Ecological Communities) as per Section 6.4 of the report.

BMT WBM (21014) provides ground verification of wetland habitats and communities (Sections 3.4 and 3.5) including mapped SEPP 14 wetlands.

## 7.3.2 Flora (including flora of conservation significance)

Dominant floral species within various communities in the study area are defined and mapped in Section 3 of BMT WBM (2013a). The main aim of this study was however to identify known and potentially threatened species and communities (as per Section 4 of this report).

The subsequent field survey (BMT WBM, 2014), provides a comprehensive description of the vegetation of all areas likely to be directly and indirectly affected by the proposed activity including an assessment of the condition of the plant communities present (refer Section 3).

## 7.3.3 Fauna (including fauna of conservation significance)

Fauna of conservation significance are described in Section 4 of BMT WBM (2013a).

# 7.3.4 Ecological Communities (endangered ecological communities and regionally significant communities)

Ecological communities of the study area are described and mapped in Section 3 of BMT WBM (2013a) (desktop assessment). Threatened communities (i.e. Endangered Ecological Communities) within the study area are described in Section 6.4 of this report.

## 7.3.5 Critical Habitat Declared under the TSC Act

The review and assessments outlined in BMT WBM (2013a) were completed in order to identify threatened species and communities within the study area which may have been impacted by the proposed activity. Section 7 of this report identifies these threatened species of birds, mammals, frogs, reptiles, invertebrates, fish, flora as well as threatened ecological communities subject to further assessment as part of a 7 Part Test.

BMT WBM (2013b) provides the 7 Part Tests for the identified species. No critical habitats for the threatened flora, fauna and communities considered are in the study area, based in the Register of critical habitats maintained by the Director-General.

#### 7.3.6 SEPP 26 Littoral Rainforest (or equivalent)

No SEPP 26 Littoral rainforest occurs within the immediate study area.

## 7.3.7 SEPP 44 Koala Habitat

The SEPP 44 legislation does not apply to land dedicated or reserved under the National Parks and Wildlife Act 1974. This covers roughly half of the study area. For the remainder, there have



been no surveys by Council or others in relation to SEPP 44, and as such mapping of koala habitat areas is not available.

As part of the field based inspections (BMT WBM 2014), a small area of *Eucalyptus robusta* open forest averaging 20m in height and 60-70% canopy cover was observed in the north west of the study area. Whilst not observed during the survey this small area of eucalypt woodland in the potential impact zone may provide habitat for *Phascolarctos cinereus* (Koala).

#### 7.3.8 Wilderness (either nominated or declared)

No Wilderness areas are known to occur within the study area.

## 7.4 Description of the Social and Cultural Environment

## 7.4.1 Aboriginal Cultural Heritage

The Arakwal people are the traditional custodians of the area extending from Seven Mile Beach south of Broken Head to the Brunswick River up north, out to the escarpment west of Byron Bay, and east out into the Tasman Sea.

Tallow Creek, which includes the project area, comprises small lakes and wetlands, and is located south of Cumbebin (Byron Bay) behind the dunal area along Tallow Beach where it flows intermittently into the Pacific Ocean. The Arakwal people have occupied and used the greater Byron Bay area (including Tallow Creek) for thousands of years.

Harry and Clara Bray, Arakwal elders, lived there in a hut north of Tallow Creek and raised their family in the surrounding land. Their grandchildren Lorna Kelly and Linda Vidler were born and raised on the land there – Elder Aunty Linda Vidler described the area as:

"This is our stomping ground as you'd call it. We live just up the hill up here. And this area, we used to come for our natural food: fish and crabs and eels, in this little creek here. In the morning before the birds got here, we used to come and get prawns by our hands, because we lived naturally, and we just took what we wanted for a feed. Every day we'd come down."

Although the Reserve was revoked in 1916 and the area heavily sand mined from the 1920s, the Arakwal used the dunal area around Tallow Creek extensively. It was and remains an area where the families gather, a place of remembrance and spirituality, a vital part of their history and an integral part of their cultural landscape.

## 7.4.2 National/State/Local Natural or Cultural Heritage Values

There are no items, objects or areas of cultural heritage value within the project area listed on any local, state or national heritage registers (European or Aboriginal heritage).

However, the project area is part of the Tallow Creek and Lake area, which represents a cultural landscape of significance to the Arakwal people with cultural, social and landscape values for this group. The Arakwal National Park (which the project area is part of) was established through the Arakwal Indigenous Land Use Agreement. This agreement is between the Arakwal custodians, the NSW Government and the local community. The agreement was registered in August 2001, following almost seven years of negotiations. The park is jointly managed by the Byron Bay


Arakwal People and the NPWS. The Park is an important part of Aboriginal heritage and a haven for migratory birds and animals.

#### 7.4.3 Vegetation of Cultural Landscape Value

Vegetation is unlikely to be impacted as part of the proposal and have not been assessed as part of the Cultural Heritage assessment.

#### 7.4.4 Other Cultural Heritage Values

The survey did not locate any Aboriginal cultural heritage objects or sites. Nor did the survey locate any items of historic (European) heritage or any objects which may have been associated with historic shipwrecks.

The dune areas have been extensively disturbed by sand mining, development and recreational use. In addition, the proposed project area and level of activity is contained in a very small, discrete area. Although there is a moderate likelihood for objects of Aboriginal or European heritage to be exposed along this area of coastline, there is very low potential for them to occur within the project area.

#### 7.4.5 Recreation Values

Recreational values present in the study area include:

- Passive recreation including walking (on beach and paths), sightseeing, beach activities, bird watching, whale watching;
- Active recreation surfing (ocean), bike riding (on paths) and fishing (on open beach). Swimming is generally not undertaken in the estuary; and
- Include indigenous uses education, traditional fishing, family gatherings.

Fishing is not generally undertaken within the estuary as it is a declared Special Purpose Zone and this is a requirement of the zonings of the Byron Bay Marine Park.

#### 7.4.6 Scenic and Visually Significant Areas

The foreshore and beaches of study area which includes parts of Suffolk Park and Arakwal National Park provide a highly scenic natural beach area which is further complimented by the high headland, forests and lighthouse at Byron Bay. Tallow beach may be one of most recognisable in Australia and it may also have international significance for its visual and scenic amenity.

The estuary and parklands within the catchment provide locally significant scenic and visual amenity and provide an important natural buffer between urbanisation at Suffolk Park and Byron Bay.

#### 7.4.7 Education and Scientific Value

Scientific values are commonly associated with sites of archaeological significance. There are no listed archaeological objects, items or sites within the project area and there is a very low likelihood



for them to be within the subsurface of the project area. As such, there is no scientific (archaeological) value associated with the site.

#### 7.4.8 Other Values

Arakwal National Park has been named on the first Green List put together by the International Union for the Conservation of Nature (IUCN) in 2013. The aim of the Green List is to highlight successful protected areas to help improve the management of nature reserves. A total of 23 National Parks and Nature Reserves worldwide were selected, all sites had voluntarily committed to the IUCN's global standard for park management.

There are no other especially significant features of the site which provide for enhanced educational or scientific value beyond what other similar system that exist locally and regionally provide.

#### 7.4.9 Interests of External Stakeholders

#### Residents

No community consultation has been undertaken as part of this project, however Council (J. Flockton, pers. Comm, 2014) has advised that adjoining landowners have an interest in the extent and duration of flooding that occurs in the Tallow Creek catchment. There are a number of landowners that have direct land inundation (not housing inundation) at various flood levels; there are also a number of landowners which will observe flooding adjacent to their land. On advice of Council (which fields complaints related to flooding) high level flooding (generally considered to be 2.0 m AHD or higher), or extended durations of flooding, i.e. weeks at a time can cause psychological stress for affected residents. Additionally, a Council maintained walkway is partially covered with water once water levels exceed around 2.0m AHD.

Unfortunately, no historical data has been maintained that is able to be analysed and presented that displays water levels and closure durations with complaint numbers and types.

#### **Traditional Owners**

Aboriginal community consultation was undertaken for this project, in accordance with OEHs guidelines. The consultation included advertising the project, calling for registrations of interest, an initial consultation meeting, site survey accompanied by an Aboriginal (Arakwal) representative and the opportunity for the Arakwal to comment on the draft Cultural Heritage report (please refer to that report for more details on the consultation).

#### Agency Interests

Agency interests are represented in correspondence received provided in Volume 2.

#### 7.4.10 Matter of National Environmental Significance under the EPBC Act:

As described in Section 3.1.7, the *Environment Protection and Biodiversity Conservation Act 1999* provides for the management of 'controlled activities'. These are actions which could result in a significant impact in matters of national environmental significance (MNES). MNES includes threatened and migratory species and threatened ecological communities. Matters that are likely to



or known to occur in the Project Area have been determined and assessed (refer Section 3.1.7 and also BMT WBM 2013b; 2014 included in Volume 2).

No significant impacts were identified for any MNES as a result of the artificial opening of Tallow Creek. This is due to the fact that only minor, localised and temporary impacts are expected to occur as a result of the artificial opening. Wherever possible, impacts will also be mitigated through relevant management actions and by following a Project EMP. For this reason the Project is not a controlled action and does not require assessment or regulation under the *Environment Protection and Biodiversity Conservation Act 1999*.



## 8 Impact Assessment

This part of the REF provides an analysis of all possible impacts from the proposed activity and a description of any proposed mitigation measures.

# 8.1 Physical and Chemical Impacts during Construction and Operation

8.1 Physical and chemic	al im	pacts during con	struction and operation				
Section 3.8 of Proponents G	Section 3.8 of Proponents Guidelines for the Review of Environmental Factors provides further guidance						
	Applicable?*	Impact level (negligible, low, medium or high; negative or positive; or N/A)	Reasons (describe the type, nature and extent of impact, taking into account the receiving environment & proposed safeguards which will limit the impact)	Safeguards/Mitigation Measures			
1. Is the proposal likely to impact on soil quality or land stability?		Not Applicable	Not Applicable	Not Applicable			
2. Is the activity likely to affect a waterbody, watercourse, wetland or natural drainage system?		Low	The activity involves infrequent opening or berm lowering of Tallow Creek to allow high level waters (according to defined trigger levels) to drain to the ocean. The activity involves minor mechanical excavation at the entrance to allow waters to drain. The draining of water will occur through the waterbody of Tallow Lake which is fringed by low-level vegetation including estuarine wetlands (mangrove forest, woodland and saltmarsh) and freshwater wetlands (sedgeland, fernland and grasslands). An artificial activity was last completed mechanically in 2004 when berm heights were estimated to have reached 2.5 m AHD (SKM, 2009), at this height there was a higher than normal risk of property flooding occurring. Based on available information natural opening generally occurs at less than 2.2 m AHD which is the defined upper level limit for artificial opening under this proposal. Hence, the artificial opening will temporarily affect water levels in Tallow Creek and surrounding areas. It will soon refill once the opening occludes to the ocean and there are catchment rains. It is expected that artificial openings would be very infrequent.	No mitigation is proposed. The artificial opening or berm lowering activity should only occur at the proposed heights for the stated purposes of alleviating public health concerns (due to poor water quality) or flooding concerns.			
3. Is the activity likely to change flood or tidal	$\boxtimes$	Low	The activity is primarily aimed at changing flood regimes, particularly to alleviate the risk of excessive property	No mitigation is proposed.			



8.1 Physical and chemical impacts during construction and operation					
Section 3.8 of Proponents G	uideline	es for the Review of	Environmental Factors provides further guidance		
regimes, or be affected by flooding?			flooding resulting from the presence of an entrance berm elevated above 2.2m AHD. Once the entrance is opened (either mechanically or naturally), ocean waters typically penetrate into the ICOLL promoting tidal water movement into and out of the estuary. This has the effect of increasing salinities in Tallow Creek. Typically Tallow Creek is tidally connected to the ocean for relatively short periods of time until sand levels increase and cut off the lake from the ocean. At this point water levels increase again in line with increases in the berm height.		
4. Is the activity likely to affect coastal processes and coastal hazards, including those projected by climate change (e.g. sea level rise)?		Negligible	The artificial opening or berm lowering at Tallow Creek is not predicted to affect coastal processes or hazards.	NA	
5. Does the activity involve the use, storage, or transport of hazardous substances or the use or generation of chemicals, which may build up residues in the environment?		Negligible	Machinery (a 5 tonne excavator scraper) will use most likely diesel fuel, it will also have a reservoir of hydraulic fluid and oils on board.	Regular inspection and servicing of machinery. If a spill occurs, this will most likely occur on sand. The location of the spill would be marked and remediated as appropriate to the material and extent of spill.	
6. Does the activity involve the generation or disposal of gaseous, liquid or solid wastes or emissions?		Not Applicable	NA	NA	
7. Will the activity involve the emission of dust, odours, noise, vibration or radiation in the proximity of residential or urban areas or other sensitive locations?		Negligible	The activity involves the infrequent and short term use of machinery to perform an artificial entrance opening or berm lowering. The machine (a 5 tonne excavator/scraper) will drive to the site along a beach and complete the works activities (1 to 3 hours). There is no housing near the entrance and this activity will cause no impacts to residential/urban areas. The process of driving the machinery to the creek entrance will cause a temporary minor disturbance as it travels past, but this will last for only a few minutes.	Negligible impacts not requiring mitigation	



# 8.2 Biological Impacts during Construction and Operation

8.2 Biological impacts d	8.2 Biological impacts during construction and operation					
Section 3.9 of Proponents G	Guidelin	es for the Review of	FEnvironmental Factors provides further guidance			
	Applicable?*	Likely impact (negligible, low, medium or high negative or positive; or N/A)	<b>Reasons</b> (describe the type, nature and extent of the impact, the nature of the receiving environment and any proposed safeguards which will limit the impact)	Safeguards/Mitigation Measures		
1. Is any vegetation to be cleared or modified? (includes vegetation of conservation significance or cultural landscape value)		Negligible	Vegetation is not to be cleared as part of the entrance management activities. However, some minor changes in vegetation composition are possible. Assessments completed have identified the zone of impact associated with the proposed activity, which includes the area and activity of the artificial opening or berm lowering, as well as potential vegetation changes associated with adopting a fixed level opening regime. Desktop and field based surveys have identified the likelihood of minor estuarine habitat interchanges (in the order of metres) with minor impacts (including potential benefits) on threatened species populations expected. Note: interchange refers to changes in the type of vegetation community; for instance from more wetland to terrestrial.	Negligible impacts not requiring mitigation, although it may be prudent to collect vegetation composition and condition data along selected transects for several years (after adoption of the opening regime) to verify that the extent of changes are as expected.		
2. Is the activity likely to have a significant effect on threatened flora species, populations, or their habitats, or critical habitat? [refer to threatened species assessment of significance (7-part test)]		Negligible	<ul> <li>Supporting assessments have within a defined study area identified threatened flora species and habitats (based on available desktop mapping) which have later been confirmed through a field based inspection.</li> <li>7 Part Tests of the identified threatened fauna and threatened floral communities has identified the likelihood of minor estuarine habitat interchanges (in the order of metres) with minor impacts (including potential benefits) on threatened species populations expected.</li> </ul>	Machinery condition (i.e. cleanliness) will be managed to prevent importation of weeds to the site during entrance management activities.		
3. Does the activity have the potential to endanger, displace or disturb fauna (including fauna of conservation significance) or create a barrier to their movement?		Medium	The proposed activity involves the artificial opening or berm lowering at the entrance of Tallow Creek using machinery, and draining high level waters within Tallow Creek. The physical act of bringing a machine to the site and entrance opening or berm lowering using machinery	Relevant parts of the entrance route for machinery will be walked prior to the machine passing (i.e. part where there is a likelihood of encountering nesting animals). The machinery when brought to the site will travel as low as possible on the beach to increase travel efficiency and avoid nesting sites in the soft sand area.		



8.2 Biological impacts during construction and operation					
Section 3.9 of Proponents G	Guidelin	nes for the Review o	f Environmental Factors provides further guidance		
			presents risk to fauna residing along the route, or nesting at the entrance where the channel may be excavated, and also to fish within Tallow Creek. Noting that there have been fish kills after previous <u>natural</u> opening events. At the entrance of Tallow Creek, the following species were identified as potentially being affected including the beach stone curlew, pied oyster catcher, little tern, loggerhead turtle and green turtle (noting that these are only the species of conservation significance). The physical excavation works if not located correctly may impact on species if they are nesting in this location at this time. Additionally, the scouring of the channel over the ensuing days may encroach onto nesting areas, although there are difficulties in estimating where the channel may migrate over time. The draining of waters from Tallow Lake has the potential to result in fish kills. The exact mechanism leading to fish kills has not been investigated in detail, but is understood to relate to de-oxygenation of residing waters within Tallow Creek after an opening event. The primary drivers for the deoxygenation of waters are likely to be the disturbance of organic rich sediments or decay of seagrasses and plants that have been compromised by the reduced water levels.	At the creek entrance, the channel will be excavated in a location that promotes channel formation away from the northern and southern vegetated foreshores, which from the experience of previous <u>natural</u> opening events, has led to erosion of the established dunes and loss of associated vegetated. The location of the opening (or berm lowering) is also subject to the outcomes of the pre-opening ecological surveys (if required based on advice from NPWS). These surveys may identify the presence of certain species around which the activity will occur. The intended outcome of the activity will be to avoid nesting species, this includes the opening channel, berm lowering swale and sand movement activities (including spreading) and the likely trajectory of the channel as it opens to the ocean. It is acknowledged that it will not always be clear to ground staff how the trajectory of the breakout channel may change over time. In addition to the location of the channel, the timing of the opening will be timed to coincide with a daytime low tide or up to 1-2 hours thereafter. This timing has been selected to minimise the extent of scour and reduce opportunities for over-draining of Tallow Creek which is thought to have been implicated in the previous fish kill events.	
4. Is the activity likely to have a significant_effect on threatened fauna species, populations, or their habitats, or critical habitat? (refer to threatened species assessment of significance (7-part test))		Low	Fauna of conservation significance were assessed using the 7-Part Tests and no significant impacts were found to exist to species provided suitable management practices were implemented. Subsequent field examination was used to validate the desktop and 7 Part Tests and this did not modify the original conclusions.	The assessments identified that a number of beach dwelling species may be impacted by activities associated with the physical entrance opening works that allow Tallow Creek to drain to the ocean including the beach stone curlew, pied oyster catcher, little tern, loggerhead turtle and green turtle. NPWS staff will be monitoring the entrance area for nesting species (Council will advise NPWS when water levels exceed 1.8m AHD). If species are thought to be nesting in the entrance area, pre-disturbance ecological surveys in consultation NPWS would be completed to locate the	



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8.2 Biological impacts during construction and operation					
Section 3.9 of Proponents G	Guidelir	es for the Review o	f Environmental Factors provides further guidance		
Section 3.9 of <i>Proponents</i> G	Guidelir	es for the Review o	f Environmental Factors provides further guidance	threatened species prior to excavation. If possible the channel location and method of excavation would be selected to avoid disturbance to nesting species, if this was not possible, forced relocations would be considered. In general, it is expected that direct impacts associated with artificial entrance management on these species could be mitigated through appropriate protocols and work procedures in consultation with the relevant authorities. An Environmental Management Plan has been prepared for adoption by Council which outlines accepted procedures for	
5. Is the activity likely to impact on an ecological community of conservation significance?		Negligible	Ecological communities of conservation significance were assessed using the 7-Part Tests and no significant impacts were found to exist to these communities. Provided artificial openings occur within the natural range of the estuary (which the current proposed triggers are understood to be) then minor habitat interchanges are anticipated. Subsequent field examination was used to validate the desktop and 7 Part Tests and this did not modify the original conclusion.	<ul> <li>entrance opening or berm lowering.</li> <li>Further data to assist in definition of natural opening regimes of Tallow Creek is recommended by way of collecting water level and quality data.</li> <li>There is some anecdotal suggestion of artificial opening by residents. Having residents open Tallow Creek entrance at lower levels over a long period of time is likely to be more impactful than forced opening at defined (higher) water level trigger points. Enforcement of illegal opening may be required by NPWS officers.</li> </ul>	
6. Is the activity likely to have a significant effect on an endangered ecological community or its habitat?_ (refer to threatened species assessment of significance [7-part test])		Negligible	As for 5 above	As for 5 above	
7. Is the activity likely to cause a threat to the biological diversity or ecological integrity of an ecological community?		Negligible	The proposed activity replicates natural behaviour of Tallow Creek but limits natural opening levels to a maximum of 2.2 m AHD. Based on available knowledge, Tallow Creek usually opens at lower levels than 2.2 m. Hence, there is not expected to be significant changes resulting from the proposal. Ecological assessments have identified that at most minor habitat interchanges may occur, these are not considered a threat to biological diversity or ecological integrity of communities present in	Negligible impacts not requiring mitigation, although it may be prudent to collect vegetation composition and condition data along selected transects for a few years (after adoption of the management regime) to verify that the extent of changes are as expected.	





8.2 Biological impacts during construction and operation					
Section 3.9 of Proponents G	Guidelin	nes for the Review o	f Environmental Factors provides further guidance		
			the study area.		
8. Is the activity likely to introduce noxious weeds, vermin, feral species or genetically modified organisms into an area?		Not applicable	Not applicable	Council machinery is cleaned after each use.	
9. Is the activity likely to affect critical habitat?		No known impact	The 7 Part Tests for the identified threatened species identified no critical habitats for the threatened flora, fauna and communities considered based in the Register of critical habitats maintained by the Director-General.	Possibly review the register of critical habitats every 5 to 10 years to determine if new critical habitats have been declared within the study area.	
10. Is the activity consistent with any applicable recovery plans or threat abatement plans?		Yes based on available	As identified in the 7 Part Tests: The proposed artificial opening (and berm lowering) at the Tallow Creek estuary is not in-consistent with the Department of Environment and Conservation NSW 2006, NSW Recovery Plan for the Bush Stone-curlew <i>Burhinus</i> <i>grallarius</i> . DEC, Sydney. The proposed artificial opening (and berm lowering) at the Tallow Creek estuary is not inconsistent with the NSW National Parks and Wildlife Service (2003) Little Tern ( <i>Sterna albifrons</i> ) Recovery Plan. The proposed artificial opening (and berm lowering) at the Tallow Creek estuary is not inconsistent with the Recovery Plan for the Koala ( <i>Phascolarctos cinereus</i> ) DECC, 2008. The proposed artificial opening (and berm lowering) at the Tallow Creek estuary is not inconsistent with the Department of Environment, Climate Change and Water NSW. 2009. Draft National Recovery Plan for the Grey- headed Flying-fox <i>Pteropus poliocephalus</i> . Prepared by Dr Peggy Eby. Department of Environment, Climate Change and Water NSW, Sydney. The proposed artificial opening (and berm lowering) at the Tallow Creek estuary is not inconsistent with the NSW National Parks and Wildlife Service (2001). Mitchell's Rainforest Snail <i>Thersites mitchellae</i> recovery plan. NPWS Huretville NSW	Possibly review any relevant new or updated recovery and threat abatement plans on a 5 or 10 yearly basis to capture any significant changes.	
11. Is the activity likely to		Not applicable	Not applicable	Not applicable	

8.2 Biological impacts during construction and operation				
Section 3.9 of Proponents Guidelines for the Review of Environmental Factors provides further guidance				
affect any joint management agreement entered into under the TSC Act?				

## 8.3 Community Impacts during Construction and Operation

8.3 Community impacts during construction and operation

Section 3.10 of Proponents Guidelines for the Review of Environmental Factors provides further guidance

	Applicable?*	Likely impact (negligible, low, medium or high negative or positive; or N/A)	<b>Reasons</b> (describe the type, nature and extent of the impact, the nature of the receiving environment and any proposed safeguards which will limit the impact)	Safeguards/Mitigation Measures
1. Is the activity likely to affect community services or infrastructure?		Positive	The key reason for entrance management is to alleviate and prevent potential flood or water quality related impacts on affected low lying areas within the catchment. Entrance management (at defined heights and triggers) will decrease maximum water levels within Tallow Creek and this has the potential to alleviate impacts on infrastructure, such as public pathways which become difficult to use as they are covered in parts with water.	Not applicable
2. Does the activity affect sites of importance to local or broader community for their recreational or other values or access to these sites?		Negligible	The activity includes the artificial opening or ocean berm lowering of Tallow Creek entrance infrequently. An artificial opening will result in scouring of an outlet channel from Tallow Creek to the ocean. Water flowing through the channel may for a short period of time affect beach users transiting along Tallow Beach from Byron Bay to Suffolk Park. It is expected that after a day or two people will be able to walk safely through the shallow outlet channel and continue along the beach.	Negligible impacts not requiring mitigation
3. Is the activity likely to affect economic factors, including employment, industry and property value?		Not Applicable	Not Applicable	Not Applicable
4. Is the activity likely to		Positive	The key reason for artificial opening or berm lowering is to alleviate and prevent potential flood or water quality	Not Applicable



8.3 Community impacts during construction and operation							
Section 3.10 of Proponents	Section 3.10 of Proponents Guidelines for the Review of Environmental Factors provides further guidance						
have an impact on the safety of the community?			related impacts on affected low lying areas within the catchment. Artificial opening (at defined heights and triggers) will decrease water levels within Tallow Creek and this will have a positive psychological effect as high water levels are reported to cause stress for affected residents. Furthermore, it may also have a positive health effect if water quality conditions have deteriorated, and for instance are producing high numbers of mosquitoes.				
5. Is the activity likely to cause a bushfire risk?		Not Applicable	Not Applicable	Not Applicable			
6. Will the activity affect the visual or scenic landscape? This should include consideration of any permanent or temporary signage (eg. signs advertising an event and related sponsorship.		Negligible	The proposed artificial openings of Tallow Creek is believed to replicate natural opening events. The temporary and short term use of machinery (and warning signage) and the presence of an outlet channel for a few days to weeks will cause only a temporary visual impact which is not significantly different from when the creek opens natural.	Negligible impacts not requiring mitigation			
7. Is the activity likely to cause noise, pollution, visual impacts, loss of privacy, glare or overshadowing to members of the community, particularly adjoining landowners?		Negligible	The activity involves the infrequent and short term use of machinery to perform an artificial openings or berm lowering. The machine (a 5 tonne excavator/scraper) will drive to the site along a beach and complete the management activities (1 to 3 hours). There is no housing near the entrance and this activity will cause no impacts to residential/urban areas. The process of driving machinery to the creek entrance will cause a temporary minor disturbance as it travels past, but this will last for only a few minutes. The opened creek will within hours of artificial opening resemble a natural opening channel as the initial pilot channel is quickly eroded and widened by the escaping waters.	Negligible impacts not requiring mitigation			



## 8.4 Natural Resource Impacts during Construction and Operation

#### 8.4 Natural resource impacts during construction and operation

Section 3.11 of Proponents Guidelines for the Review of Environmental Factors provides further guidance

	Applicable?*	Likely impact (negligible, low, medium or high negative or positive; or N/A)	Reasons (describe the type, nature and extent of the impact, the nature of the receiving environment and any proposed safeguards which will limit the impact)	Safeguards/Mitigation Measures
1. Is the activity likely to result in the degradation of the reserve or any other area reserved for conservation purposes?		Negligible	Assessments completed have identified the zone of impact associated with the proposed activity, which includes the area and activity of artificial opening or berm lowering, as well as potential vegetation changes associated with adopting a fixed level opening regime. Desktop and field based surveys have identified the likelihood of minor estuarine habitat interchanges (in the order of metres) with minor impacts (including potential benefits) on threatened species populations expected. Note: interchange refers to changes in the type of vegetation community say from more wetland to terrestrial for instance.	No mitigation required, however, it is recommended that Council pursue the collection of relevant water level and quality data from Tallow Creek to enable further quantification of entrance opening behaviour to enable refinement of the proposed opening strategy over time. It may also be prudent to collect vegetation composition and condition data along selected transects for several years (after adoption of the entrance management regime) to verify that the extent of changes are as expected.
2. Is the activity likely to affect the use of, or the community's ability to use, natural resources?		Negligible	In the area of the opening channel, there may be some short term restrictions on beach use due to the presence of the channel and changed beach profile. There is also some likelihood that beach users may not choose to swim in the tannin stained water emanating from Tallow Creek as it enters the ocean. Typically these waters push up along the beach in the direction of the ocean current. There may be a visible discolouration of water for hundreds of metres from the opening which reduces over distance from the opening as waters mix and dilute with ocean waters. A similar occurrence is regularly observed on the outgoing tide at Belongil Creek, typically beach goers/swimmers locate on the other side of the opening where the waters are not affected, if they are at all concerned about it.	Negligible short terms impacts not requiring mitigation
3. Is the activity likely to involve the use, wastage, destruction or depletion of natural resources including water, fuels, timber or extractive materials?		Negligible	Some fuel will be consumed in the excavator/dozer used to perform the opening. An appropriately sized machine equipped for beach travel will be used to optimise its performance and minimise fuel use.	There are no viable alternatives to use of machinery.



8.4 Natural resource impacts during construction and operation				
Section 3.11 of Proponents (	Guideli	nes for the Review c	f Environmental Factors provides further guidance	
This should include opportunities to utilise recycled or alternative products.				
4. Does the activity provide for the sustainable and efficient use of water and energy?		Not Applicable	Not Applicable	Not Applicable
Where relevant to the proposal, this should include consideration of high efficiency fittings, appliances, insulation, lighting, rainwater tanks, hot water and electricity supply.				

# 8.5 Aboriginal Cultural Heritage Impacts during Construction and Operation

8.5 Aboriginal cultural heritage impacts during construction and operation					
	Applicable?*	Likely impact (negligible, low, medium or high negative or positive; or N/A)	<b>Reasons</b> (describe the type, nature and extent of the impact, the nature of the receiving environment and any proposed safeguards which will limit the impact)	Safeguards/Mitigation Measures	
1. Will the activity disturb the ground surface or any culturally modified trees?	$\boxtimes$	Negligible	The proposed activity will only disturb a small area of the ground surface, which is regularly disturbed from natural processes.	Aboriginal cultural monitors should be utilised during ground disturbing works.	
2. Does the activity affect known Aboriginal objects or Aboriginal places?		Negligible	The work will occur in area which has no known Aboriginal objects or items and a very low likelihood for subsurface objects.	N/A	
Include all known sources of information on likely presence of Aboriginal objects or places, including					



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8.5 Aboriginal cultural h	eritag	e impacts during	construction and operation	
AHIMS search results.				
<ul> <li>3. Is the activity located within, or will it affect, areas containing the following landscape features?</li> <li>within 200m of waters*;</li> <li>within a sand dune system*;</li> <li>on a ridge top, ridge line or headland;</li> <li>within 200m below or above a cliff face; or</li> <li>within 20m of or in a cave, rock shelter or a cave mouth.</li> <li>*see REF Proponents Guide for definitions.</li> </ul>		Low	The work will occur in an area that is within 200m of waters and is within a sand dune system. However, the work is confined to a very small area which has been previously disturbed by sand mining and by naturally occurring processes (the creek naturally opening in times of high water levels).	Aboriginal cultural monitors should be utilised during ground disturbing works.
4. If Aboriginal objects or landscape features are present, can impacts be avoided?		N/A	N/A	N.A
<ul> <li>5. If the above steps indicate that there remains a risk of harm or disturbance, has a desktop assessment and visual inspection^ been undertaken (refer to the Due Diligence Code)?</li> <li>^ for activities proposed by DECCW, at a minimum this should be undertaken by a DECCW employee with Aboriginal Site Awareness training and relevant practical experience, as</li> </ul>		Negligible	The work will occur in area which has no known Aboriginal objects or items and a very low likelihood for subsurface objects.	A cultural heritage assessment has been prepared in accordance with the Due Diligence Code of Practice.



8.5 Aboriginal cultural heritage impacts during construction and operation				
approved by an Area Manager				
6. Is the activity likely to affect wild resources or access to these resources, which are used or valued by the Aboriginal community?		N/A	N/A	N/A
7. Does the activity affect areas subject to Native Title claims?		No	N/A	N/A

## 8.6 Other Cultural Heritage Impacts during Construction or Operation

8.6 Other cultural heritage impacts during construction or operation

Section 3.13 of Proponents Guidelines for the Review of Environmental Factors provides further guidance				
	Applicable?*	Likely impact (negligible/ maintenance, minor, major, contentious; or N/A)	<b>Reasons</b> (describe the type, nature and extent of impact, taking into account the receiving environment & proposed safeguards which will limit the impact)	Safeguards/Mitigation Measures
1. What is the impact on places, buildings, landscapes or moveable heritage items?		N/A	There are no places, buildings, landscapes or moveable heritage items of European heritage significance in or near the project area.	N/A
2. Is any vegetation of cultural landscape value likely to be affected (eg. gardens and settings, introduced exotic species, or evidence of broader remnant land uses)?		N/A	N/A	N/A



## 8.7 Matters of National Environmental Significance under EPBC Act

#### 8.7 Matters of national environmental significance under the EPBC Act

Section 3.14 of *Proponents Guidelines for the Review of Environmental Factors* provides further guidance. Also refer to guidelines produced by the Commonwealth Department of Sustainability, Environment, Water, Population and Communities

	Applicable?*	Impact level (negligible, low, medium or high; negative or positive; or N/A)	<b>Reasons</b> (describe the type, nature and extent of impact, taking into account the receiving environment & proposed safeguards which will limit the impact)	Safeguards/Mitigation Measures
1. Is the proposal likely to impact on matters of national environmental significance under the EPBC Act, as follows:				
Listed threatened species or ecological communities		Negligible	Desktop assessments were used to identify known and potentially affected flora, fauna and communities. The precautionary principle was adopted when identifying potentially affected species. These species were assessed using 7 Part Tests. Subsequent field surveys were undertaken to validate the desktop and 7 Part Tests. Provided suitable management practices are implemented, significant impacts are not anticipated.	The assessments identified that a number of beach dwelling species may be impacted by activities associated with the physical entrance opening works that allow Tallow Creek to drain to the ocean. Pre-disturbance ecological surveys in consultation with the relevant authorities would be required to locate any threatened species and their presence in the beach areas to be impacted prior to excavation. It is expected that the direct impacts associated with artificial entrance management on these species could be mitigated through appropriate protocols and work procedures in consultation with the relevant authorities. An Environmental Management Plan has been prepared for adoption by Council which outlines accepted procedures for entrance opening.
Migratory species     protected under     international     agreements		Negligible	Desktop assessments were used to identify known and potentially affected migratory species. Twenty-one migratory species were identified as potentially occurring in the study area and of these the Little Tern and Marine Turtles were identified as potentially being impacted by the proposal. Provided suitable management practices are implemented, significant impacts to these species are not anticipated.	As above
Ramsar wetlands		Not Applicable	Not Applicable	Not Applicable
Commonwealth		Not Applicable	Not Applicable	Not Applicable



8.7 Ma	8.7 Matters of national environmental significance under the EPBC Act				
Section	Section 3.14 of <i>Proponents Guidelines for the Review of Environmental Factors</i> provides further guidance. Also refer to guidelines produced by the Commonwealth				
Departin	nent of Sustainability,	EIIVIIO	nmeni, waler, Popu	ilation and Communities	
ma	rine environment				
• Wo pro her	orld heritage operties or national ritage places		Not Applicable	Not Applicable	Not Applicable

# 9 **Proposals Requiring Additional Information**

## 9.1 Lease or Licence Proposals under s151, NPW Act

The proposed opening of Tallow Creek for flood mitigation purposes requires a Licence to be issued from NPWS under Section 151A of the NPW Act. Byron Shire Council intends to undertake the Tallow Creek opening works under the licence issued by NPWS.

The licence would be issued under Part 12 of the NPW Act, however, the licence can only be granted for a purpose listed in s151A. The following purposes are deemed relevant to the Project:

- (a)(v) to enable activities for natural heritage management, cultural heritage management, *parks management* or fire management to be carried out and the provision of facilities for that purpose
- (a)(viii) any other purpose that is: (A) *consistent with relevant management principles* for the land set out in Division 2 of Part 4
- (c) any purpose that enables the adaptive reuse of an existing building or structure or *the use of* a modified natural area.

#### 9.1 Lease or licence proposals under s.151 NPW Act

Section 2.2 of *Proponents Guidelines for the Review of Environmental Factors* provides further guidance

Proponents must complete and submit a **Sustainability Assessment** together with the REF. This also applies where DECCW is the proponent for projects of the kind listed in s.151A, NPW Act.

For information on the sustainability assessment criteria and guidelines, including assessment templates, go to: <a href="http://www.environment.nsw.gov.au/protectedareas/developmntadjoiningdecc.htm">http://www.environment.nsw.gov.au/protectedareas/developmntadjoiningdecc.htm</a>

Note that for **minor activities and uses** (usually events and similar proposals involving less than 400 people) a streamlined and combined REF and Sustainability Assessment template is available (**Template 1**).

Sustainability assessment attached as follows:

Special activities and uses (involving more than 400 people) – Sustainability Assessment Template 2

Built structures and facilities – Sustainability Assessment **Template 3** 



# 10 Threatened Species Assessment of Significance (7 Part Test)

Please refer to Tallow Creek Entrance 7 Part Tests (BMT WBM, 2013b) provided in Volume 2.



## **11 Summary of Impacts**

A summary of impacts is provided below. This section summarises impacts that were assessed as low (or above) from Section 8 (Impact Assessment). Positive impacts are also noted.

The proposed activity will impact the Tallow Creek system as it will result in the infrequent forced drainage of waters from the lower portions of Tallow Creek (Tallow Lagoon) downstream of Broken Head Road. The impact is considered low on the basis that forced opening is an infrequent event with the last one being performed by Council in 2004. The system is noted to typically occlude (i.e. lose its tidal connection to the ocean) relatively quickly after opening events and revert back to its normal state which is closed. Hence impacts of an artificial opening are likely to be short-lived and be of similar duration to natural opening events.

Such infrequent forced opening events suggest that activity will have a low impact on fringing lowlevel vegetation including estuarine wetlands (mangrove forest, woodland and saltmarsh) and freshwater wetlands (sedgeland, fernland and grasslands). Openings at a defined height that is below the maximum range of entrance opening heights may result in the terrestrialisation of vegetative species above the defined height (i.e. 2.2m AHD) as these species will no longer receive inundation. Desktop and field based surveys completed as part of this study have identified that the proposed activity provides for the likelihood of minor estuarine habitat interchanges (in the order of metres) with minor impacts (including potential benefits) on threatened species populations expected.

The most significant potential impacts of the proposed activity include risk to fauna residing along the machinery access route, nesting at the entrance where the channel may be excavated (including sand dispersal area and resulting drainage channel), and also to fish within Tallow Creek. At the entrance of Tallow Creek, the following species were identified as potentially being affected including the beach stone curlew, pied oyster catcher, little tern, loggerhead turtle and green turtle (noting that these are only the species of conservation significance). The physical excavation works if not located correctly may impact on species if they are nesting in this location at this time. Additionally, the scouring of the channel over the ensuing days may encroach onto nesting areas, although there are difficulties in estimating where the channel may migrate over time.

Additionally, the draining of waters from Tallow Lake has the potential to result in fish kills. The exact mechanism leading to fish kills has not been investigated in detail, but is understood to relate to de-oxygenation of waters residing within Tallow Creek after the opening event. The primary drivers for the deoxygenation of waters are likely to be the disturbance of organic rich sediments or decay of seagrasses and plants that have been compromised by the reduced water levels. The effects of this are to be mitigated by timing the opening with tides to limit the extent of entrance scour and system drainage.

Given the inherent uncertainties associated with assessing the likelihood of impacts of entrance opening on nesting species (i.e. timing of opening, location of opening, actual presence of species, etc), an adaptive management regime has been proposed which involves observation for the presence of nesting species near the entrance once water levels reach a lower water level trigger of 1.8m AHD. If found to be present, early planning for potential mitigation actions will be



undertaken by Council in conjunction with qualified ecologists and in discussion with NPWS. The likelihood of nesting species being present at the entrance at the time of an opening is considered to be low as species are not typically observed to nest there, and mechanical opening is rare. However, contingencies for the unlikely eventuality have been made to avoid impacts, if and where possible.

The proposed activity has been assessed to have a positive impact on community safety and infrastructure. The key reason for entrance opening is to alleviate and prevent potential flood or water quality related impacts on affected low lying areas within the catchment. Entrance opening (at defined heights and triggers) will decrease maximum water levels within Tallow Creek and this has the potential to alleviate impacts on infrastructure, such as public pathways which become difficult to use as they are covered in parts with water. Furthermore, the use of the water quality trigger to drain the estuary may also have a positive health effect if water quality conditions have deteriorated, and for instance are producing high numbers of mosquitoes.





## 12 Conclusions

The potential environmental effects of the proposed activity have been assessed and have been found to present a limited range of impacts to the Tallow Creek system, surrounds and species utilising the area. The nature of the activity and the legal frameworks guiding it do not indicate that an Environmental Impact Statement is required for preparation.

To address the limited real and potential impacts associated with the activity it is recommended that an adaptive management approach is adopted to manage the key potential impacts which are to nesting species which may be present near the opening of Tallows Creek when an artificial opening is required. The adaptive management approach requires involvement of NPWS, clear communication with Council, advice from specialist ecologists and implementation of agreed actions. Overall, the likelihood of this being required is considered low, but contingency approaches have been outlaid for this eventuality.

In respect of cultural heritage, assessments have found that the proposed works will have very little impact on cultural heritage. Following the steps of the Due Diligence process, it has been determined that the proposed development could 'Proceed with Caution'. This means that Council should be allowed to perform the intended actions, as long as the Proceed with Caution guidelines are strictly followed as part of any works on site.

As part of the guidelines, advice is provided regarding unexpected finds and the requirements for Aboriginal Heritage Impact Permits (AHIPs), should such a find be made on the site. The proponent will need to ensure that they are familiar with the Proceed with Caution guidelines and when and where AHIPS and Stop Work Procedures are to be implemented.

On-site works will be conducted by Council under an Environmental Management Plan for the activity which will integrate the Proceed with Caution guideline requirements, and other recommended actions that manage and mitigate the potential environmental and social impacts of the proposed activity.

The following additional items are recommended for Council to implement over time (subject to funding and resources) to improve the knowledge base and potential management processes associated with opening of Tallow Creek:

- Collection of data on opening events including berm height for all openings (natural, artificial), collection of water level information preferably via a stilling tube or bottom mounted pressure sensor that records data regularly (e.g. every ten minutes). This data can be used to infer the timing, duration and magnitude of opening events, as well as water level responses to catchment rainfall events and conditions.
- Collection of key water quality datasets such as electrical conductivity. These data are not as important as water level information, but for minor additional cost, this information can be collected. It aids in understanding the freshwater/marine balance maintained by the estuary, as well as aiding mixing and flushing characteristics during and after opening events.
- Further investigation into the fish kill mechanism to better understand the processes that lead to this eventuality, such that factors contributing to fish kills can be reduced or avoided. This will



require data collection to support these findings, particularly relating to water levels, and other water quality indicators such as dissolved oxygen.

- Collection of vegetative composition and condition data along selected transects for several years (after adoption of the opening regime) to verify that the extent of changes are as expected (i.e. interchange of predominantly wetland/aquatic species to terrestrial species) at heights above 2.2 m AHD.
- Link the proposed opening approach (e.g. Table 5-1) onto relevant websites to outline to interested parties, the adopted activities and responsibilities regarding monitoring and opening procedures.
- Complete a 5 to 10 year review of the register of critical habitats and species recovery and threat abatement plans to capture any significant changes.



# **13** Supporting Documentation

Supporting documentation referred to below is included in Volume 2.

This volume includes the following supporting correspondence as identified in Section 4.

- Letter from Council to Planning and Infrastructure regarding requirements for an EIS (5/11/13).
- Letter from Planning and Infrastructure to Council regarding requirements for an EIS (18/11/13).
- Letter from Council to MPA/NPWS/Arakwal Corporation seeking in-principle support for the preparation of a Review of Environmental Factors (19/5/2014).
- Letter from DPI (covering both Fisheries NSW and the Marine Park Authority) to Council providing in-principle support to prepare the REF (28/5/2014).
- Letter from NPWS to Council providing in-principle support to prepare the REF (i.e. this document) (26/6/2014).
- Response from Arakwal Corporation to Council identifying in-principle support for the preparation of a Review of Environmental Factors (30/9/2014).

This volume includes the following supporting reports as identified in Section 7.

- Ainsworth Heritage, 2015, Cultural Heritage Assessment, Tallow Creek Opening, report prepared for Byron Shire Council, Ainsworth Heritage, Byron Bay.
- BMT WBM 2013a, Tallow's Creek Proposed Artificial Opening Threatened Species and Communities Data Review, report prepared for Byron Shire Council, BMT WBM, Brisbane.
- BMT WBM 2013b, Tallow Creek Entrance 7 Part Tests, report prepared for Byron Shire Council, BMT WBM, Brisbane.
- BMT WBM 2014, Tallow Creek Flora and Fauna Habitat Assessment, report prepared for Byron Shire Council, BMT WBM, Brisbane.

## 13.1 References

Other references to external (not included) publications, reports and electronic media are provided below:

BMT WBM (2011), Review of Environmental Factors Entrance Management of Narrabeen, Dee Why and Curl Curl Lagoons, report prepared for Warringah Council, BMT WBM, Newcastle.

Bureau of Meteorology, Climate Data Online, <u>http://www.bom.gov.au/climate/data/</u> [last accessed October 2014].

DECC (2006), NSW Recovery Plan for the Bush Stone-curlew Burhinus grallarius. DECC, Sydney.

DECC (2008), Recovery Plan for the Koala (Phascolarctos cinereus).

DECCW (2007), Arakwal National Park Plan of Management.



DECCW (2009), Draft National Recovery Plan for the Grey-headed Flying-fox *Pteropus poliocephalus*. Prepared by Dr Peggy Eby. Department of Environment, Climate Change and Water NSW, Sydney.

DECCW (2010), Vehicle Access - General Policy,

http://www.environment.nsw.gov.au/resources/parks/policyVehicleAccessGeneral.pdf [last accessed October 2014]

Haines (2006), Physical and chemical behaviour and management of Intermittently Closed and Open Lakes and Lagoons (ICOLLs) in NSW. PhD candidate report prepared for Griffith Centre for Coastal Management School of Environmental and Applied Sciences, Griffith University, Queensland.

Hanslow *et al* (2000), Berm heights at coastal lagoon entrances in NSW. Proceedings 10<sup>th</sup> Annual NSW Coastal Conference. 20 – 24<sup>th</sup> November 2000, Yamba NSW.

MPA (2003), Background Resource Working Paper for the Cape Byron Marine Park, Marine Park Authority, Byron Bay.

NPWS (2001). Mitchell's Rainforest Snail *Thersites mitchellae* recovery plan. NPWS, Hurstville, NSW.

NPWS (2003) Little Tern (Sterna albifrons) Recovery Plan.

OEH (2010), Proponents Guidelines for the Review of Environmental Factors.

SKM (2009) Tallow Creek Floodplain Risk Management Study and Plan. Report prepared for the Byron Shire Council, SKM Brisbane.

Roy *et al* (2001) Structure and Function of South-east Australian estuaries. Estuarine, Coastal and Shelf Science (2001) 53, 351-384.

## **13.2 Consistency of Proposal with Relevant Policies**

As noted in the study brief, the REF should address the following (where applicable):

- The NSW Coastal Policy 1997, which has as its central focus the ecologically sustainable development of the NSW coast;
- The Estuary Management Policy, with the general goal to achieve an integrated, balanced, responsible and ecologically sustainable use of the State's estuaries, which form a key component of coastal catchments; and
- The Coastline Hazard Policy 1988 (mostly objectives from this policy are incorporated into the NSW Coastal Policy 1997, and with the NSW Sea Level Rise Policy, 2007 (now retracted).

Table 13-1, Table 13-2 and Table 13-3 provide detail on how the REF addresses the requirements of these policies. Table 13-1 outlines how the REF meets the objectives of the Coastal Protection Act.



Specific Objectives of the CP Act	Addressed by this CZMP
(a) to protect, enhance, maintain and restore the environment of the coastal region, its associated ecosystems, ecological processes and biological diversity, and its water quality	The proposed entrance opening is considered to maintain the environment of the coastal region. The opening is expected to have short duration impacts on its surrounds (i.e. draining waters). Additionally the proposed opening is likely to be highly infrequent (even rare), further reducing its potential long term impact.
(b) to encourage, promote and secure the orderly and balanced utilisation and conservation of the coastal region and its natural and man-made resources, having regard to the principles of ecologically sustainable development	The proposed opening regime seeks to balance the needs of pre-dating human occupation within the estuary with maintenance of existing environmental values.
<ul> <li>(c) to recognise and foster the significant social and economic benefits to the State that result from a sustainable coastal environment, including:</li> <li>(i) benefits to the environment,</li> <li>(ii) benefits to urban communities, fisheries, industry and recreation,</li> <li>(iii) benefits to culture and heritage,</li> <li>(iv) benefits to the Aboriginal people in relation to their spiritual, social, customary and economic use of land and water,</li> </ul>	The proposed opening regime is seen as a sustainable management practice as it does not have any significant effects on the environment, human usage or European or Aboriginal cultural heritage, in the study area.
(d) to promote public pedestrian access to the coastal region and recognise the public's right to access	The proposed opening regime has no long term impact on access. Temporary access restrictions may occur during opening events for the purposes of public safety.
(e) to provide for the acquisition of land in the coastal region to promote the protection, enhancement, maintenance and restoration of the environment of the coastal region	NA
(f) to recognise the role of the community, as a partner with government, in resolving issues relating to the protection of the coastal environment	Community requirements in relation to flooding have been captured in key supporting documents, and as such have been reflected in the adopted opening strategy approach.
(g) to ensure co-ordination of the policies	The opening strategy integrates the needs of the

#### Table 13-1 Coastal Protection Act 1979 Objectives



Specific Objectives of the CP Act	Addressed by this CZMP
and activities of the Government and public authorities relating to the coastal region and to facilitate the proper integration of their management activities	NPWS and Council (and other agencies with OEH, Marine Parks Authority, DPI Fisheries and Aquaculture, etc). A clear process for action and communication has been established.
(h) to encourage and promote plans and strategies for adaptation in response to coastal climate change impacts, including projected sea level rise	Coastal climate change adaptation will be considered in ongoing updates to the adopted opening strategy as further scientific direction is provided, particularly in relation to the response of ICOLL openings in response to increasing sea level rises. Also updates to the Tallow Creek flood study may occur to integrate potential climate change effects, such as changes to rainfall temporal patters and intensity-frequency- duration (IFD) relationships.
(i) to promote beach amenity	Beach amenity is not affected by the proposal.

### 13.2.1 Meeting the NSW Coastal Policy Goals and Objectives

This REF meets the goals and objectives of the NSW Coastal Policy as outlined in Table 13-2.

Coastal Policy Goals	Addressed by the REF
To protect, rehabilitate and improve the natural environment	Minimal impact to the natural environmental is expected to result from the proposal. Identified impacts (which are mostly potential impacts) are to be managed through an adaptive management approach and environmental management plan applied to the opening process.
To recognise and accommodate natural processes and climate change	The proposed opening strategy mimics natural opening processes and infrequent (even rare) forced openings are expected to occur as the water level trigger height for opening is higher than the level at which the estuary normally opens.
To protect and enhance the aesthetic qualities	The aesthetic quality of the entrance of Tallow Creek and Tallow Creek in general will not be affected by the proposed opening regime.
To protect and conserve cultural heritage	Cultural heritage assessments have been completed and the proposed opening regime has been found to have very limited impact on cultural heritage.
To promote Ecologically Sustainable Development	The proposal does not contravene the principles of ESD

#### Table 13-2 NSW Coastal Policy goals and relevance to this REF



Coastal Policy Goals	Addressed by the REF
(ESD)	
To provide for ecologically sustainable human settlement	The proposed opening regime balances the needs of existing human settlement in the catchment with environmental requirements. Future development within the catchment will accord with Council's Flood Policies and rely on Flood Studies in respective catchments to provide technical detail relating to the sustainability of development from a flooding perspective.
To provide for appropriate public access and use	Public access and use of facilities along public foreshore lands are to be maintained by the proposal, except during the rare opening event where machinery may occupy the beach. During these rare short duration events egress along the beach may be restricted.
To provide information to enable effective management	The opening regime provides a method which involves the key land managers of NPWS and Byron Shire Council. It promotes clear communication in relation to entrance management activities.
To provide for integrated planning and management	The REF has been prepared to address potential environmental concerns and will result in an agreed method for entrance management. This method will become part of planning and management for both the NPWS and Byron Shire Council.

## 13.2.2 Addressing the Coastal Management Principles

This REF addresses the coastal management principles, as espoused in the CZMP guidelines, as outlined in Table 13-3.

Principle No#	Coastal Management Principles (DECCW, 2010)	Addressed by Pambula Lake CZMP
1	Consider the objectives of the <i>Coastal</i> <i>Protection Act 1979</i> and the goals, objectives and principles of the NSW Coastal Policy 1997 and the <i>NSW Sea</i> <i>Level Rise Policy Statement (2009)</i> #	The objectives of the <i>Coastal Protection Act</i> , 1979, and the NSW Coastal Policy 1997 have been considered herein.
2	Optimise links between plans relating to the management of the coastal zone	The REF links with a number of relevant plans including the Floodplain Risk Management Study and Plan for Tallows, as well as the Arakwal National Park Plan of Management.
3	Involve the community in decision-making and make coastal information publicly	The REF did not require community consultation, other than consultation

 Table 13-3
 Coastal Management Principles Addressed by the REF



Principle No#	Coastal Management Principles (DECCW, 2010)	Addressed by Pambula Lake CZMP
	available.	with Aboriginal groups which was completed.
4	Base decisions on the best available information and reasonable practice; acknowledge the interrelationship between catchment, estuarine and coastal processes; adopt a continuous improvement management approach.	The opening strategy outlined in this REF presents a balance between environmental requirements (for coastal, catchment and estuarine processes) with human settlement and use of the catchment. Further datasets are recommended for collection to enable refinement of datasets over time.
5	The priority for public expenditure is public benefit; public expenditure should cost effectively achieve the best practical long- term outcomes	The opening strategy is likely to be of very low cost as openings are expected to be very infrequent (even rare).
6	Adopt a risk management approach to managing risks to public safety and assets; adopt a risk management hierarchy involving avoiding risk where feasible and mitigation where risks cannot be reasonably avoided; adopt interim actions to manage high risks while long-term options are implemented	Although a formal risk assessment was not required for the REF, risks of environmental and social harm have been considered and strategies developed to mitigate these risks. An EMP will be developed and utilised for the actual opening events.
7	Adopt an adaptive risk management approach if risks are expected to increase over time, or to accommodate uncertainty in risk predictions	One are of potential unknown risk is in relation to the presence of nesting species near the estuary entrance. The adaptive risk management approach allows for monitoring prior to the event to advise on the presence of species and to provide time to develop a course of action that minimises impacts.
8	Maintain the condition of high value coastal ecosystems; rehabilitate priority degraded coastal ecosystems	The proposal protects the existing values of Tallows Creek.
9	Maintain and improve safe public access to beaches and headlands consistent with the goals of the NSW Coastal Policy	Access is not affected by the proposal.
10	Support recreational activities consistent with the goals of the NSW Coastal Policy	Recreational opportunities are not impacted by the proposal.

# Note that the NSW Government on 8 September 2012 withdrew its Sea Level Rise Policy.



## 14 Fees

Are provided with the application.



# 15 Signature of Proponent

#### Signature of Document Preparer

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